Notice of Meeting

Local Traffic Committee Meeting

A Local Traffic Committee Meeting of Byron Shire Council will be held as follows:

Venue	**Conference Room, Station Street, Mullumbimby**
Date	**Tuesday, 15 November 2022**
Time	**2.00pm**

Phillip Holloway
Director Infrastructure Services

I2022/1670
Distributed 08/11/22

BYRON SHIRE COUNCIL

BUSINESS OF MEETING

1. APOLOGIES

2. DECLARATIONS OF INTEREST – PECUNIARY AND NON-PECUNIARY

3. ADOPTION OF MINUTES FROM PREVIOUS MEETINGS

3.1 Local Traffic Committee Meeting held on 11 October 2022

4. MATTERS ARISING

5. OUTSTANDING ISSUES/RESOLUTIONS

6. REGULATORY MATTERS

REGULATORY MATTERS

Report No. 6.1 Additional information regarding Byron Bay Traffic and Pedestrian Management Strategy for the Christmas & New Years eve Period 2022

File No: I2022/1524

Initial planning for the management of Byron Bay traffic and pedestrian safety over the Christmas and New Year period 2022 was presented to the LTC in October 2022.

Transport for NSW requested clarification on the use of the following regulatory signage included in the Traffic Control Plans:

- "No Entry" signs (at Byron St / Jonson St and in Lateen La)
- "No Parking" signs in Bay St
- the "All Traffic Right" sign in Fletcher St at Bay St

This report presents the LTC with details of the signage used in the TCP's and assurance they conform to regulatory requirements and are endorsed by a qualified authority.

Traffic Control Plans have also been updated to include additional Traffic Controllers in specific places. In consultation with NSW Police there will now be 5 traffic controllers placed on Jonson Street to help manage pedestrian and vehicle movements. The dates for which this will apply are Wednesday 21 December 2022 to Wednesday 4 Janurary 2023 until 8pm each day.

To clarify some of the signage on the plans:

- "No Entry" signs (at Byron St / Jonson St and in Lateen Lane): These signs are existing signs already in place and being permanent they abide by all regulations.
- "No Parking" signs in Bay St – These are supplied and installed by council and meet regulations. Council has authority to install them and they were requested by Police NSW as they are useful in minimising the amount of traffic parked and flowing through this area.
- The "All Traffic Right" sign in Fletcher St at Bay St – These have been removed from the TCPs as this is another spot with an existing "No Entry" sign so the "All traffic right" sign is unnecessary. The permanent "No Entry" sign has been added to the plan. The blue arrows in the TCP show the path that vehicles have to take as per the "No Entry" requirement.

RECOMMENDATION:

That the Local Traffic Committee notes:

1. **The type of regulatory signage used in the TCP's is the appropriate signage endorsed by a qualified authority, and**

2. **That updated TCP's are provided for the information of the Committee showing altered traffic control arrangements, including the addition of Traffic Controllers in key areas over the event period.**

Attachments:

1 Soul Street NYE 2022 Traffic Control Plans V3.0, E2022/104917 , page 5

www.invarion.com

Date: 25/10/22 **Author:** John Leeming **Project:** New Years Eve 2022 - Lawson St Pedestrian Control
Client: Byron Shire Council

Spinifex

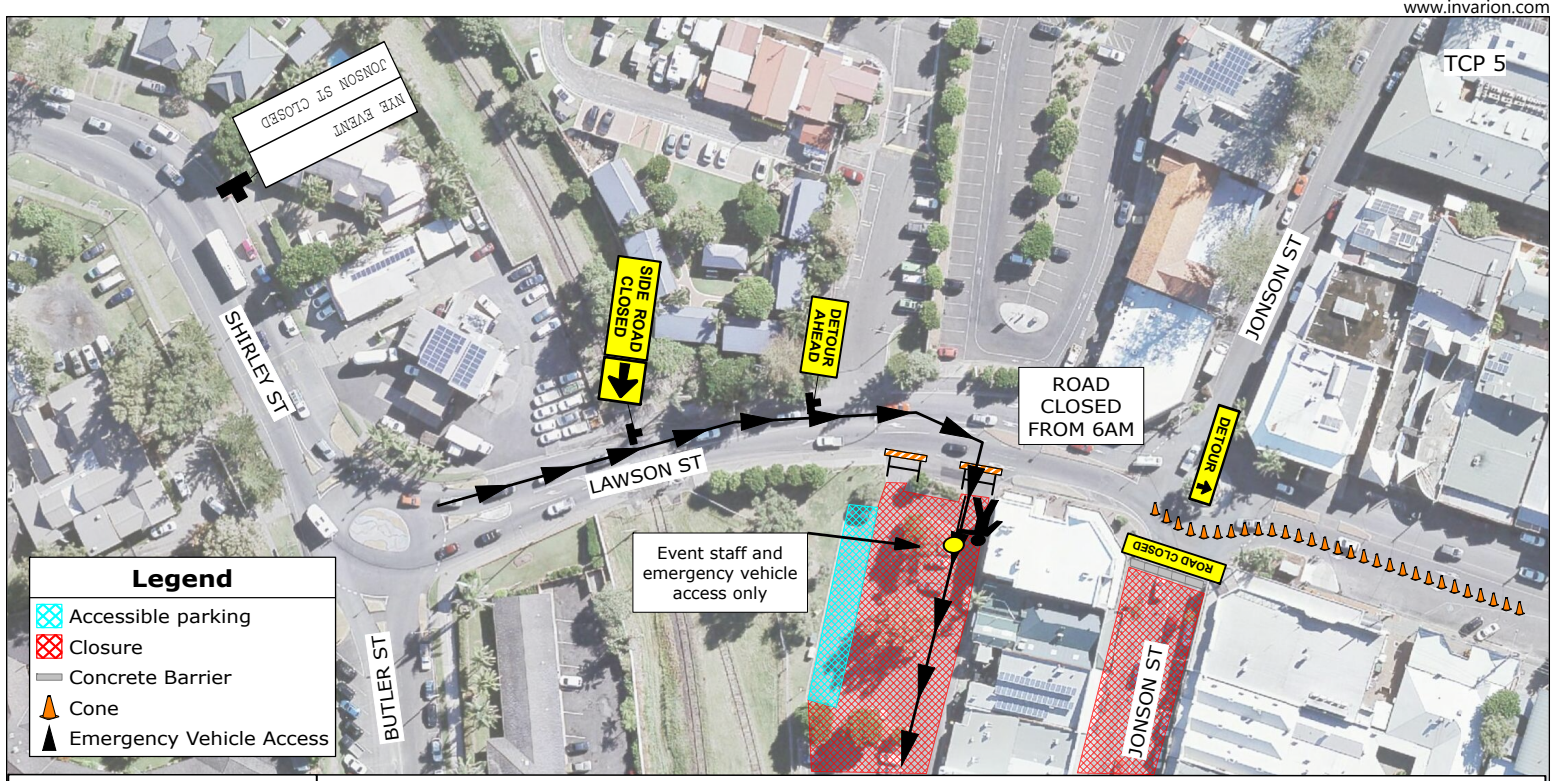
Comments:

SHORT TERM WORK
Based on TCP 83 from TC@WS Manual Version 5.0 & AS 1742.3
All signage and traffic control devices to be set up in accordance with TC@WS Manual Version 5.0
Traffic control to stop traffic and allow pedestrians to cross in groups
Signage to be placed to allow visibility to motorists

Designed & Inspected by John Leeming TCT0035936
RMS Prepare A Work Zone Traffic Management Plan

And Checked By Scott Pieniacki TCT0066389
RMS Prepare A Work Zone Traffic Management Plan

www.invarion.com



Date: 25/10/22 **Author:** John Leeming **Project:** New Years Eve 2022
Client: Byron Shire Council

Comments:

LONG TERM STATIC WORK
Based on Australian Standards 1742.3
All signage and traffic control devices to be set up in accordance with AS 1742.3
Westbound traffic on Lawson St to be merged into single lane (left lane closed except for emergency vehicles)

Inspected & Designed by John Leeming TCT0035936
Prepare A Work Zone Traffic Management Plan

Checked by Scott Pieniacki.....TCT0066389
Prepare A Work Zone Traffic Management Plan

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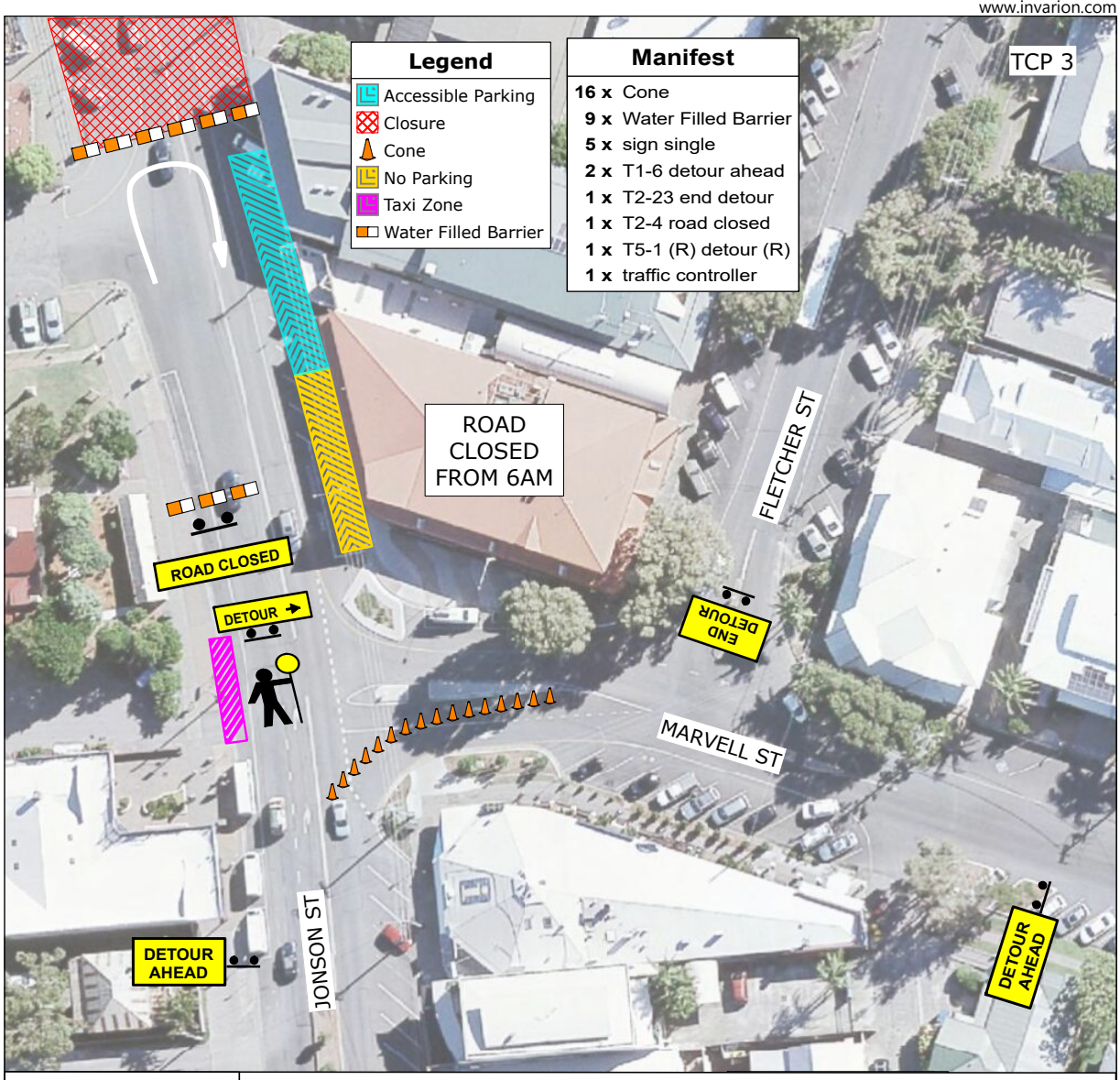

Date: 25/10/22 **Author:** John Leeming **Project:** New Years Eve 2022
Client: Byron Shire Council

Comments:

LONG TERM STATIC WORK
Based on Australian Standards 1742.3
All signage and traffic control devices to be set up in accordance with AS 1742.3

Spinifex Recruiting

Inspected & Designed by John Leeming TCT0035936
Prepare A Work Zone Traffic Management Plan

Checked by Scott Pieniacki.....TCT0066389
Prepare A Work Zone Traffic Management Plan

www.invarion.com

Date: 25/10/22 **Author:** John Leeming **Project:** New Years Eve 2022
Client: Byron Shire Council

Comments:

LONG TERM STATIC WORK
Based on Australian Standards 1742.3
All signage and traffic control devices to be set up in accordance with AS 1742.3

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Prepare A Work Zone Traffic Management Plan

Checked by Scott Pieniacki.....TCT0066389
Prepare A Work Zone Traffic Management Plan

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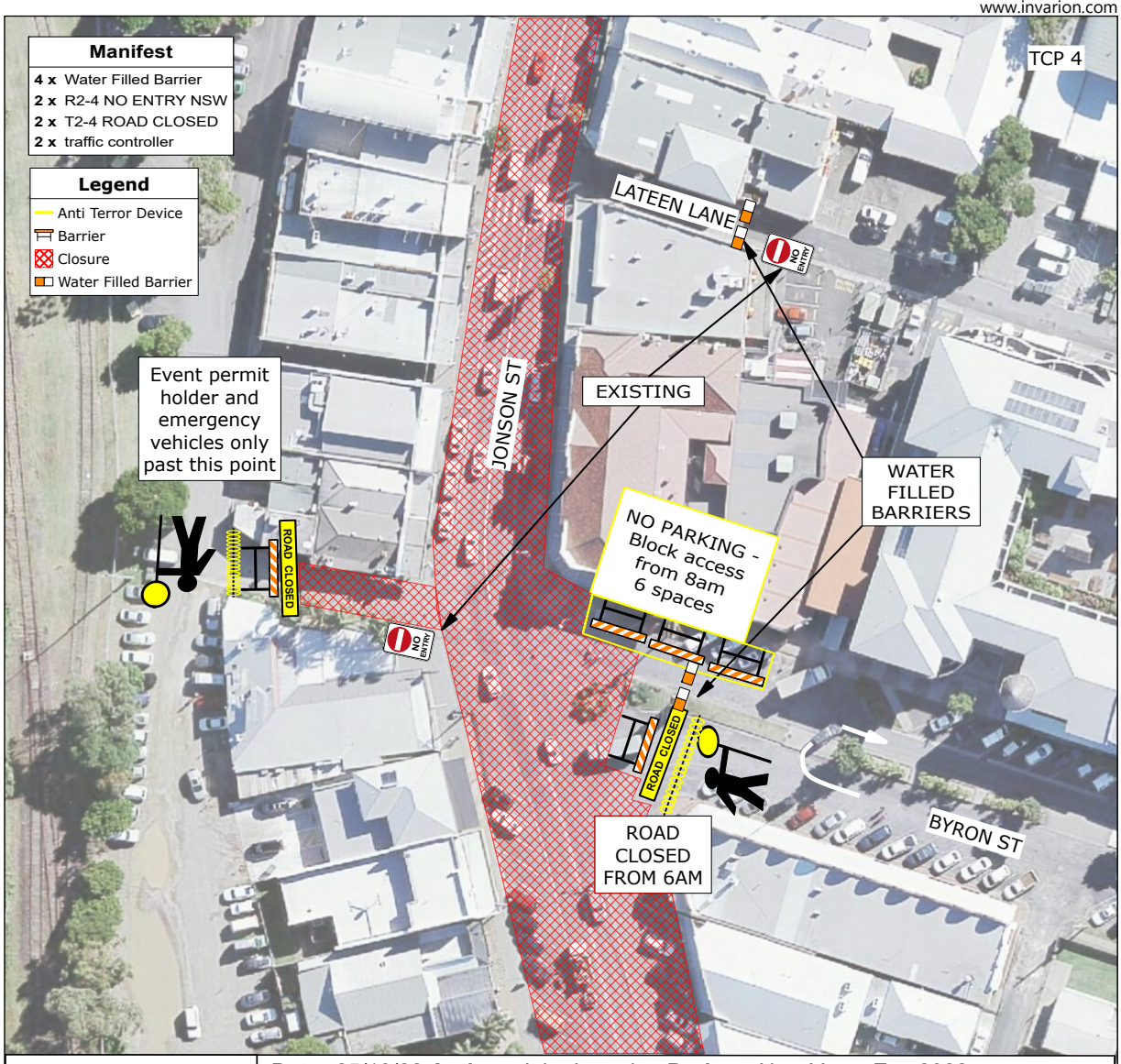


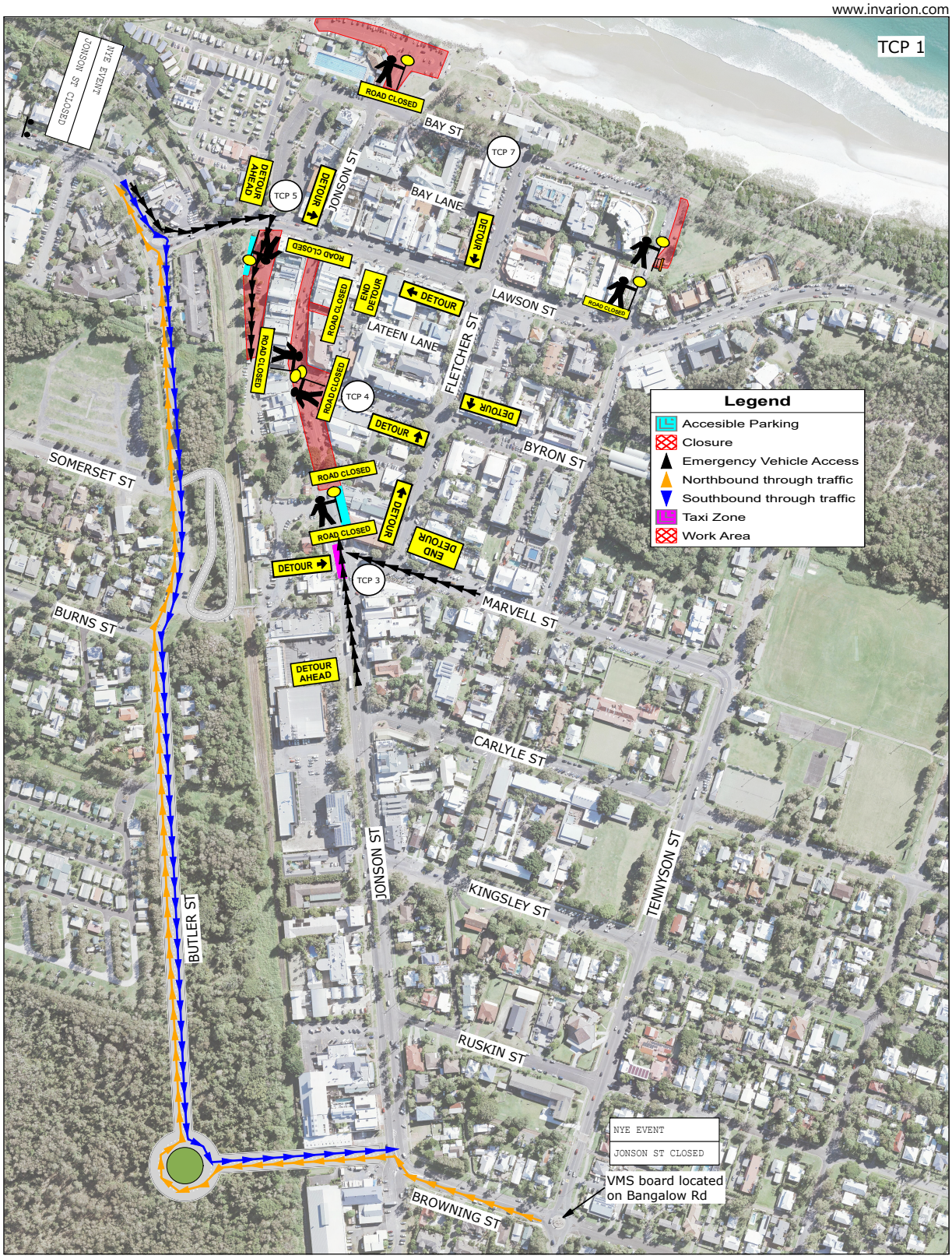
Date: 25/10/22 **Author:** John Leeming **Project:** New Years Eve 2022
Client: Byron Shire Council

Comments:

LONG TERM STATIC WORK
Based on Australian Standards 1742.3
All signage and traffic control devices to be set up in accordance with AS 1742.3
Bread shop laneway traffic controller to allow cleanup crew in at 12:30am
Byron St traffic controller to advise motorists of u-turn and allow emergency service access

Inspected & Designed by John Leeming TCT0035936
Prepare A Work Zone Traffic Management Plan

Checked by Scott Pieniacki.....TCT0066389
Prepare A Work Zone Traffic Management Plan


www.invarion.com
TCP 1
NYE EVENT
JONSON ST CLOSED
ROAD CLOSED
BAY ST
TCP 7
JONSON ST
BAY LANE
DETOUR AHEAD
TCP 5
DETOUR
ROAD CLOSED
END DETOUR
LAWSON ST
LATEEN LANE
FLETCHER ST
TCP 4
DETOUR
BYRON ST
SOMERSET ST
ROAD CLOSED
DETOUR
END DETOUR
DETOUR
TCP 3
MARVELL ST
BURNS ST
DETOUR AHEAD
CARLYLE ST
JONSON ST
TENNYSON ST
KINGSLEY ST
BUTLER ST
RUSKIN ST
BROWNING ST
Legend
Accesible Parking
Closure
Emergency Vehicle Access
Northbound through traffic
Southbound through traffic
Taxi Zone
Work Area
NYE EVENT
JONSON ST CLOSED
VMS board located on Bangalow Rd

Report No. 6.2 Belongil Parking Scheme Review - New parking limits

File No: I2022/1537

Council completed a parking scheme review for Belongil Beach on Childe, Border and Kendall Streets, and Council supported the recommendations when they were reported to Council on 25 Nov 2021 under resolution number 21-562

Subsequently, Council's Infrastructure Advisory Committee endorsed the proposed works in report no 4.4 on 7 Oct 2022. This was also adopted by Council on 27 October 2022 under resolution number 22-594

The drawing attached shows the proposed regulatory signage for Childe, Border and Kendall Streets that are a result of the above resolutions. Upon Local Traffic Committee support and Council endorsement these changed will be put in place.

RECOMMENDATION:

That the Local Traffic Committee supports the No Parking areas proposed for Belongil Beach on Childe, Border and Kendall Streets included in Attachment 1 (E2022/89910)

Attachments:

1 Belongil Beach - Parking Improvements - Construction Drawings, E2022/89910 , page 12⇩

103mm AT ORIGINAL SIZE

CHILDE ST & BORDER ST
BYRON BAY NSW
RAISED PEDESTRIAN CROSSING AND TRAFFIC CALMING MEASURES

DRAWING NO.	TITLE	REVISON
J7618-0001	COVER SHEET, DRAWING INDEX AND LOCALITY PLAN	B
J7618-0005	OVERALL PLAN & SIGNAGE PLAN	B
J7618-0006	PARKING PLAN	A
J7618-0010	RAISED PEDESTRIAN CROSSING DETAIL	B
J7618-0020	CHILDE STREET & DON STREET DETAIL	B
J7618-0030	KENDALL STREET & BORDER STREET DETAIL	B

LOCALITY PLAN (SOURCE: NEARMAPS, 2022)
SCALE - 1:1000

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	PRELIMINARY ISSUE	23.08.22	JM	JM	MP	MP
B	DRAWING INDEX UPDATED	13.09.22	JM	JM	MP	MP

SCALES: 0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: J.MCDONAGH
DESIGN BY: J.MCDONAGH
APPROVED BY:
DATE:
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SUITE 9A, 80-84 BALLINA STREET
PO BOX 161
LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 20 099 261 711
EMAIL: administration@planitconsulting.com.au

CLIENT: BYRON BAY COUNCIL
LOCAL GOVERNMENT AUTHORITY: BYRON BAY COUNCIL

PROJECT: CHILDE STREET BELONGIL
DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES COVER SHEET, DRAWING INDEX AND LOCALITY PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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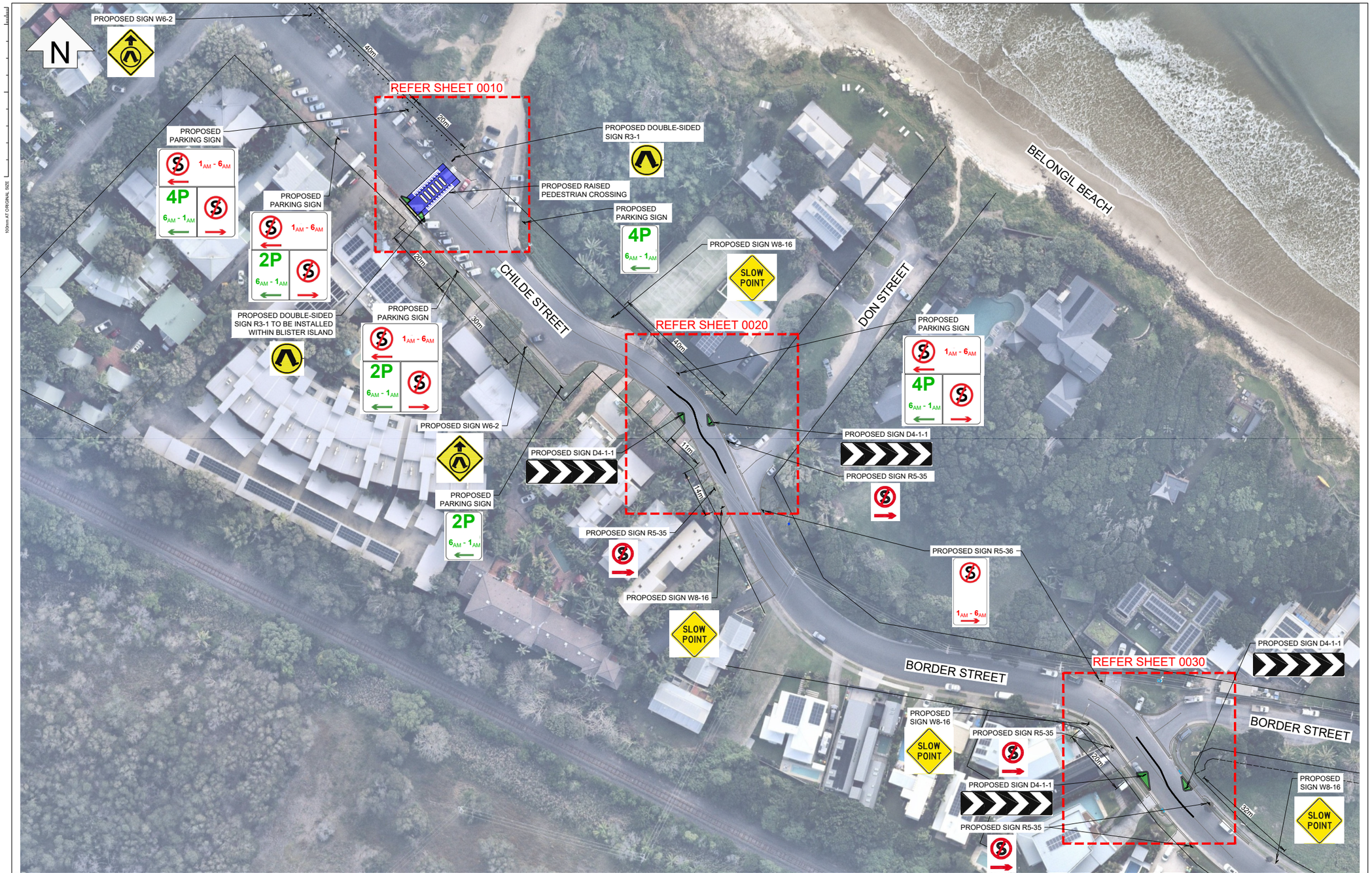

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A	PRELIMINARY ISSUE	23.08.22	JM	JM	MP	MP
B	PARKING SIGNAGE ADDED	13.09.22	JM	JM	MP	MP

SCALES: 0 5 10 20 30 — Full Size 1:500 ; Half Size 1:1000 Scale (m)

DO NOT SCALE FROM DRAWING

DRAWN BY: J.MCDONAGH
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LOCAL GOVERNMENT AUTHORITY: BYRON BAY COUNCIL

PROJECT: CHILDE STREET BELONGIL

DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES OVERALL PLAN & SIGNAGE PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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A	PRELIMINARY ISSUE	13.09.22	JM	JM	MP	MP

SCALES: 0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)

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PROJECT: CHILDE STREET BELONGIL

DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES PARKING PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J7618	0006	A

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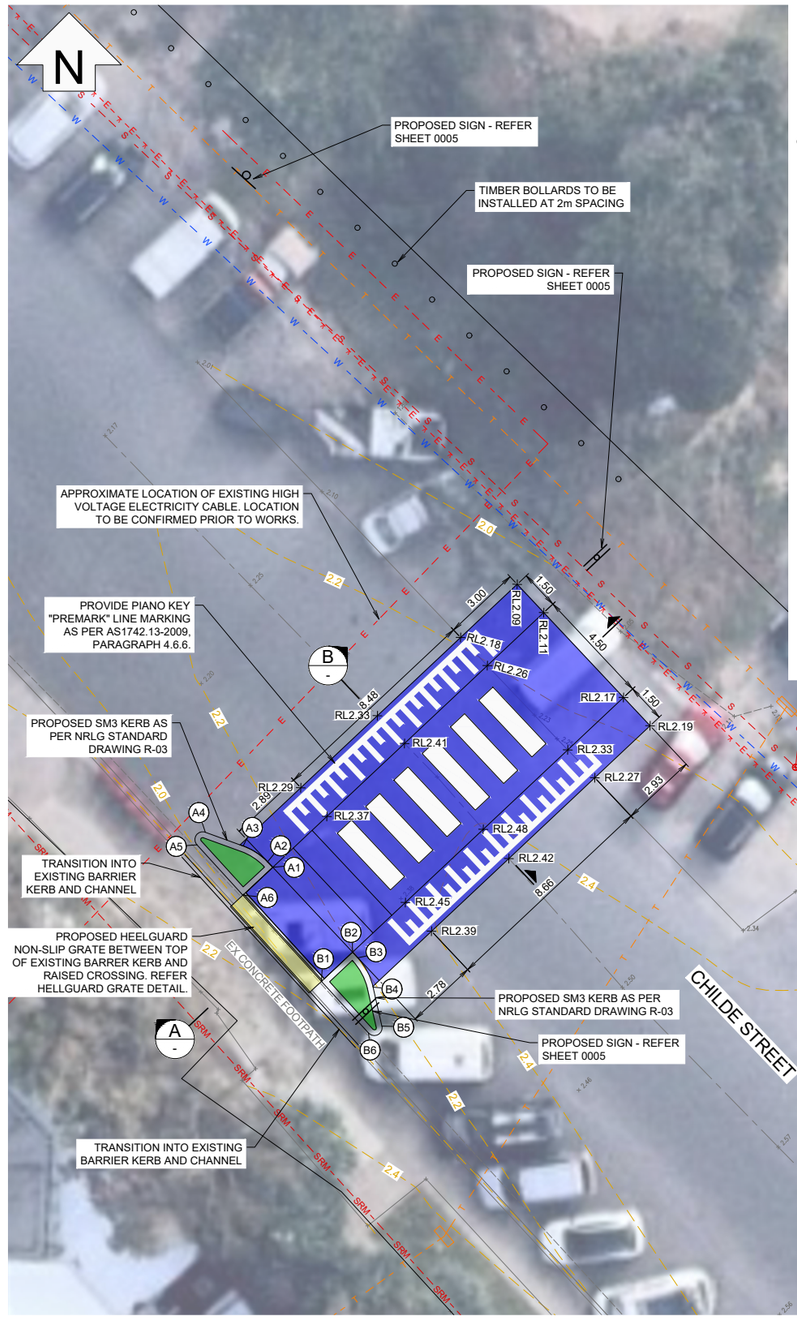
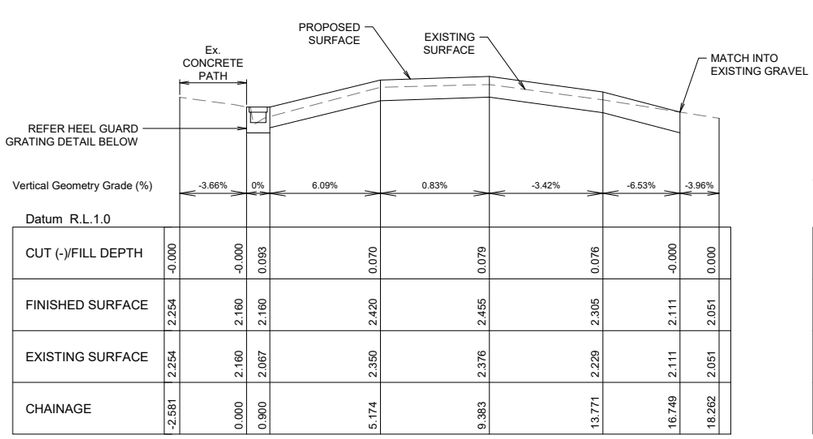




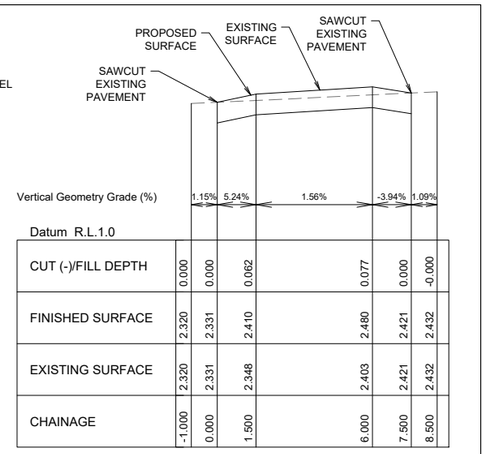
CUT (-)/FILL DEPTH	-0.000	-0.000	0.093	0.070	0.079	0.076	-0.000	0.000
FINISHED SURFACE	2.254	2.160	2.160	2.420	2.455	2.305	2.111	2.051
EXISTING SURFACE	2.254	2.160	2.067	2.350	2.376	2.229	2.111	2.051
CHAINAGE	-2.581	0.000	0.900	5.174	9.383	13.771	16.749	18.262

SECTION A-A

PROPOSED PEDESTRIAN CARRIAGEWAY ACROSS EXISTING ROAD

SCALE HORIZ. - 1:100

SCALE VERT. - 1:25



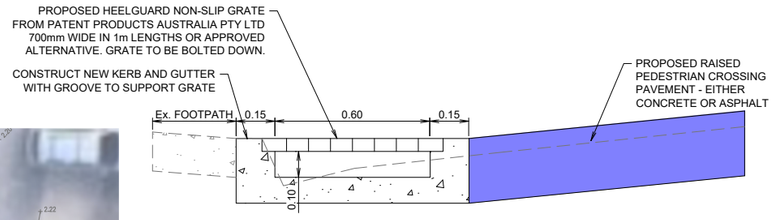
CUT (-)/FILL DEPTH	0.000	0.000	0.062	0.077	0.000	-0.000
FINISHED SURFACE	2.320	2.331	2.410	2.480	2.421	2.432
EXISTING SURFACE	2.320	2.331	2.348	2.403	2.421	2.432
CHAINAGE	-1.000	0.000	1.500	6.000	7.500	8.500

SECTION B-B

Ex ROAD CENTRELINE

SCALE HORIZ. - 1:100

SCALE VERT. - 1:25



HEELGUARD GRATING DETAIL

SCALE - 1:10

KERB A LIP SETOUT		
POINT	EASTING	NORTHING
A1	558574.202	6832345.259
A2	558573.999	6832345.468
A3	558573.056	6832346.079
A4	558571.595	6832346.610
A5	558571.270	6832346.126
A6	558573.044	6832344.180

KERB B LIP SETOUT		
POINT	EASTING	NORTHING
B1	558576.083	6832340.850
B2	558577.285	6832341.978
B3	558577.484	6832341.760
B4	558578.075	6832340.628
B5	558578.417	6832339.121
B6	558577.903	6832338.853

LEGEND

- EXISTING WATER MAIN — W
- EXISTING ABANDONED WATER MAIN — W
- EXISTING OVERHEAD ELECTRICITY — E
- EXISTING UNDERGROUND ELECTRICITY — E
- EXISTING TELECOMMUNICATIONS CABLE — T
- EXISTING STORMWATER — SW
- EXISTING GRAVITY SEWER — S
- EXISTING SEWER RISING MAIN — SRM
- PROPOSED RAISED BLISTER PAVED OR LANDSCAPED
- PROPOSED RAISED PEDESTRIAN CROSSING PAVEMENT - CONCRETE OR ASPHALT
- PROPOSED HEELSAFE NON-SLIP GRATE
- EXISTING CONTOURS — 4.00
- PROPOSED SIGNAGE

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	PRELIMINARY ISSUE	23.08.22	JM	JM	MP	MP
B	ADDITIONAL SIGNAGE AND BOLLARDS SHOWN	13.09.22	JM	JM	MP	MP

SCALES: 0 1 2 4 6

Full Size 1:100 ; Half Size 1:200

Scale (m)

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DESIGN BY: J.MCDONAGH

APPROVED BY:

DATE:

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PROJECT: CHILDE STREET BELONGIL

DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES RAISED PEDESTRIAN CROSSING DETAIL

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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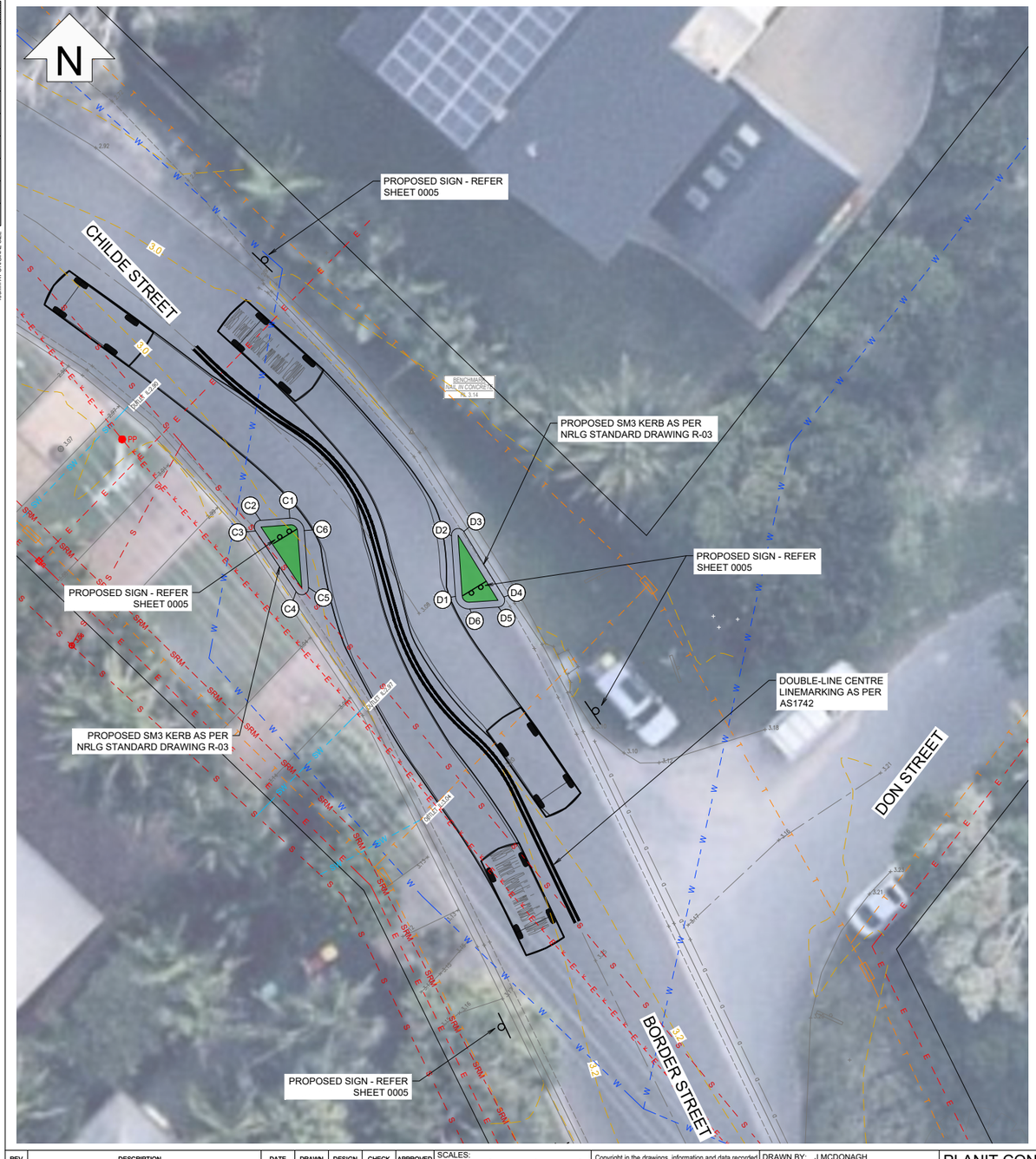
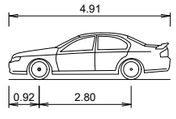


KERB C LIP SETOUT		
POINT	EASTING	NORTHING
C1	558654.339	6832282.638
C2	558653.037	6832282.540
C3	558652.816	6832282.065
C4	558654.620	6832279.368
C5	558655.175	6832279.548
C6	558654.983	6832282.084

KERB D LIP SETOUT		
POINT	EASTING	NORTHING
D1	558661.717	6832279.155
D2	558661.538	6832281.857
D3	558662.088	6832282.042
D4	558663.869	6832279.127
D5	558663.627	6832278.679
D6	558662.356	6832278.595

LEGEND

- EXISTING WATER MAIN — W
- EXISTING ABANDONED WATER MAIN — W
- EXISTING OVERHEAD ELECTRICITY — E
- EXISTING UNDERGROUND ELECTRICITY — E
- EXISTING TELECOMMUNICATIONS CABLE — T
- EXISTING STORMWATER — SW
- EXISTING GRAVITY SEWER — S
- EXISTING SEWER RISING MAIN — SRM
- PROPOSED RAISED BLISTER PAVED OR LANDSCAPED
- EXISTING CONTOURS — 4.00
- PROPOSED SIGNAGE



B85 Vehicle (Realistic min radius) (2004)

Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	5.750m

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
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B	ADDITIONAL SIGNAGE SHOWN	13.09.22	JM	JM	MP	MP

SCALES: 0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
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PROJECT: CHILDE STREET BELONGIL
DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES CHILDE STREET & DON STREET DETAIL

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J7618	0020	B

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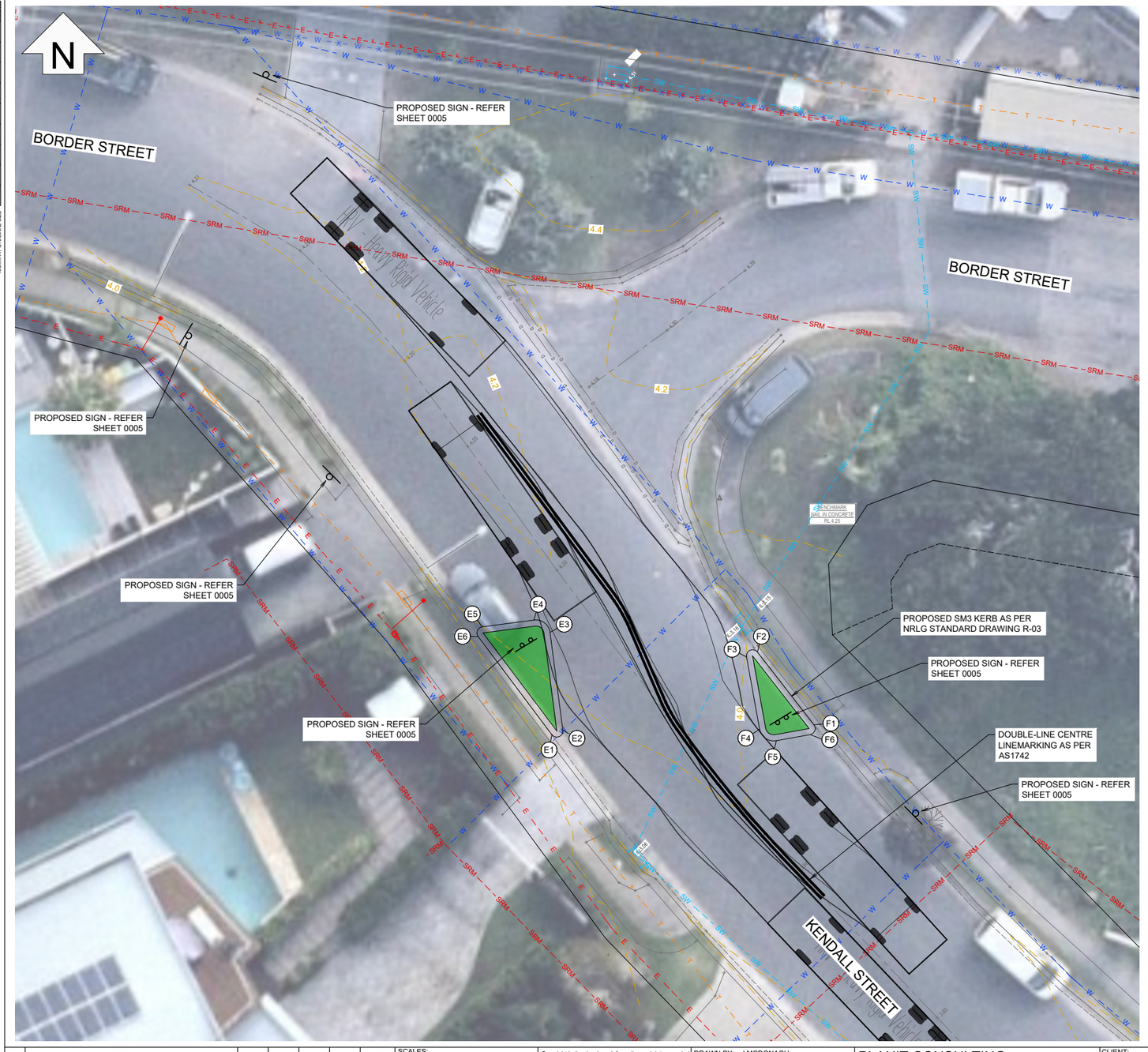
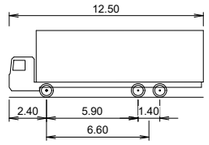


KERB F LIP SETOUT		
POINT	EASTING	NORTHING
F1	558804.889	6832171.519
F2	558802.125	6832175.072
F3	558801.593	6832174.835
F4	558802.232	6832171.302
F5	558803.045	6832170.738
F6	558804.705	6832171.039

KERB E LIP SETOUT		
POINT	EASTING	NORTHING
E1	558792.064	6832171.034
E2	558792.601	6832171.254
E3	558791.973	6832176.037
E4	558791.188	6832176.640
E5	558788.658	6832176.308
E6	558788.458	6832175.830

LEGEND

- EXISTING WATER MAIN — W
- EXISTING ABANDONED WATER MAIN — W
- EXISTING OVERHEAD ELECTRICITY — E
- EXISTING UNDERGROUND ELECTRICITY — E
- EXISTING TELECOMMUNICATIONS CABLE — T
- EXISTING STORMWATER — SW
- EXISTING GRAVITY SEWER — S
- EXISTING SEWER RISING MAIN — SRM
- PROPOSED RAISED BLISTER PAVED OR LANDSCAPED
- EXISTING CONTOURS — 4.00
- PROPOSED SIGNAGE



HRV - Heavy Rigid Vehicle

Overall Length	12.500m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	12.500m

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	PRELIMINARY ISSUE	23.08.22	JM	JM	MP	MP
B	ADDITIONAL SIGNAGE SHOWN	13.09.22	JM	JM	MP	MP

SCALES: 0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
Scale (m)
DO NOT SCALE FROM DRAWING

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DESIGN BY: J.MCDONAGH
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT CONSULTING
SUITE 9A, 80-84 BALLINA STREET
PO BOX 161
LENNOX HEAD NSW 2478

TELEPHONE: 02 6687 4666
ABN: 20 099 261 711
EMAIL: administration@planitconsulting.com.au

CLIENT: BYRON BAY COUNCIL

LOCAL GOVERNMENT AUTHORITY: BYRON BAY COUNCIL

PROJECT: CHILDE STREET BELONGIL

DRAWING TITLE: PEDESTRIAN CROSSING & TRAFFIC CALMING MEASURES KENDALL STREET & BORDER STREET DETAIL

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J7618	0030	B

CAD FILE: I:\J7618 - BELONGIL PEDESTRIAN CROSSING\7 - ENGINEERING\7.4 DRAFTING\J7618 - CONCEPT PLAN.DWG PLOTTED BY: PE.JAMES PLOT DATE: 13/09/2022 4:30:04 PM

Report No. 6.3 Additional parking restrictions on Short Street, Byron Bay (Road safety)

File No: I2022/1540

Short Street is a short (≈80m) residential street in Byron Bay that runs between two minor residential collector streets Massinger Street and Paterson Street. When vehicles are parked on each side of the road there is not insufficient space for two-way traffic to pass (refer to figure 1).

Residents have advised there has been numerous near misses (head-on) and a recent crash. There has only been one recorded crash in the last 5 years (minor injury) which was from a vehicle turning left onto Massinger Street, from Short Street and not giving way resulting in a side swipe crash type in the near side lane.

Figure 1: Short Street approach to Massinger Street

Council staff have spoken with residents on-site to discuss their concerns and upon investigation staff have prepared the plan below (figure 2 and attachment 1) to improve safety in the street.

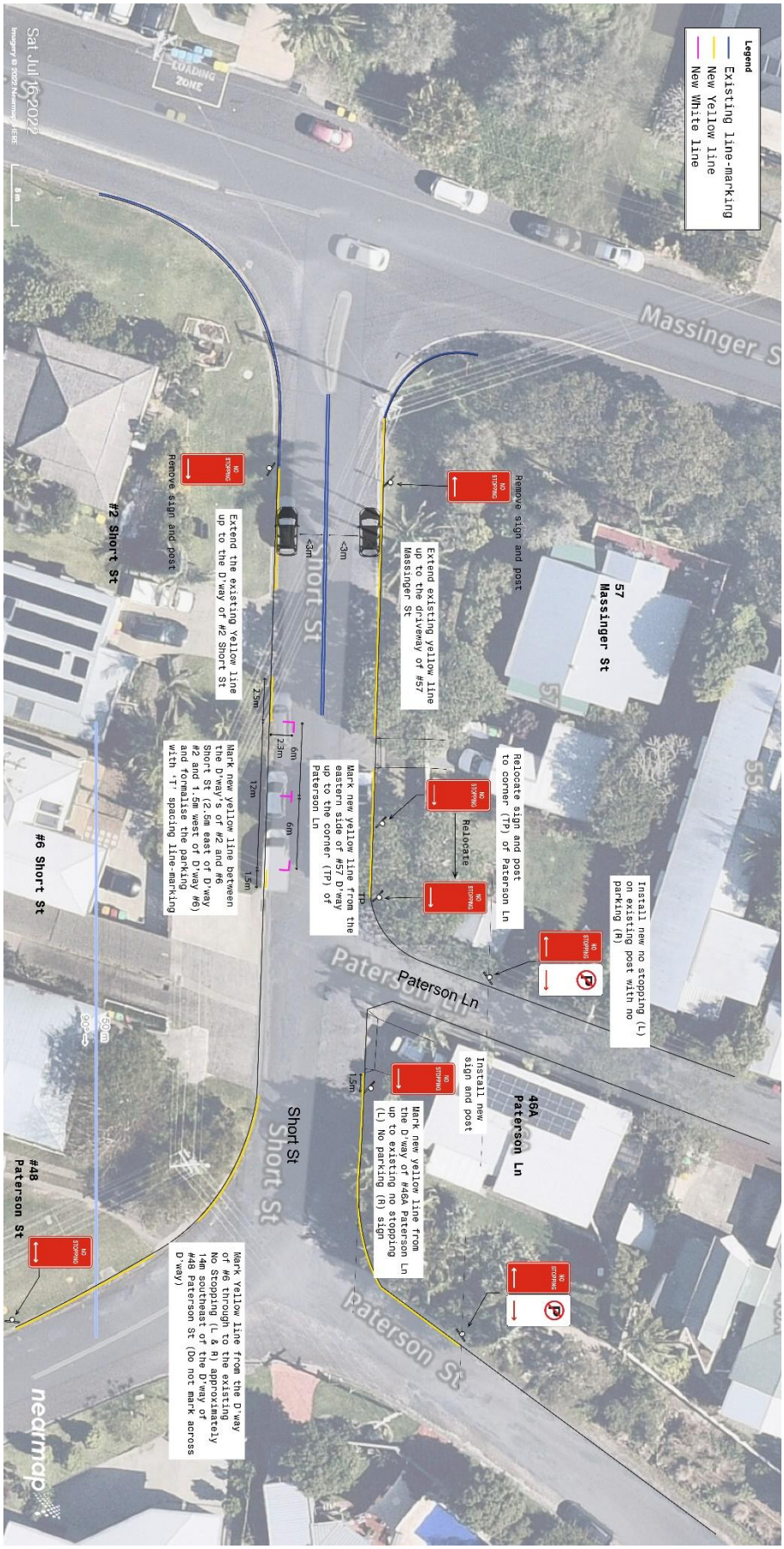


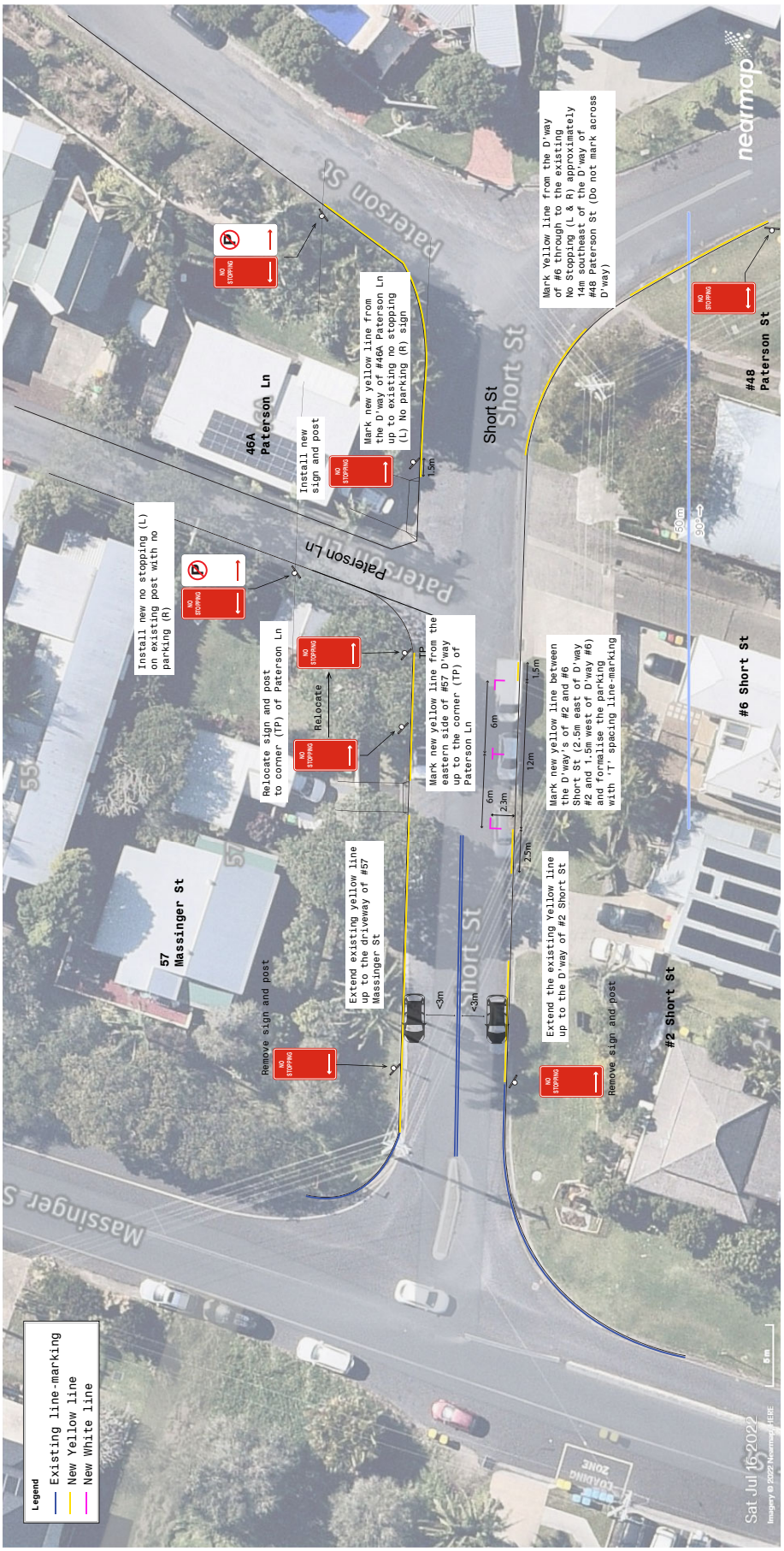
Figure 2: Signs and line instruction order

RECOMMENDATION:

It is recommended that the parking restrictions contained within figure 2 and attached within this report be implemented to increase road safety.

Attachments:

1 Short Street_No Stopping_Signs and Lines Plan_26 October 2022, E2022/104246 , page 21⇩


Legend
Existing line-marking
New Yellow line
New White line
Paterson St
Short St
Massinger St
Paterson Ln
46A Paterson Ln
57 Massinger St
#6 Short St
#2 Short St
#48 Paterson St
Install new no stopping (L) on existing post with no parking (R)
Relocate sign and post to corner (TP) of Paterson Ln
Relocate
Remove sign and post
Extend existing yellow line up to the driveway of #57 Massinger St
Install new sign and post
Mark new yellow line from the D'way of #46A Paterson Ln up to existing no stopping (L) No parking (R) sign
Mark new yellow line from the eastern side of #57 D'way up to the corner (TP) of Paterson Ln
Extend the existing Yellow line up to the D'way of #2 Short St
Remove sign and post
Mark new yellow line between the D'way's of #2 and #6 Short St (2.5m east of D'way #2 and 1.5m west of D'way #6) and formalise the parking with 'T' spacing line-marking
Mark Yellow line from the D'way of #6 through to the existing No Stopping (L & R) approximately 14m southeast of the D'way of #48 Paterson St (Do not mark across D'way)
NO STOPPING
<3m
6m
2.3m
12m
1.5m
2.5m
50m
90°
8m
Sat Jul 16 2022
nearmap

Report No. 6.4 Byron Bay Sleep Bus

File No: I2022/1559

The purpose of this report is to obtain endorsement from the Local Traffic Committee for the installation of regulated parking signage to allow for a community initiative (Sleep Bus) to operate on Friday – Sunday, between 8pm and 8am.

The parking signage plan is shown below in figure 1.

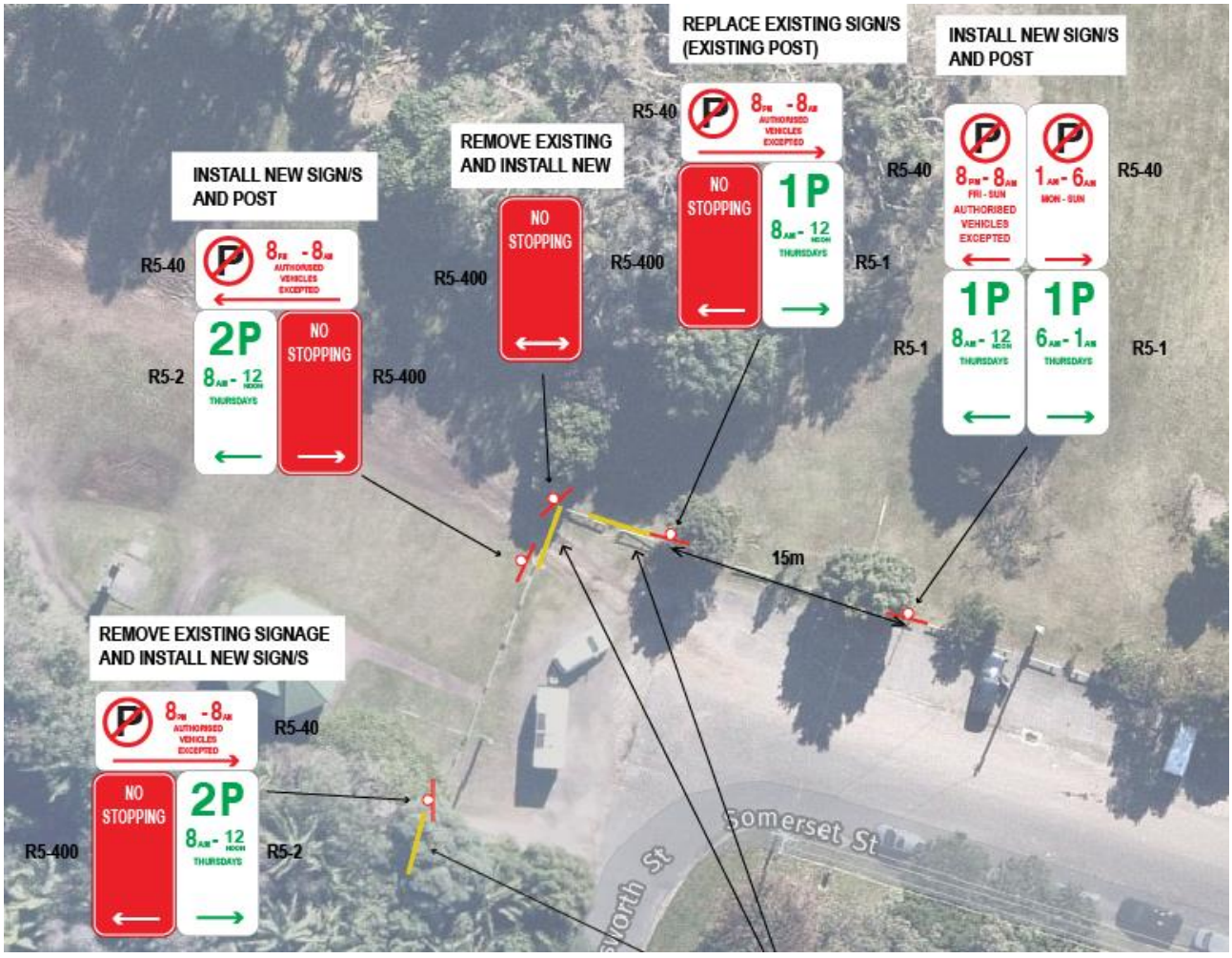


Figure 1: Signage plan (Sleep Bus).

Sleep Bus Background

The sleep bus is an organisation that aims to bring safe, temporary, overnight accommodation to people without a residence.

The Sleep Bus is already operating in Queanbeyan, Maroochydore and the ACT. The Sleep bus has been operational in Queanbeyan for over a year and has provided 839 safe sleeps (beds for the night) for people without homes.

The Sleep Bus operates from 8pm – 8pm, below is a snapshot of the operation schedule (figure 2).

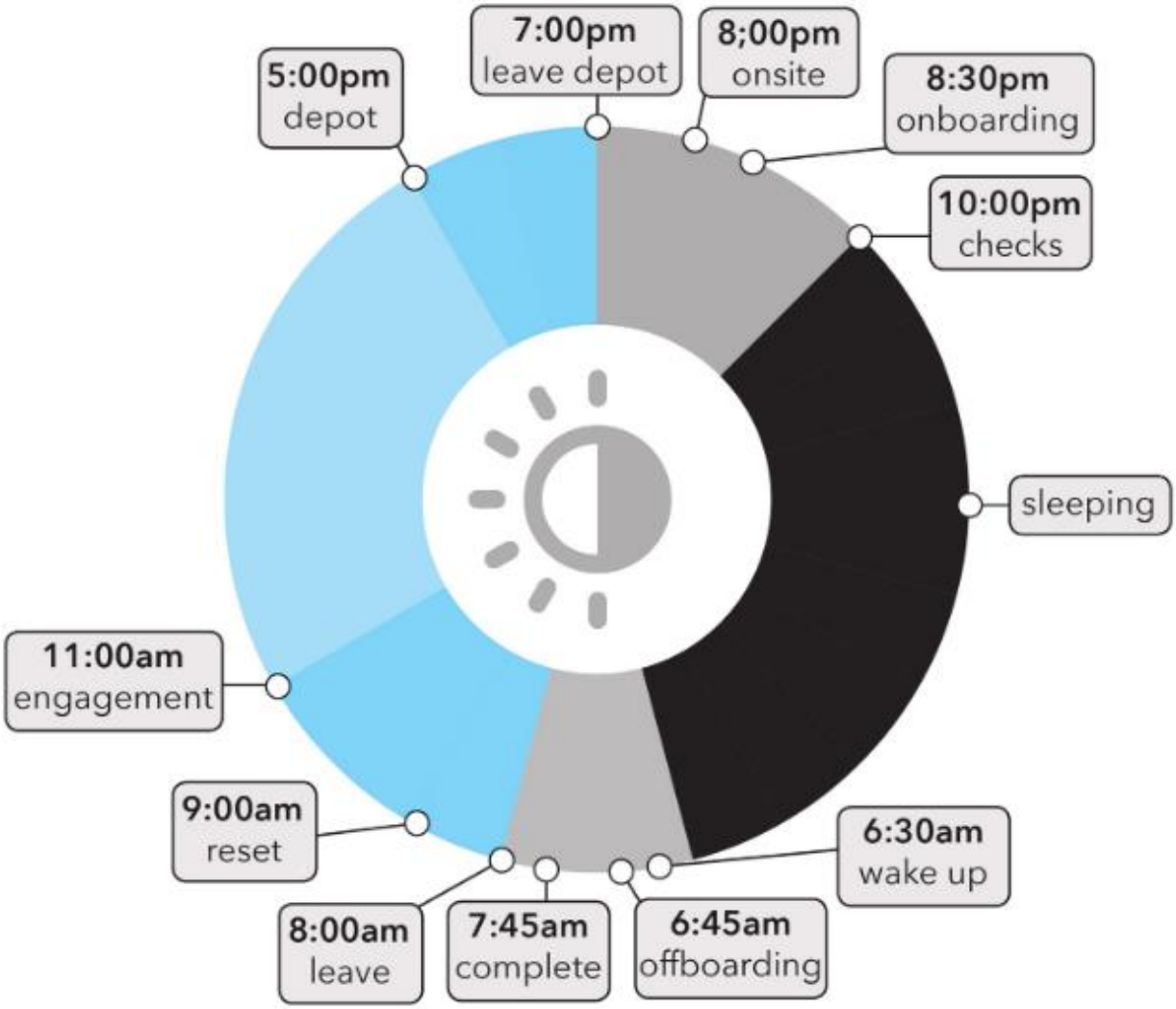


Figure 2: Operational schedule

RECOMMENDATION:

It is recommended that Local traffic Committee support the installation of the signage shown in figure 1 of report at the intersection of Somerset Street and Wordsworth Street, Byron Bay.

Report No. 6.5 Centennial Circuit One Way System, Byron Bay

File No: I2022/1614

On 7 November 2021 Council resolved Resolution 21-478):

Resolved *that Council:*

1. *Extends the one-way traffic trial for an additional 12 months, or until such time as a permanent solution can be implemented.*

2. *Considers a quarterly budget review of $17,900 to commission the design for permanent one-way traffic circulation and to fund the interim trial extension measures.*

3. *Continues to consider other opportunities for improving traffic circulation and flow within the Byron Arts and Industry Estate, including further linemarking and the possibility of other one-way streets.*

This report seeks approval of the regulatory signage layout for the proposed permanent one way solution.

Council engineering design/traffic staff have assessed the existing one-way trial signage layout and found that while the implemented trial signage has been successful for the temporary arrangement, there are changes to the signs and layout required for the permanent implementation to meet Council/ TfNSW and Australian Standard guidelines.

The proposed layout is shown on in attachment one. Plan Number 2957 – Centennial Circuit, Byron Bay One-Way Permanent Install, Document E2022/107955, Issue B dated 3 November 2022.

During recent site visits by engineering staff, the trial arrangement was discussed informally with some business owners / workers who confirmed that the one-way traffic arrangement has been successful in their opinion and should remain permanent.

Community consultation and feedback was a significant part of the 12 month extension to the trial approved by resolution 21-478. (Refer to report I2021/1566 that proposed the resolution).

RECOMMENDATION:

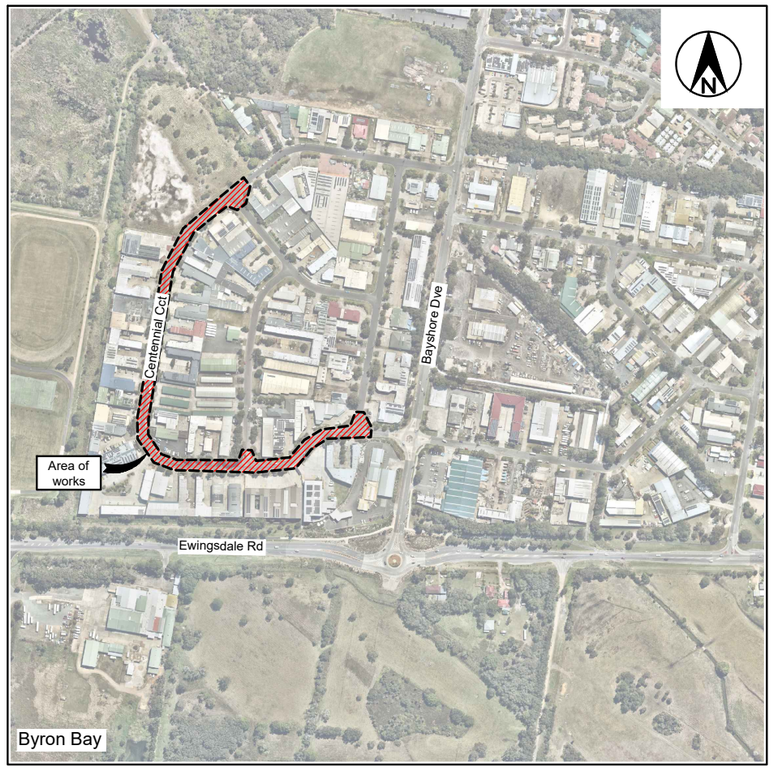
That the Local Traffic Committee supports the permanent one-way installation and regulatory signage proposed for Byron Bay Industrial Estate on Centennial Circuit, Brigantine Street, Tasman Way and Wollongbar Street included in Attachment 1 (E2022/107955)

Attachments:

1 Plan Number 2957, E2022/107955 , page 26

Centennial Circuit, Byron Bay
One-Way permanent install

Byron Shire Council



Locality sketch

Index

Description	DWG No.	Issue
Index and Locality Sketch	2957-01	A
General Notes	2957-02	A
Site Layout & Key Plan	2957-03	B
Intersection Detail Brigantine Street	2957-04	B
Intersection Detail Tasman Way	2957-05	B
Intersection Detail Wollongbar Street	2957-06	B

Legend

Issue A, B, C, etc. = Preliminary approvals / tender drawings (NOT FOR CONSTRUCTION)
Issue 1, 2, 3, etc. = Construction issue drawings

Project No
2957

Preliminary
not for construction

☐ Project has been constructed in accordance with these plans

OR

☐ Project has been constructed with departures from these plans as shown marked in red

.....
Construction Engineer

Date: .....

Approval
on behalf of the General Manager

.....
Director Infrastructure Services

Date: .....

Project number: 2957	
Drawing number	Issue
2957-01	A

ACAD FILE No: G:\Engineer\CAD\2900-2999\2957-Centennial Cct One-way permanent install\Civil Design\DWG\PRELIMINARY\2957-Centennial Cct One Way.dwg

General

1. These drawings shall be read in conjunction with the relevant Northern Rivers Local Government development design and construction manuals and standard drawings.
2. This note and the following notes form an integral part of this drawing set.
3. All dimensions are in metres unless shown otherwise.
4. Dimensions shall not be scaled from the drawings.
5. Materials and workmanship shall be in accordance with the specifications, together with the requirements of all applicable codes of practice, Australian standards and statutory authorities.
6. Survey data has been compiled from field pick-ups and office records. The project manager should ensure that sufficient data is shown to enable construction without disturbance to features that are not shown on the drawings.
7. Services shown hereon have been located where visible on the site, from information received from relevant authorities and from historical records held by Byron shire council.
8. Prior to any demolition, excavation or construction on site, the relevant authorities should be contacted for possible location of further underground services and detailed location of all services (Dial before you dig 1100).
9. The title boundaries shown hereon were not field investigated or marked at the time of survey and have been determined by plan dimensions only.
10. The origin of co-ordinates is MGA.
11. The datum for levels is AHD.

Site works

1. All soils containing organic matter (e.g. roots, grass etc.) must be stripped from the construction site prior to filling / building works and must not be used as fill material.
2. All exposed surfaces shall be grassed or paved to prevent scour and erosion damage.
3. The constructor is responsible for implementing all necessary sedimentation and erosion control measures specified or deemed necessary to protect the works and adjacent areas.
4. The constructor is responsible for the maintenance and management of a temporary and / or permanent erosion and sedimentation controls during the construction and maintenance period.
5. All oversized material, which may impede compaction, must be removed from the fill platform.
6. Fill is to be uniformly compacted in up to 200-300mm horizontal layers and must achieve a minimum standard of compaction of greater than 95% standard compaction to AS 1289 for cohesive soils, or a density index of greater than 65% for cohesionless soils. Benching of the natural ground will be required on sloping ground prior to commencement of fill operations.
7. Clays of high plasticity or high in-situ moisture content are not to be used as fill.
8. An imported granular fill with a plasticity index preferably less than 15%, with no excessive oversized material, may be used.
9. Field density tests, or equivalent, should be carried out to verify that the standard of compaction is achieved. Field density tests are to be taken over the full depth of the layer or from the bottom of the layer.

Restoration of surfaces

1. The constructor shall clean pavements, lawns and other improved areas and leave them in the same order as they were at the commencement of the works. The constructor shall restore any fencing removed during construction and shall restore lawns with turf cut and set aside from the original surface and with imported turf from a source approved by the construction engineer. (WSA 02 2002 Part 3, Section 25).
2. Immediately after backfilling of a trench excavated through a pavement has been completed, the constructor shall temporarily restore the pavement. Where the trench crosses bitumen or concrete pavement, the surface is to be protected from deterioration. A pre-mixed asphaltic material may be used for such temporary restoration. the constructor shall maintain the temporary restoration until final restoration is carried out. Final restoration of the pavement shall be carried out to restore the pavement and its sub-base to no less than the original condition. Final restoration may include, if required by the construction engineer, the removal of temporary restoration.
3. In other than roadways, the constructor shall place the backfill sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the defects liability period in order that the surface of the completed trench may then conform with the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the constructor. Where dry weather conditions have persisted after the original backfilling, including during the defects liability period, the constructor shall take all necessary steps to consolidate the trench before removing surplus materials from the site.
4. In locations where, in the opinion of the construction engineer, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the satisfaction of the construction engineer in such a way as to avoid future erosion of the backfill and adjacent ground surfaces. The constructor shall maintain the backfill and adjacent ground until the expiry of the defects liability period.
5. Where, within public or private property, the reasonable convenience of persons will require such, the construction engineer may order the constructor to level trenches at the time of backfilling. The constructor shall make good any subsequent settlement, as required by placing additional fill.
6. The constructor shall immediately restore any damaged or disturbed private property and services.
7. Should the constructor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces. The constructor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the defects liability period.
8. The constructor shall provide notice to affected property owners of any pending works.

Driveways

1. All existing driveways affected by new works are to be cut back, removed & reconstructed using material to match existing.
2. The constructor shall liaise with the property owners regarding any variation to the above.
3. Reconstruction of existing concrete driveway or pathway is to be in accordance with Northern Rivers Local Government D1.37 AND D1.38 "Handbook for driveway access to property" and relevant standard drawings .
4. Reconstruction of existing bitumen sealed driveway shall be of similar construction to that of the existing with a compacted gravel base course

Existing services

1. The constructor shall be responsible for the location of existing services prior to commencing with the works.
2. The constructor shall be responsible for the replacement of any existing services damaged during construction with new services of equivalent type and specifications.
3. The constructor shall be responsible for liasing with telecommunications and electrical supply authorities with supply and fitment of replacement telecommunications and electricity pits and/or lids to suit his works program
4. When constructing or working near existing pressure mains it should be expected that there are concrete thrust blocks located at bends or other fittings on the existing main. It is very important not to disturb the bearing soil behind the thrust block to avoid failure of the existing pressure main. If excavation around existing thrust blocks can not be avoided then the existing pressure main shall be taken off line during the excavation works.

Concrete

All workmanship and materials shall be in accordance with A.S.3600, current edition with amendments

1. Concrete quality (unless otherwise shown) shall be as follows
   - course aggregate - maximum size 20mm
   - cement - type "A" Portland cement.
   - concrete shall have the following slump during placement
     - beams ,slabs and footings 80mm
     - columns and walls 80mm
3. Slab joints shall be placed as follows
   - footpaths - as per Northern Rivers Local Government standard drawing R-07
   - Slabs and walls - refer to slab jointing plan within this drawing set
   - Slab sawn joints shall be cut within 24 hours of slab pouring in a neat and straight cut.
4. All splatter to surrounding surfaces shall be cleaned up immediately
5. Cover to reinforcement shall be obtained by the use of plastic bar chairs with maximum spacing of 800mm in any direction
6. All concrete shall be compacted using high frequency vibrators.
7. Curing of concrete surfaces shall commence immediately after surfaces are finished and shall continue to cure for a minimum of 7 days
8. Slabs with specific rough finishes shall be kept free of bleed water and floated to prevent the formation of plastic shrinkage cracks.

PRELIMINARY
NOT FOR CONSTRUCTION

Issue	Amendment details	Drawn	Check	Date
A	Original issue	A.D.	H.K.	03.11.22

 # Use figured dimensions only. Do not scale.

ACAD FILE No: G:\Engineer\CAD\2900-2999\2957-Centennial Cct One-way permanent install\Civil Design\DWG\PRELIMINARY\2957-Centennial Cct One Way.dwg

Infrastructure Services
Council offices
70-90 Station Street,
Mullumbimby NSW 2482.
Phone 02 66267000
Fax 02 66843018
Website www.byron.nsw.gov.au

BYRON SHIRE COUNCIL

Approved on behalf of the General Manager

..... Date .....

Designed	Geolink	03.11.22
Drawn	A.D.	03.11.22
Checked	H.K.	03.11.22
Horizontal datum		MGA
Vertical datum		AHD

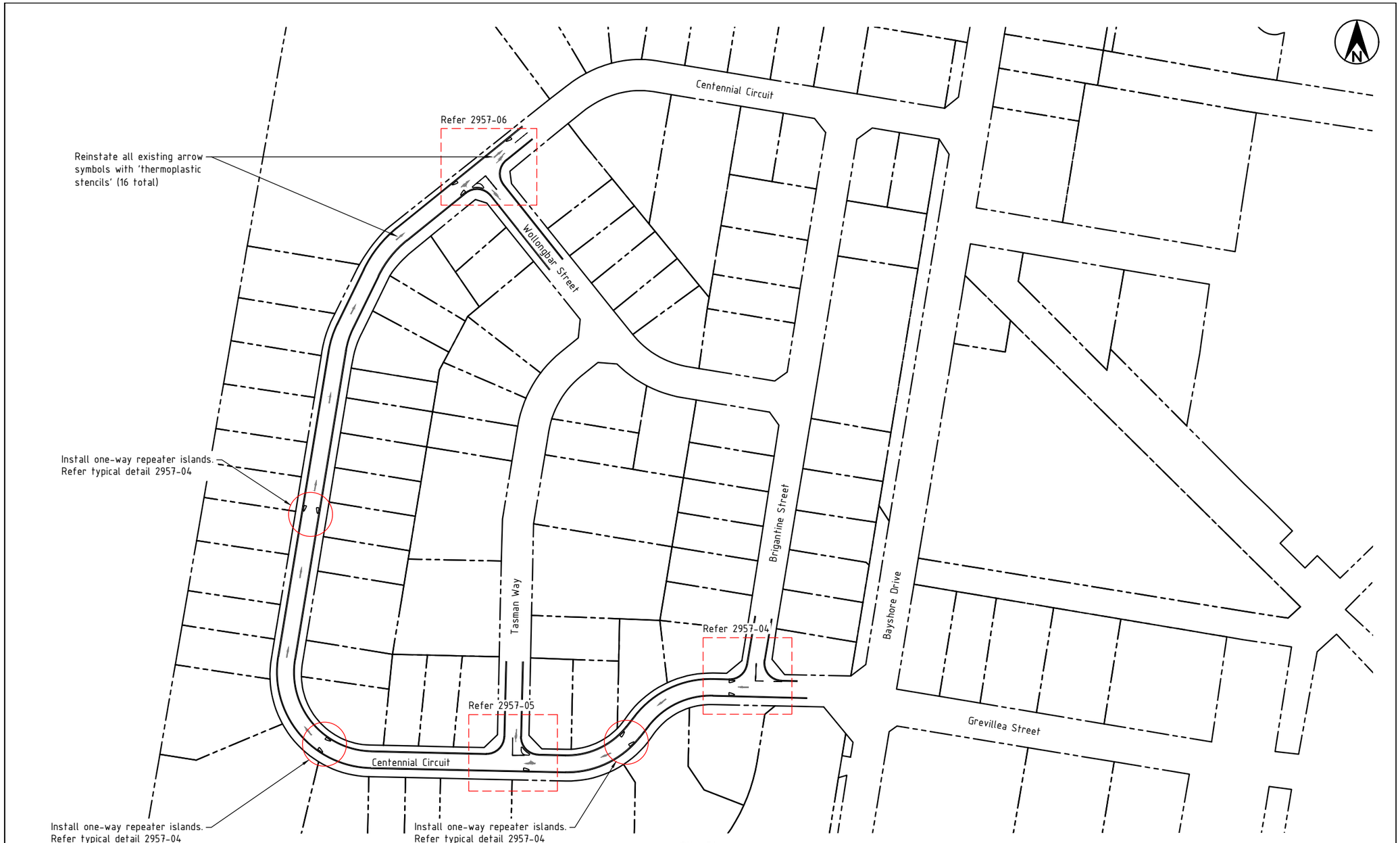
Project: **Centennial Circuit, Byron Bay One-Way permanent install**

Project number: **2957**

Plan title: **General notes**

Drawing number: **2957-02**

Issue: **A**



Site Plan

Scale 1:2000 (A3)

PRELIMINARY
NOT FOR CONSTRUCTION

Issue	Amendment details	Drawn	Check	Date
B	Additional line marking	A.D.	H.K.	03.11.22
A	Original issue	A.D.	H.K.	04.08.22

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000

0 10 20 40 60 80 100m

Use figured dimensions only. Do not scale.

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Checked	H.K.	04.08.22
Horizontal datum		MGA
Vertical datum		AHD

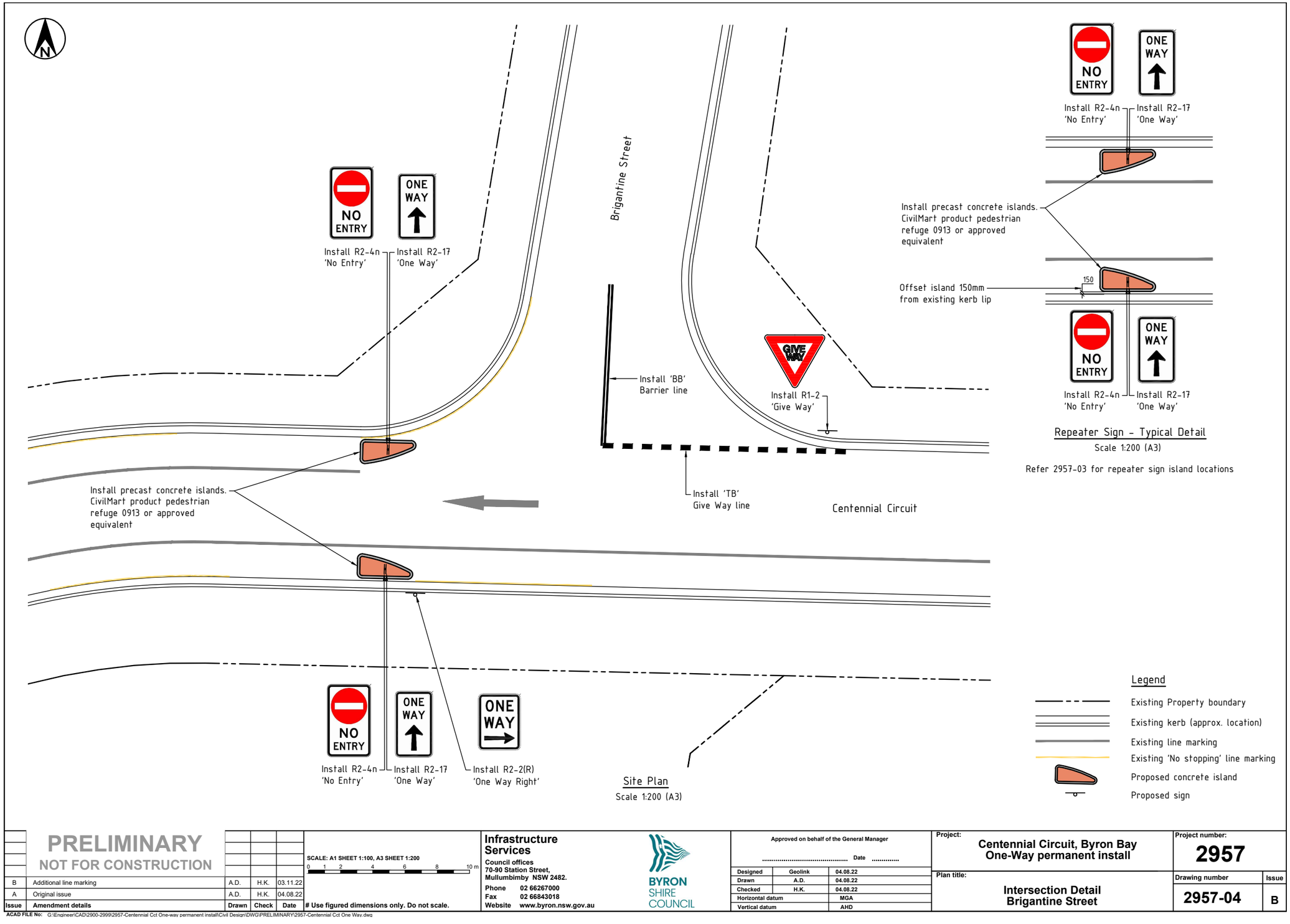
Project: **Centennial Circuit, Byron Bay One-Way permanent install**

Project number: **2957**

Plan title: **Site layout & Key Plan**

Drawing number: **2957-03**

Issue: **B**



PRELIMINARY
NOT FOR CONSTRUCTION

Issue	Amendment details	Drawn	Check	Date
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A	Original issue	A.D.	H.K.	04.08.22

SCALE: A1 SHEET 1:100, A3 SHEET 1:200
0 1 2 4 6 8 10 m
 # Use figured dimensions only. Do not scale.

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Council offices
70-90 Station Street,
Mullumbimby NSW 2482.
Phone 02 66267000
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BYRON SHIRE COUNCIL

Approved on behalf of the General Manager
..... Date .....

Designed	Geolink	04.08.22
Drawn	A.D.	04.08.22
Checked	H.K.	04.08.22
Horizontal datum		MGA
Vertical datum		AHD

Project: Centennial Circuit, Byron Bay
One-Way permanent install

Project number: 2957

Plan title: Intersection Detail
Brigantine Street

Drawing number 2957-04

Issue B

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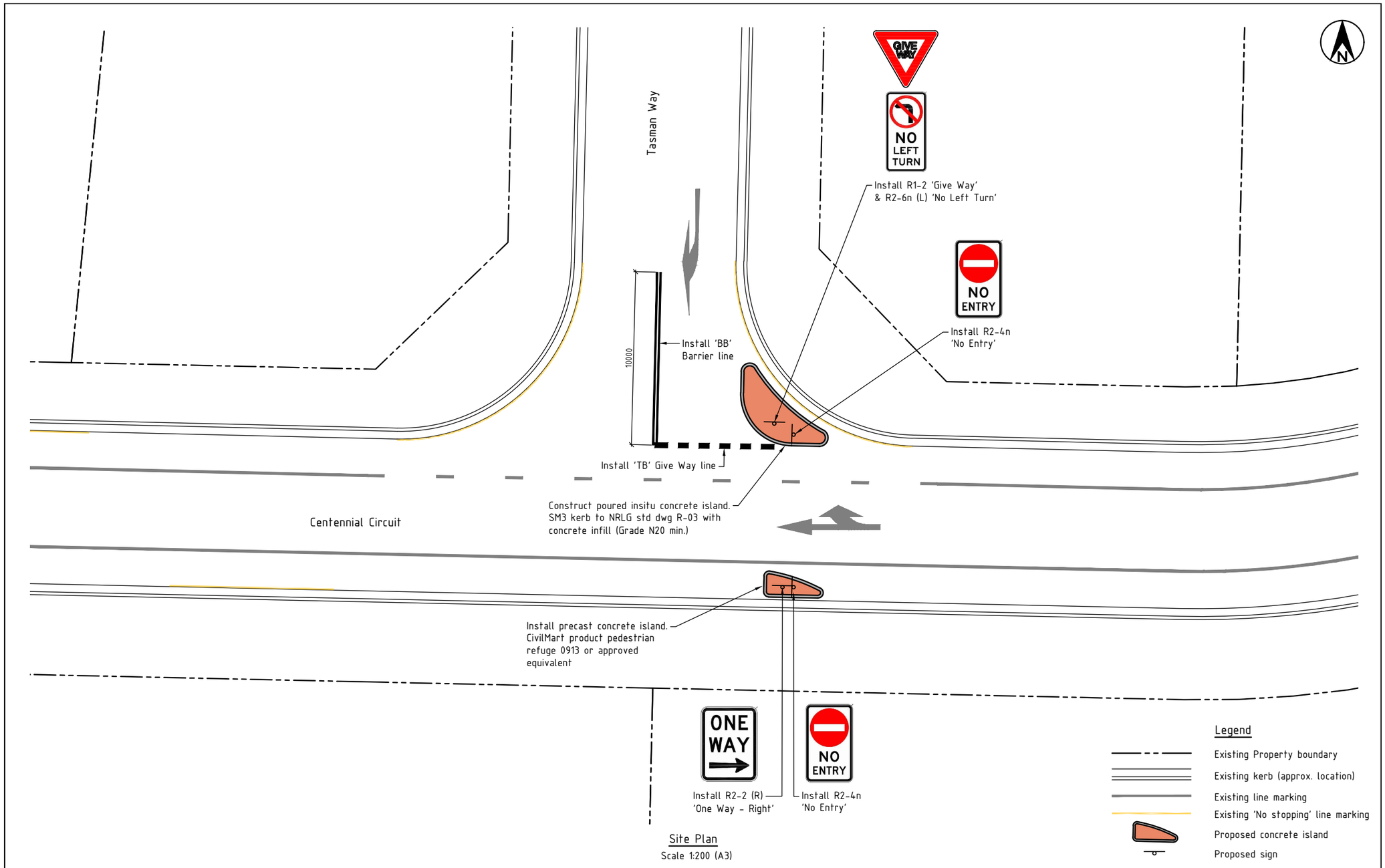

Site Plan

Scale 1:200 (A3)

PRELIMINARY
NOT FOR CONSTRUCTION

Issue	Amendment details	Drawn	Check	Date
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A	Original issue	A.D.	H.K.	04.08.22

SCALE: A1 SHEET 1:100, A3 SHEET 1:200

0 1 2 4 6 8 10 m

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Mullumbimby NSW 2482.
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BYRON SHIRE COUNCIL

Approved on behalf of the General Manager

..... Date .....

Designed	Geolink	04.08.22
Drawn	A.D.	04.08.22
Checked	H.K.	04.08.22
Horizontal datum		MGA
Vertical datum		AHD

Project: **Centennial Circuit, Byron Bay One-Way permanent install**

Project number: **2957**

Plan title: **Intersection Detail Tasman Way**

Drawing number: **2957-05**

Issue: **B**

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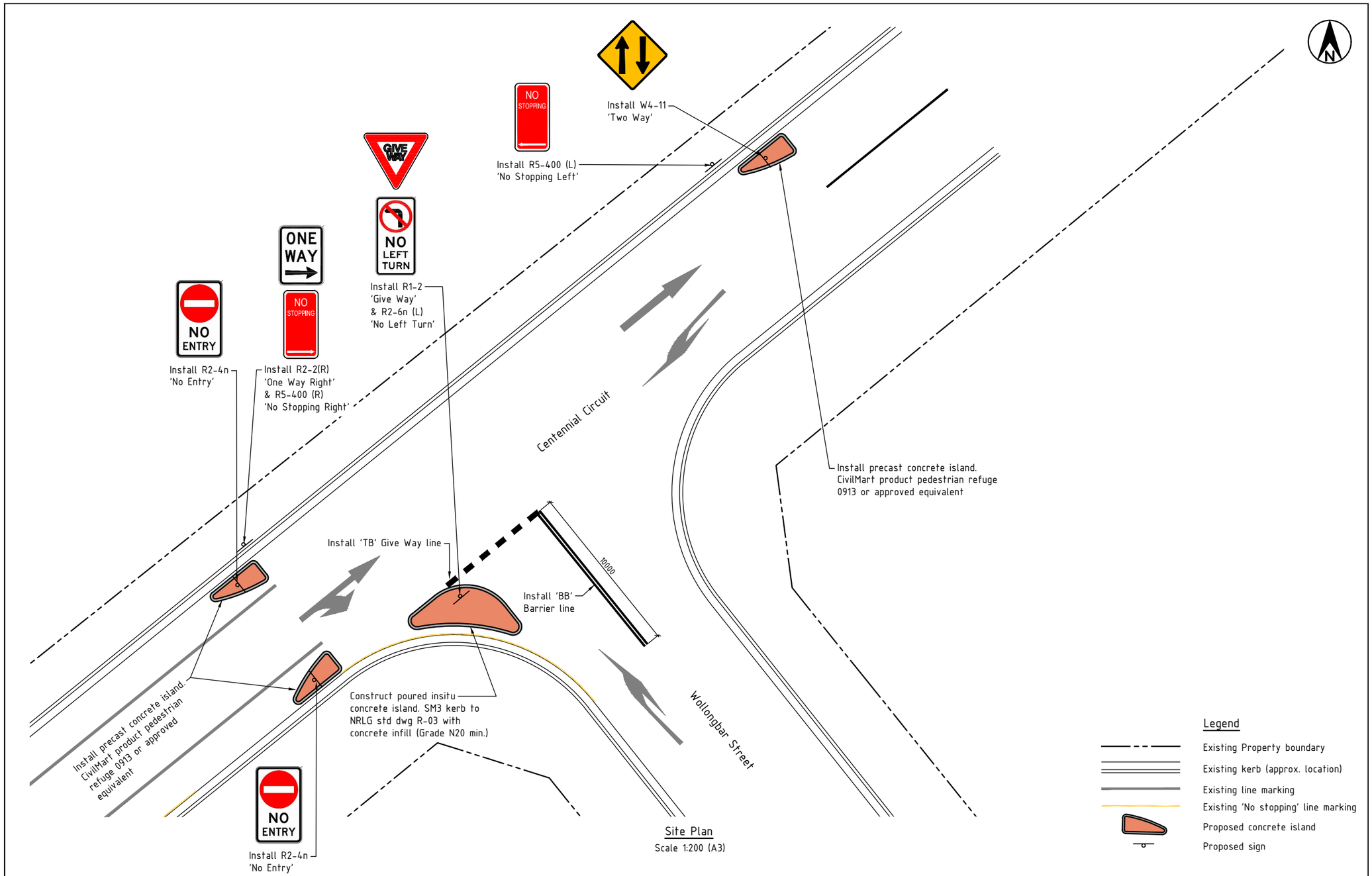

PRELIMINARY
NOT FOR CONSTRUCTION

Issue	Amendment details	Drawn	Check	Date
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A	Original issue	A.D.	H.K.	04.08.22

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ACAD FILE No: G:\Engineer\CAD\2900-2999\2957-Centennial Cct One-way permanent install\Civil Design\DWG\PRELIMINARY\2957-Centennial Cct One Way.dwg

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Approved on behalf of the General Manager
..... Date .....

Designed	Geolink	04.08.22
Drawn	A.D.	04.08.22
Checked	H.K.	04.08.22
Horizontal datum		MGA
Vertical datum		AHD

Project: Centennial Circuit, Byron Bay
One-Way permanent install

Project number: 2957

Plan title: Intersection Detail
Wollongbar Street

Drawing number 2957-06

Issue B

Report No. 6.6 Mobile Library Suffolk Park, Beech Drive, Suffolk Park

File No: I2022/1619

5 The purpose of this report is to obtain Local Traffic Committee endorsement for the installation of regulatory parking signage (timed no parking), to enable a mobile library to operate from the kerb in Beech Drive, Suffolk Park.

The signage installation plan is contained in figure 1.

10 **Figure 1: Signage installation plan**

RECOMMENDATION:

That the Local Traffic Committee endorse the installation of the no parking signage shown in figure 1.

Report No. 6.7 Intersection Reprioritisation - Tincogan Street at Dalley Street and Stuart Street

File No: I2022/1632

Current situation

Burringbar Street, which runs through the centre of Mullumbimby has been identified as a high pedestrian activity zone, as such the speed limit has been reduced to 30km/h.

Consequently, Tincogan Street has been identified by most drivers as the northern, east-west through movement corridor around the town centre of Mullumbimby. This redistribution of traffic was anticipated by the Shires Place and Planning Strategy and Infrastructure Services.

The reprioritisation of the intersections of Dalley / Tincogan Street and Stuart / Tincogan Street is part of a larger scheme to manage the impacts from the Burringbar Street place making treatments, while providing a safe movement corridor around the centre of town.

Another key factor for the reprioritisation of Tincogan Street is that Dalley Street and Stuart Street are currently the only two intersecting streets on Tincogan Street that maintain priority (Tincogan Street gives way).

See locality map in figure 1 below.

Figure 1: Locality Map

Purpose

The purpose of this report is to obtain Local Traffic Committee endorsement for the proposed priority change to the intersections of Tincogan / Dalley Street and Tincogan / Stuart Street.

A concept for each intersection is shown below, this concept is for visualisation purposes only and will be designed to conform with all the relevant standards and guidelines should endorsement be received. Further detail can be found in attachment 1 and 2 contained within this document.

Figure 2: Concept layout Tincogan Street and Dalley Street

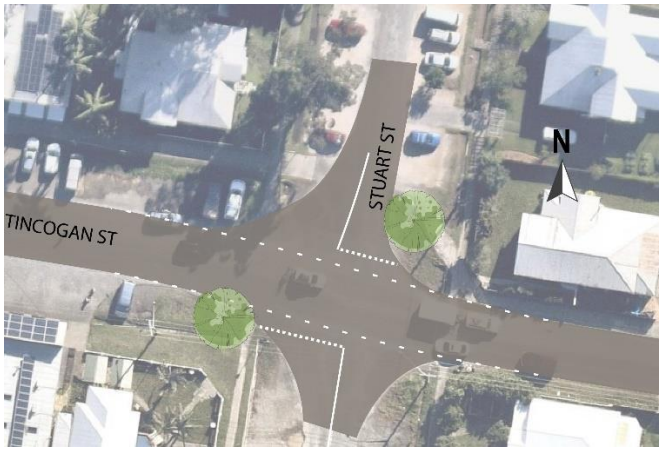

Figure 3: Concept layout Tincogan St and Stuart St

5

Figure 4: Current intersection layout

The intersection reprioritisation concepts contained within attachment 1 and 2 of this report were modelled (Sidra intersection analysis) with a 10-year design life. Analysis has

indicated that there is adequate capacity extending beyond 10 years should the change occur.

A detailed traffic study undertaken by Stantec Consulting has also taken place which included a microsimulation model. This modelling did not include the concept scenarios contained within this report. The model only considered straight reprioritisation without any additional lanes or median storage potential for right turning drivers from the minor legs.

This microsimulation model indicated there would be no net worsening in terms of performance following 10 years of traffic growth. This report can be found in attachment 3 (E2022/90532) of this report.

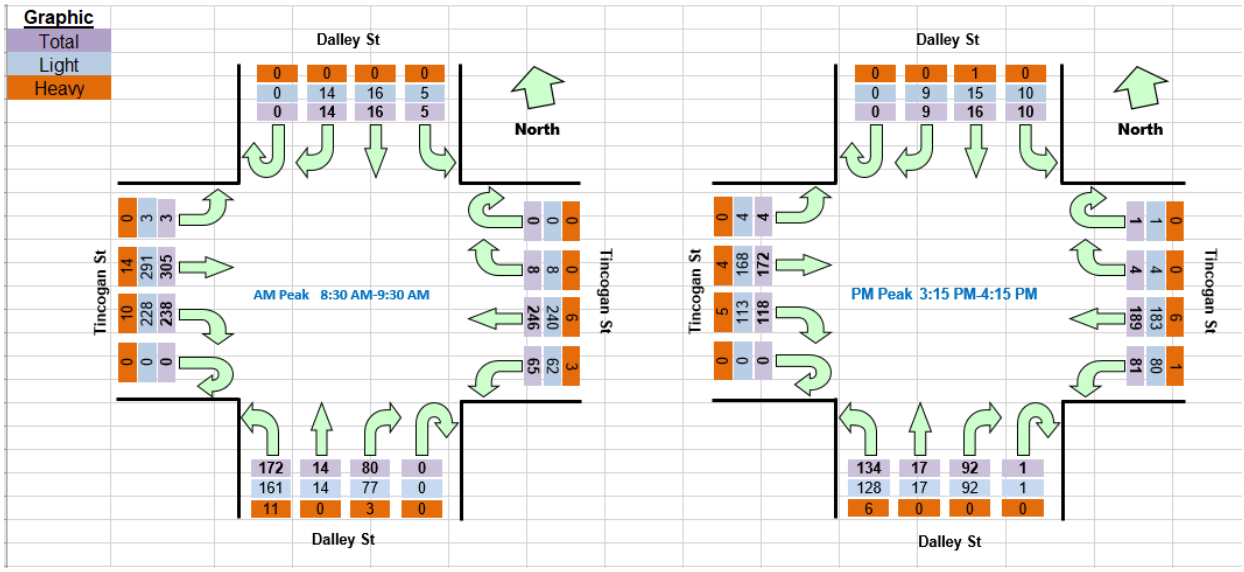

Figure 5: Traffic survey data (intersection count) Dalley St/Tincogan St, 17 June 2021

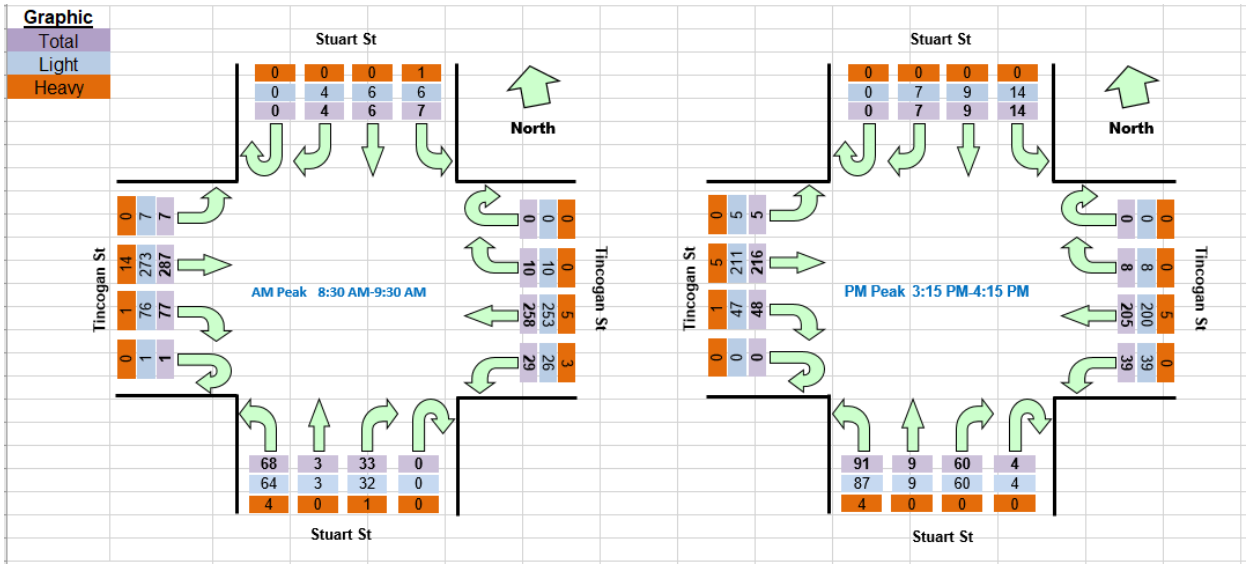

Figure 6: Traffic survey data (intersection count) Stuart St/Tincogan St, 17 June 2021

Safety (Current situation)

An investigation of the available crash data has indicated that there have been no reported crashes in the last 5-years at either of the subject intersections. However, there are significant perception issues at both intersections. When travelling on Tincogan Street drivers have been seen to give-way to through traffic on Tincogan Street from Dalley Street and Stuart Street.

Anecdotally, one reason for this is that the road functionality significantly changes on the northern side of Tincogan, Dalley and Stuarts Streets become residential access streets rather than minor collectors. Consequently, the intersections almost feel like “T” intersections with Dalley and Stuart Streets forming the minor approaches (south). This issue is also exacerbated by the fact that on both approaches all other intersections give way to Tincogan Street.

Figure 7: Tincogan St, westbound approach to Dalley St

Associated works

There are a number of works that will be undertaken to facilitate the reprioritisation at the intersection of Tincogan / Dalley Street, these works will include but not be limited to:

- Removal of the existing kerb ramps north-south on the westbound approach (Tincogan Street)
- Link new crossing points with footpath and kerb extensions
- Provide tactile footpath/crossing treatments
- Provide advanced warning signage (Changed traffic conditions)
- Pedestrian chanelisation (e.g., fencing, gardening, street furniture)

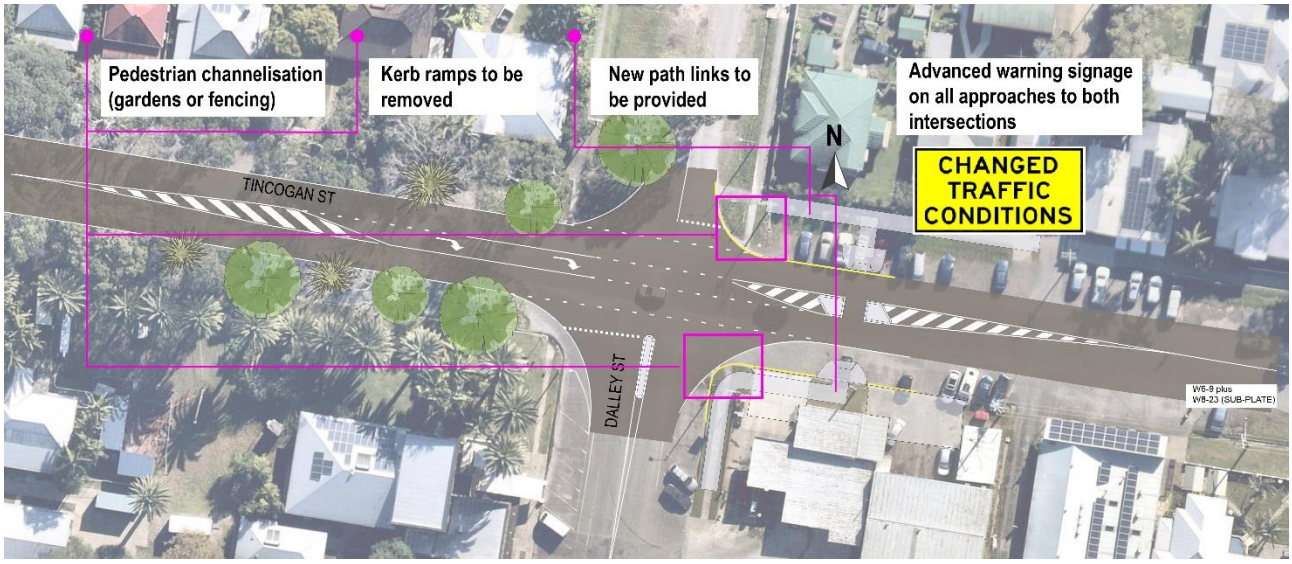

Figure 7: Associated works (Tincogan St/Dalley St intersection

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RECOMMENDATION:

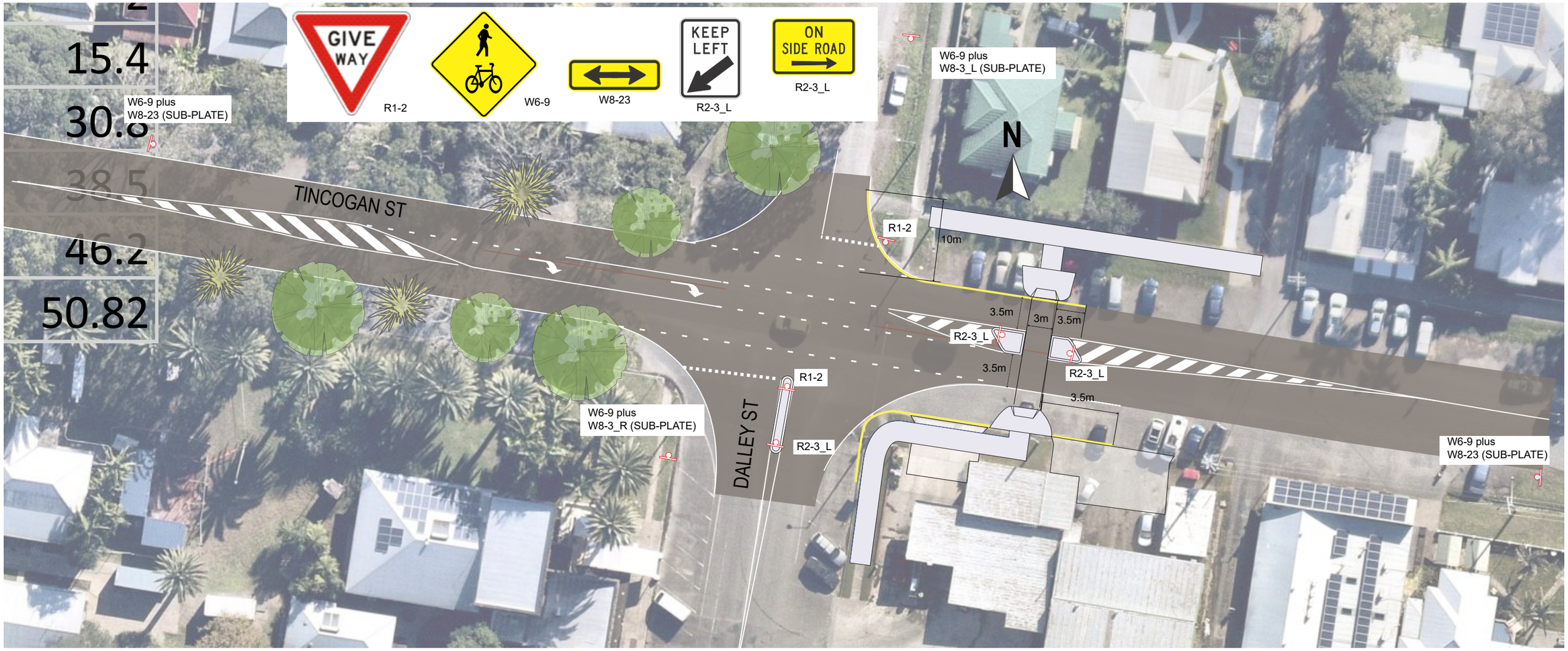
That the Local Traffic Committee endorse the reprioritisation of the intersections of Stuart / Tincogan Street and Dalley / Tincogan Street based on the layout contained within attachment 1 (E2022/108371) and 2 (E2022/108372) of this report.

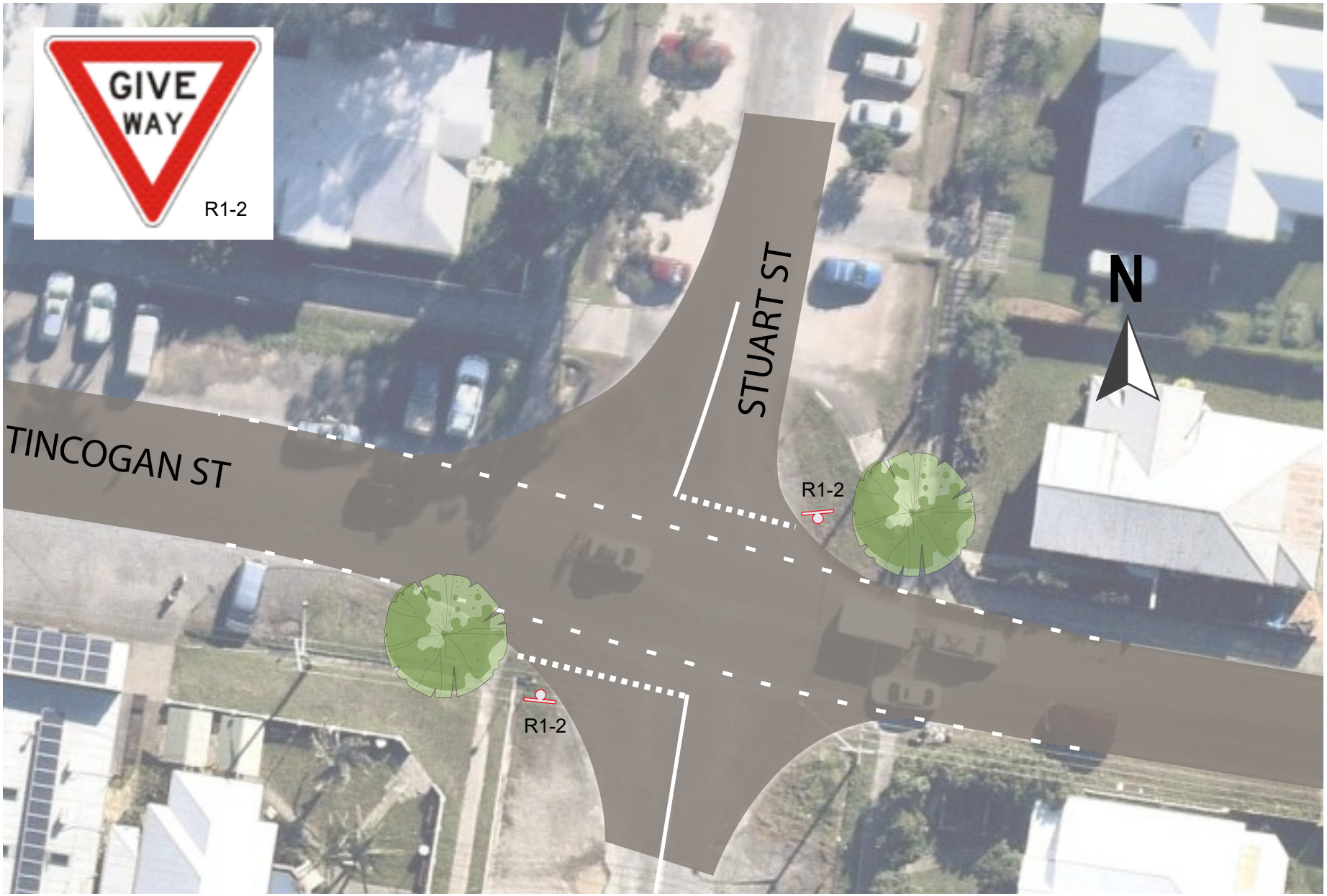
Attachments:

1 Dalley St_Tincogan St _Concept_Sketch_(reprioritisation)_LTC_6_November_2022, E2022/108371 , page 40⇩

2 Stuart St_Tincogan St_Concept_Sketch_LTC__Novemebr_2022, E2022/108372 , page 41⇩

3 Mullumbimby Traffic and Transport Draft Report 15 September 2022, E2022/90532 , page 42⇩


GIVE WAY
R1-2
W6-9
W8-23
KEEP LEFT
R2-3_L
ON SIDE ROAD
R2-3_L
W6-9 plus W8-23 (SUB-PLATE)
W6-9 plus W8-3_L (SUB-PLATE)
N
TINCOGAN ST
R1-2
10m
3.5m
3m
3.5m
R2-3_L
3.5m
R2-3_L
3.5m
R1-2
R2-3_L
DALLEY ST
W6-9 plus W8-3_R (SUB-PLATE)
W6-9 plus W8-23 (SUB-PLATE)


GIVE WAY
R1-2
STUART ST
TINCOGAN ST
N
R1-2
R1-2

Traffic and Transport Assessment Report

Mullumbimby Traffic Investigations

80022070

Prepared for
Byron Shire Council

14 September 2022

Cardno
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Stantec

Contact Information

Stantec Australia Pty Ltd
Cardno

Level 9 – The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com
www.stantec.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

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Karan Khanna
Transport Modeller

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Approved By:

Siavash Shahsavaripour
Transport Modelling Team Leader

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A	14/09/2022	Draft	Karan Khanna Edward Wu	Siavash Shahsavaripour

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Appendices

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1 Introduction

1.1 Background

Mullumbimby is located within the Byron Shire local government area, on the Northern Rivers region of New South Wales. Situated 120 kilometres south of Brisbane and 630 kilometres from Sydney, Mullumbimby has a strong rural town identity. The M1 Motorway is located approximately four kilometres east of the town, and provides connectivity to surrounding regions on the north coast of New South Wales and Queensland. The regional context of Mullumbimby is shown in **Figure 1-1**.

The Our Mullumbimby Masterplan is a high-level road map which sets out the aspirations of Byron Shire Council and the community for Mullumbimby over the next ten years. Adopted by Council in December 2019, the Masterplan provides a direction for the long-term future of the township and its surrounds with a focus on preserving the town's unique character and enhancing environmental, economic and social sustainability.

Several projects outlined in the Masterplan are now underway or are in the design and planning process across Mullumbimby, including the Stuart Street Green Spine project, the Talking Street trial and Tincogan Street traffic calming and intersection priority changes. However, the Masterplan does not specify any heavy vehicle routes through the town centre. Treatments for the road network in Mullumbimby that are outlined in the Masterplan will ultimately be dependent on the heavy vehicle route selected. Additionally, the community has highlighted preferences for additional transport outcomes in Mullumbimby, such as bus stop locations, satellite parking areas and pedestrian crossings on Tincogan Street. Therefore, Council has identified the need for additional investigation to successfully implement the aspirations of the Masterplan to Council's and the community's expectations.

Council has commissioned Cardno to undertake a traffic and transport study of the Mullumbimby town centre. The study aims to develop a preferred route for heavy vehicles through the town and understand the impacts on the transport network on a broader scale, while promoting Mullumbimby's unique local character and improving safety and accessibility for all road users, including pedestrians and cyclists.

1.2 Project objectives

The objectives of the Mullumbimby town centre traffic and transport study can be summarised as follows:

- Review background information and existing conditions in the study area to develop a comprehensive understanding of the Mullumbimby town centre, and summarise the issues and opportunities affecting the future direction of the town and its community
- Develop a local area traffic model of the Mullumbimby town centre to replicate existing traffic conditions across the network, identify current issues, performance deficiencies and congestion hotspots and establish a reliable and robust platform for testing future year scenarios
- Model alternative heavy vehicle traffic routes through the town centre to link traffic from the Pacific Motorway to Main Arm and Coolamon Scenic Drive (south)
- Assess the layout of the Tincogan Street / Dalley Street and Tincogan Street / Stuart Street intersections
- Assess the implications of a zebra crossing on Tincogan Street
- Analyse each heavy vehicle route, compare their advantages and disadvantages and select a preferred route from the perspectives of safety, traffic performance, infrastructure, land-use suitability and implications on the Mullumbimby Masterplan
- Develop concept plans and layout maps for the Tincogan Street intersections and the preferred heavy vehicle route
- Prepare the Traffic and Transport Assessment Report, summarising the outcomes of the study.

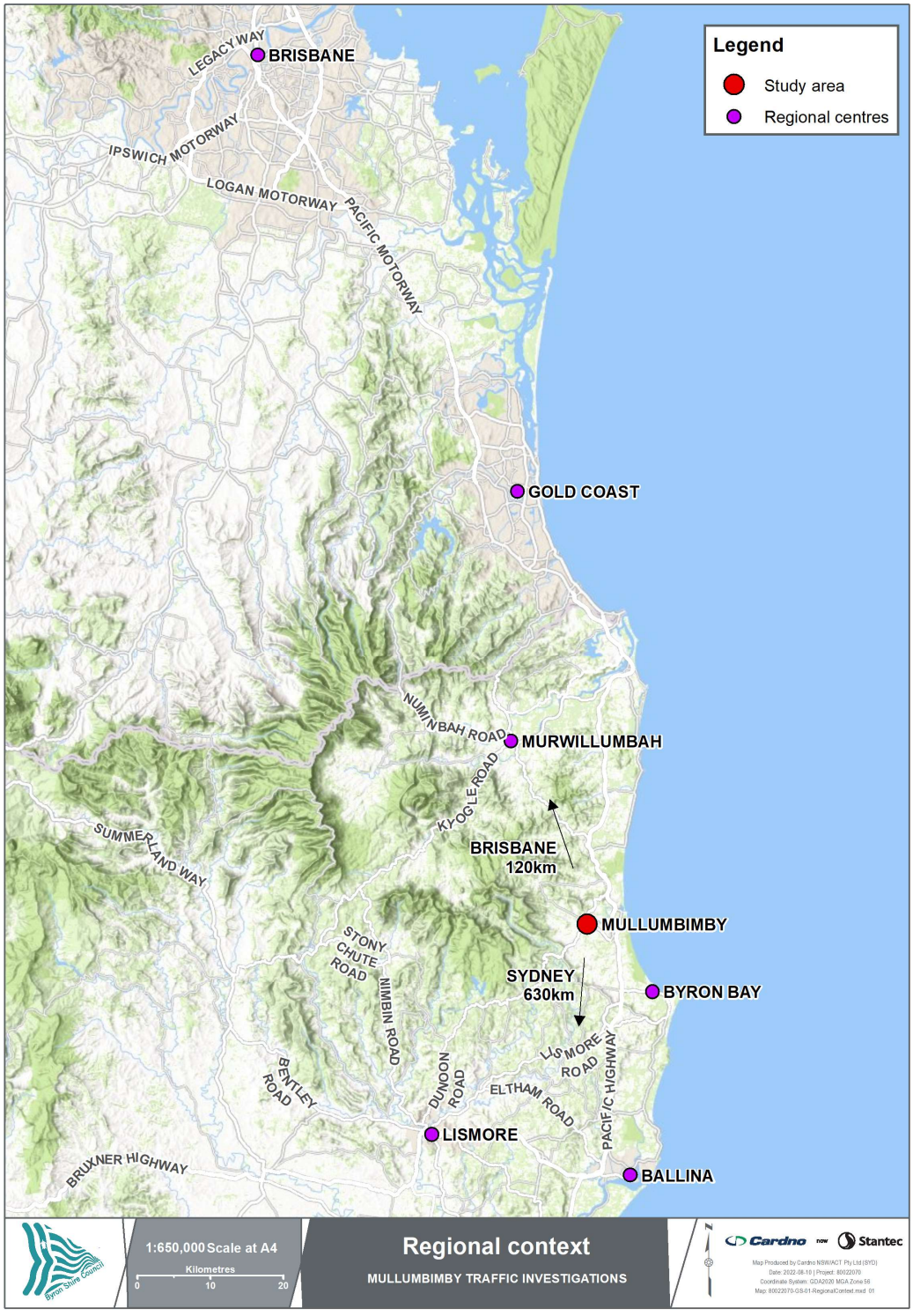


Figure 1-1 Regional context

1.3 Scope of works

- Review strategic background information, including Our Mullumbimby Masterplan, priority projects, planning proposals, community concerns and other relevant documentation
- Analyse population and demographic trends, land use, existing transport network, pavement integrity and travel behaviour in the study area from the background review and site visit observations
- Summarise issues and barriers to change identified in the review of existing conditions, and present three relevant case studies to examine benefits, issues, lessons learnt and considerations for the study area
- Develop a 2022 Base Model to capture existing conditions on a typical weekday in the AM peak and PM peak, and calibrate and validate the Base Model in accordance with the Traffic Modelling Guidelines (Roads and Maritime Services, 2013) *(completed)*
- Prepare the Base Model Development Report in accordance with *Technical Direction 2017/001: Operational Modelling and Reporting Structure* (Roads and Maritime Services, 2017) *(completed)*

The development of the 2022 Base Model was documented in the *Base Model Development Report* (Cardno, August 2022), provided in **Appendix A**.

- Assess and estimate the future year traffic demands to form the basis of the future-year assessment based on:
  - Historical growth data provided by Council
  - Nominal growth rates agreed with Council
  - First principles traffic generation or data from previous studies for the new developments of 1660 Coolamon Scenic Drive and 156 Stuart Street (Lot 22).
- Develop the following future year scenarios and extract the modelling results:
  - Do Minimum: Existing road network including any committed infrastructure upgrades and with projected traffic growth
  - Options 1-4: Network including different heavy vehicle routes, any uncommitted intersection upgrades and other town centre improvements developed on top of the Do Minimum model
  - Preferred Option: Refinement of the preferred option from Options 1-4 with small modifications/minor tweaks to identify simple improvements.
- Conduct a Safe System Assessment (SSA) of the heavy vehicle route options accordance with the *Safe Systems Assessment Framework (AP-R509-16)* (Austroads, 2016)
- Assess the heavy vehicle routes against the Our Mullumbimby Masterplan actions, and endorse or provide alternative solutions to the initiatives listed in the Masterplan for Precinct 1
- Analyse and compare the heavy vehicle route options from the perspectives of safety, traffic performance, infrastructure and land-use suitability and implications on the Our Mullumbimby Masterplan, and select the Preferred Option
- Develop and assess the Preferred Option scenario
- Develop and assess two design options for Tincogan Street / Dalley Street and Tincogan Street / Stuart Street intersections
- Produce 2D strategic design drawings for the Tincogan Street / Dalley Street and Tincogan Street / Stuart Street intersections based on the preferred intersection layout
- Produce schematic drawings showing the preferred heavy vehicle route through the town
- Prepare the Traffic and Transport Assessment Report (this report).

1.4 Study area

The study area is centred on the Mullumbimby town centre. The study area is bounded by Tincogan Street to the north, Station Street to the east, Fern Street to the south, and Brunswick Terrace and River Terrace to the west.

The primary access links to the study area are via Argyle Street to the east, Jubilee Avenue to the south, and Murwillumbah Road to the west. Tincogan Street, Station Street, Stuart Street, Dalley Street, Fern Street and Burringbar Street are the major links within the study area. Large amounts of on-street angle parking and several pedestrian crossings exist on Dalley Street, Stuart Street and Burringbar Street, adjacent to the commercial and retail developments.

Figure 1-2 shows the study area and modelled road network.

Figure 1-2 Study area

1.5 Stakeholders

Stakeholders for the project include:

> Byron Shire Council

1.6 Report outline

The structure of this report is outlined below:

- **Section 1 – Introduction**: Provides project background, project objectives and scope of work
- **Section 2 – Background review**: Provides review of strategic documents
- **Section 3 – Existing conditions**: Analyses existing conditions in the study area
- **Section 4 – Summary of issues and barriers**: Summarises issues and barriers to change identified in the review of existing conditions
- **Section 5 – Option testing**: Describes in detail the future year options tested
- **Section 6 – Safe System Assessment**: Summarises the Safe System Assessment of each future year option
- **Section 7 – Our Mullumbimby Masterplan objectives assessment**: Assesses the heavy vehicle routes against the *Our Mullumbimby Masterplan* actions
- **Section 8 – Modelling assumptions**: Describes all modelling assumptions adopted as part of the process of assessing the future year scenarios
- **Section 9 – Future demand development**: Process applied to derive future year trip demand matrices
- **Section 10 – Base Model operational results**: Outlines the base year (2022) model operational results
- **Section 11 – Do Minimum operational results**: Outlines the future Do Minimum model operational results for 2032
- **Section 12 – Option operational results**: Describes the performance of the option model testing for 2032
- **Section 13 – Option operational comparison**: Compares the modelling outputs between all the assessed scenarios
- **Section 14 – Heavy vehicle route comparison**: Compares the advantages and disadvantages of the four proposed heavy vehicle route options in terms of traffic performance, safety and impacts on the relevant Our Mullumbimby Masterplan action items.
- **Section 15 – Concept plans**: Provides concept plans for the Preferred Option
- **Section 16 – Conclusion**: Outlines main outcomes, results and recommendations.

2 Background review

This section summarises our review of the documentation that influence and impact planning decisions relating to the Mullumbimby town centre. Documents are summarised under two categories – state government and local government.

2.1 State government

2.1.1 Regional NSW Services and Infrastructure Plan, Transport for NSW, 2018

Both the Regional NSW Services and Infrastructure Plan and the North Coast Regional Plan sit within Future Transport 2056, which aims to guide growth and investment in NSW over the next 40 years.

The Regional NSW services and infrastructure plan states that a key to supporting the growth and vibrancy of our regional cities, centres and towns through transport is making them places people want to walk and cycle in. Walking and cycling contribute to the amenity of places and provide opportunities for social interaction and increase the perception of safety in places through passive surveillance. Places with a high amenity are also generally places people want to travel through and spend time in. This often means more foot traffic and money being spent locally.

Byron Bay and Mullumbimby are identified as being places with the highest percentages of people who cycle to work from home.

Relevant customer outcomes for regional NSW are outlined in **Figure 2-1**, and apply to the Mullumbimby setting.

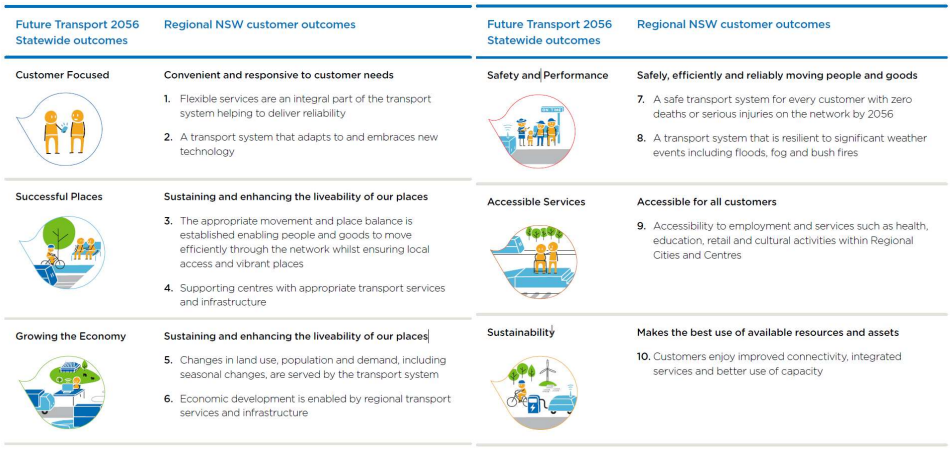


Figure 2-1 Regional NSW customer outcomes

Source: Regional NSW Services and Infrastructure Plan, Transport for NSW, 2018

2.1.2 North Coast Regional Plan 2036, DPIE, 2017

The North Coast Regional Plan is a blueprint to planning and delivering infrastructure to 2036 within the region. The Plan identifies Byron Shire as a great place in Australia to live, work and play due to spectacular and vibrant communities. The population of the North Coast is estimated to increase by 76,200 people by 2036, with 46,000 more homes required.

The Plan identifies Mullumbimby as an important centre for growth within the region, with access to creative communities, boutique retail, food and accommodation options, essential services and unique lifestyles. Relevant directions for the North Coast Region set out in the Plan and are applicable to Mullumbimby include:

> Direction 1: Deliver environmentally sustainable growth

> Direction 6: Develop successful centres of employment

> Direction 8: Promote the growth of tourism

> Direction 14: Provide great places to live and work

> Direction 15: Develop healthy, safe, socially engaged and well-connected communities.

2.2 Local government

2.2.1 Our Mullumbimby Masterplan (Byron Shire Council, 2019)

Our Mullumbimby Masterplan provides a direction for the long-term future of the township and its surrounds with a focus on preserving the town's unique character and enhancing environmental, economic and social sustainability.

The vision for Mullumbimby is:

> …a diverse, dynamic, creative, and caring country town that fosters innovation, sustainability and a funky verve for life.
>
> It embraces its history and confidently strides forward with a foundation of resilience, strong community spirit and a desire to be "good-different".

Five principles support this vision with associated actions. Actions from the Masterplan relating to transport are documented in **Table 2-1**.

Table 2-1 Our Mullumbimby Masterplan – relevant principles and actions

Principle	Relevant transport and land use actions
Balance the need for housing with the desire to retain Mullumbimby's country town feel	▪ By supporting the development of diverse, affordable housing and a multi-purpose hub on the hospital site ▪ By consciously embracing those on lower incomes through the provision of diverse and affordable housing primarily through new land close to town, the urban village on the rail lands, infill development on laneways and the provision of shop-top housing and mixed use/live work
Maintain and enhance Mullumbimby's high level of self-sufficiency, adaptability and resilience	▪ By encouraging business lands close to the centre of town (and looking to respectfully increase density in these areas) ▪ By introducing water sensitive urban design (WSUD) to alleviate local flooding and improve ecological and infrastructure outcomes.
Ensure Mullumbimby is accessible and well connected	▪ By encouraging active transport connections (walking and cycling) through the provision of key infrastructure including a 'green spine' in Stuart Street ▪ By formalising the alternative routes along Tincogan and Fern Streets ▪ By turning Burringbar Street into a "Talking Street" shared zone.
Protect and enhance Mullumbimby's green and leafy character and reconnect with the river	▪ By creating a comprehensive street tree plan for the town
Enhance and Celebrate Mullumbimby's existing eclectic character, spirit of entrepreneurship and identity and make the future of Mullumbimby as fun as its people.	▪ By creating a story trail that encompasses history from the town and integrates with the sculpture walk ▪ By activating the 'shared zone' of Burringbar Street with a program of events ▪ By ensuring that new development is well integrated and connected with the existing town

The Masterplan identifies the main challenges affecting Mullumbimby as:

> Rapid socio-economic change and ageing population

> Changes in culture and lifestyle and growing population

> Extreme weather events and climate change

> Reliance on private vehicles

> Lack of public and active transport infrastructure

> Rising house prices

> Diversity in opinions and views.

2.2.1.2 Strategies and actions

The Burringbar Talking Street project is shared zone and core meeting point for Mullumbimby residents and visitors. Key features of the zone include slowed vehicle speeds to ten kilometres per hour, removing formal gutters and blurring the lines between pedestrian and road spaces, and providing urban amenity upgrades through tree plantings and street furniture.

Four priority projects for Mullumbimby which will enable the Burringbar 'Talking Street' are outlined in **Table 2-2**. Other relevant actions are outlined on **Figure 2-2** and **Figure 2-3**.

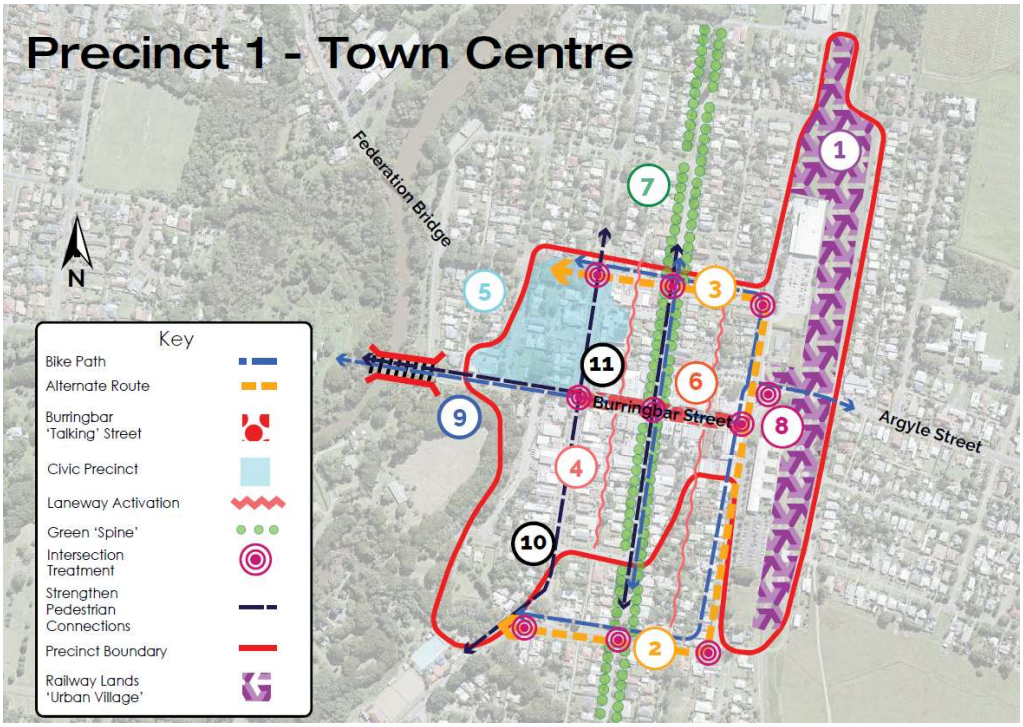


Figure 2-2 Our Mullumbimby Masterplan – Mullumbimby town centre

Source: Our Mullumbimby Masterplan, Byron Shire Council, 2019

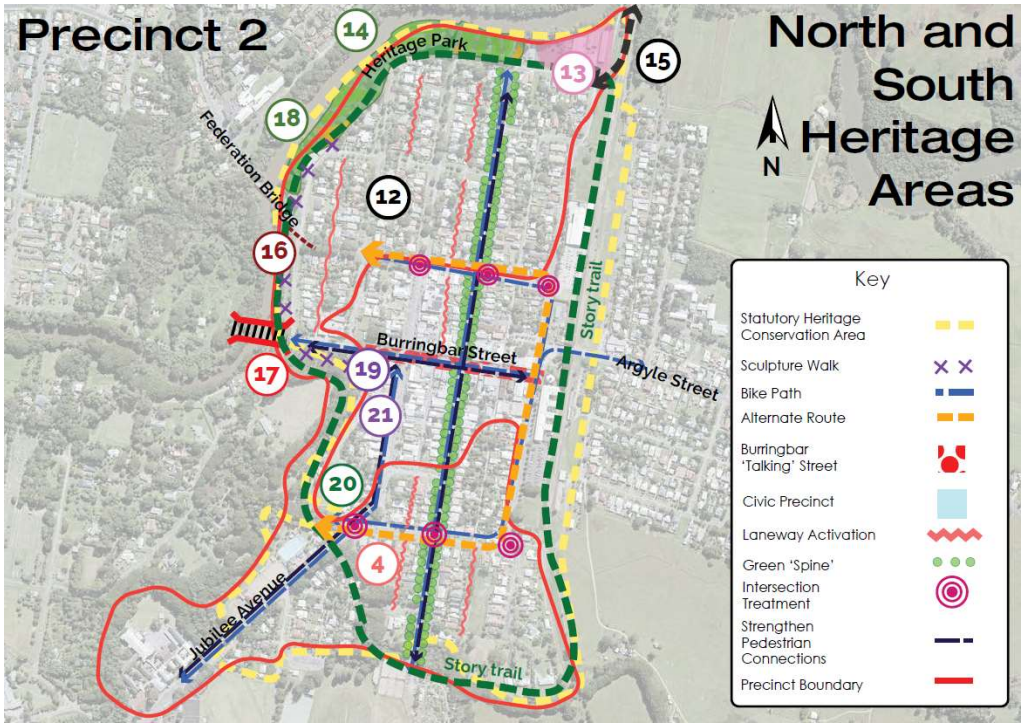


Figure 2-3 Our Mullumbimby Masterplan – Mullumbimby north and south Heritage areas

Source: Our Mullumbimby Masterplan, Byron Shire Council, 2019

Table 2-2 Our Mullumbimby Masterplan priority projects

Project	Map reference	Description
Stuart Street Green Spine **(Priority project)**	7	Create a 'green spine' along Stuart Street – make this the primary walking/ cycling north south route, include trees to create a boulevard from the river to the community gardens. ▪ Create a comprehensive street tree plan that specifies species selection, financing options and planting layout and design to roll out a green spine along Stuart Street incorporate this with Water Sensitive Urban Design initiatives. ▪ Improve pedestrian and cycling connectivity by creating cycleways along Stuart street, improving the connectivity between the community garden, the river and Heritage Park
Formalising the 'Alternate Routes' **(Priority project)**	2	Formalise 'alternative route from Argyle Street to Jubilee Avenue via Fern Street. ▪ Investigate widening the road along Fern Street. ▪ Upgrade intersections to increase safety for pedestrians and cyclists. ▪ Formalise 'alternative route' from Argyle Street to Federation Bridge via Tincogan Street ▪ Re-orientate the give way signs on Tincogan Street to give priority to East West traffic ▪ Re-align the intersections at Stuart and Dalley Streets to improve safety and traffic flow. ▪ Improve the intersection safety along Tincogan Street for pedestrians and cyclists.
Placemaking Seed Projects **(Priority project)**	11	Create a Placemaking Seed Grants project that aims to engage local creatives to activate and beautify areas in and around the Town Centre. Create spaces that are beautiful, engaging and enjoyable for people to mingle, linger and hang out in.

Project	Map reference	Description
Story Trail **(Priority project)**	20	Create a story trail that features local artists and incorporates stories of indigenous connection to place. ▪ Support community groups to take the lead and tell the creative and historical stories of Mullumbimby. ▪ Use the Story Trail to link both the past and present, and the various areas around the town centre through cohesive wayfinding signage, art and storytelling.

Source: Our Mullumbimby Masterplan, Byron Shire Council, 2019

Two projects from *Our Mullumbimby Masterplan* have already secured funding and are underway. This includes the Stuart Street Green Spine project and the Burringbar Street Talking Street project. Stage 1A of the Green Spine project between Burringbar Street and Fern Street has already been completed, and Stage 1B is due to be completed by the end of 2022. The preferred heavy vehicle route must integrate with these initiatives, and limit as much as possible any interactions between pedestrians, cyclists and vehicles.

2.2.2 Mullumbimby Movement Strategy, 2018

The Mullumbimby Movement Strategy supports the Masterplan with a focus on transport and movement of people within the town. It recommends policies, projects and supporting interventions which are informed by extensive stakeholder engagement known as *Mullumbimby Immersion*. Key themes from this engagement are as follows:

- **Car parking** – this is perceived as a major issue in Mullumbimby as it often is for regional towns, stemming from both high occupancy of car parking in the town centre; and a driving 'habit' that is largely pervasive across the region.
- **Traffic congestion** – this is caused somewhat by car parking behaviours of people queuing or circulating looking for a park very close to their destination. Typically, 30% of town centre traffic congestion is caused from 'cruising' cars in search of available car parking spaces.
- **Road maintenance and conditions** – The street and road network in Mullumbimby and across the region is anecdotally in a poor state of repair. It was mentioned many times in the immersion, and it seems to have been part of Byron life for so long, it has become accepted by the community. This may be impacting on town pride, investment opportunities or modal choice (whether people walk or ride bikes).
- **Pedestrian facilities** – The car dominance of the town centre was regularly referenced as a feature at odds with the community's vision for the town. Improving the pedestrian facilities in the centre to genuinely make it a place where people can enjoy walking to, from, in and around the town.
- **Safety for cyclists** – This was a dominant theme that emerged at both the parklet and at the community/stakeholder workshops. Perceived safety is clearly one of the major impediments holding back residents from cycling more as a common mode of transport, particularly for children.
- **Housing affordability** – Not exclusive to Mullumbimby but a very challenging matter, housing affordability is a significant issue which is compounded by a lack of housing diversity in the town but also an anti-development sentiment that was regularly expressed during community engagement. Improving housing options, including utilising infill opportunities within the town centre will support population growth in a sustainable manner while reducing the need for residents to operate private vehicles in Mullumbimby. Allowing town centre residential development enables these residents to walk or cycle to town while local roads and car parking spaces are prioritised for residents and visitors who arrive at Mullumbimby from further afield by vehicle.

Relevant transport recommendations from the Movement Strategy are provided in **Table 2-3**.

Mullumbimby Immersion revealed the desire from residents to divert heavy vehicles away from the town centre. Four potential alternate route options are shown in **Figure 2-4**.

Table 2-3 Relevant transport recommendations from Movement Strategy

Transport mode	Strategy	Relevant transport recommendations
Walking	Create an environment where walking is a safe, enjoyable and accessible travel choice for both residents and visitors to Mullumbimby.	Introduce new intersections at ▪ Burringbar Street/ Stuart Street ▪ Burringbar Street/Dalley Street ▪ Tincogan Street/Stuart Street (subject to alternative route option) ▪ Tincogan Street/Dalley Street (subject to alternative route option) ▪ Tincogan Street/Gordon Street (subject to alternative route option).
		Encourage infill development within the walking catchment of Mullumbimby.
		Introduce pedestrian bridges to connect both sides of the river at the end of Burringbar Street connecting Palm Park to Riverside Drive across the river (this is the priority project).
		Upgrade footpaths along key pedestrian networks through town centre and from residential areas to town centre and traffic generating areas (i.e., schools etc.).
Cycling	Make cycling an enjoyable and accessible mode of transport for people of all confidence levels by committing to the provision of world class, safe and sustainable cycling infrastructure.	Introduce protected on-street bike lanes at priority locations: ▪ Burringbar Street (if preferred option) ▪ Stuart Street (Whian Street to Tincogan Street) ▪ Dalley Street (Whian Street to Tincogan Street).
		Expand regional cycling network to connect peripheral locations.
		Expand bike parking facilities.
		Commence detailed design and planning for a bike path (in conjunction with keeping rail infrastructure for any future rail return) connecting Mullumbimby with other key towns along the existing rail line.
Street network, cars and traffic	To ensure the street and road network operates effectively and safely for all users while supporting Mullumbimby's boarder sustainable objectives.	Introduce standard town centre cross-sections at identified intersections, including: ▪ Stuart Street ▪ Burringbar Street ▪ Dalley Street.
		Conduct feasibility study to determine most suitable option for a future town centre alternative route, consistent with Council objectives and community values.
		Trial the closure of Burringbar Street for street festivals and other activations. Monitor outcomes for consideration of permanent interventions.
		Investigate traffic modifications to improve traffic safety at Brunswick Terrace/Tincogan Street intersection including consideration of closing off Brunswick Terrace to through traffic at the Tincogan Street/Murwillumbah Road approach. Future design responses should address cyclist and pedestrian safety.
Car parking		Review minimum parking requirements for developments within the town centre zone.

Transport mode	Strategy	Relevant transport recommendations
	Manage parking in Byron Bay to support positive active travel outcomes and adequate accessibility for those with a genuine need for private car travel.	Formalise on-street car parking at identified locations, including: ▪ Stuart Street ▪ Dalley Street ▪ Tincogan Street ▪ Areas identified in town centre.
		Expand town centre car parking by developing peripheral car parking at preferred site.
		Introduce revised parking time restrictions consistent with the Mullumbimby Town Centre Parking Supply Management Strategy.
		Monitor car parking occupancy in Mullumbimby and investigate paid parking as a management tool, consistent with Council's policy for paid parking in Byron Bay.
		Expand the provision of loading zones in the town centre consistent with guidance from Mullumbimby Parking Supply and Management Strategy.
		Ensure streetscape works include accessible parking provision.
Public transport	Ensure that the provision of public transport is high-quality, accessible and efficient in serving community needs.	Develop Byron Shire Car Share Policy.
		Investigate options to introduce on-demand shuttle bus service in Mullumbimby.
		Continue to advocate for improved bus services to and from Mullumbimby.

Source: Mullumbimby Movement Strategy, Byron Shire Council, 2018

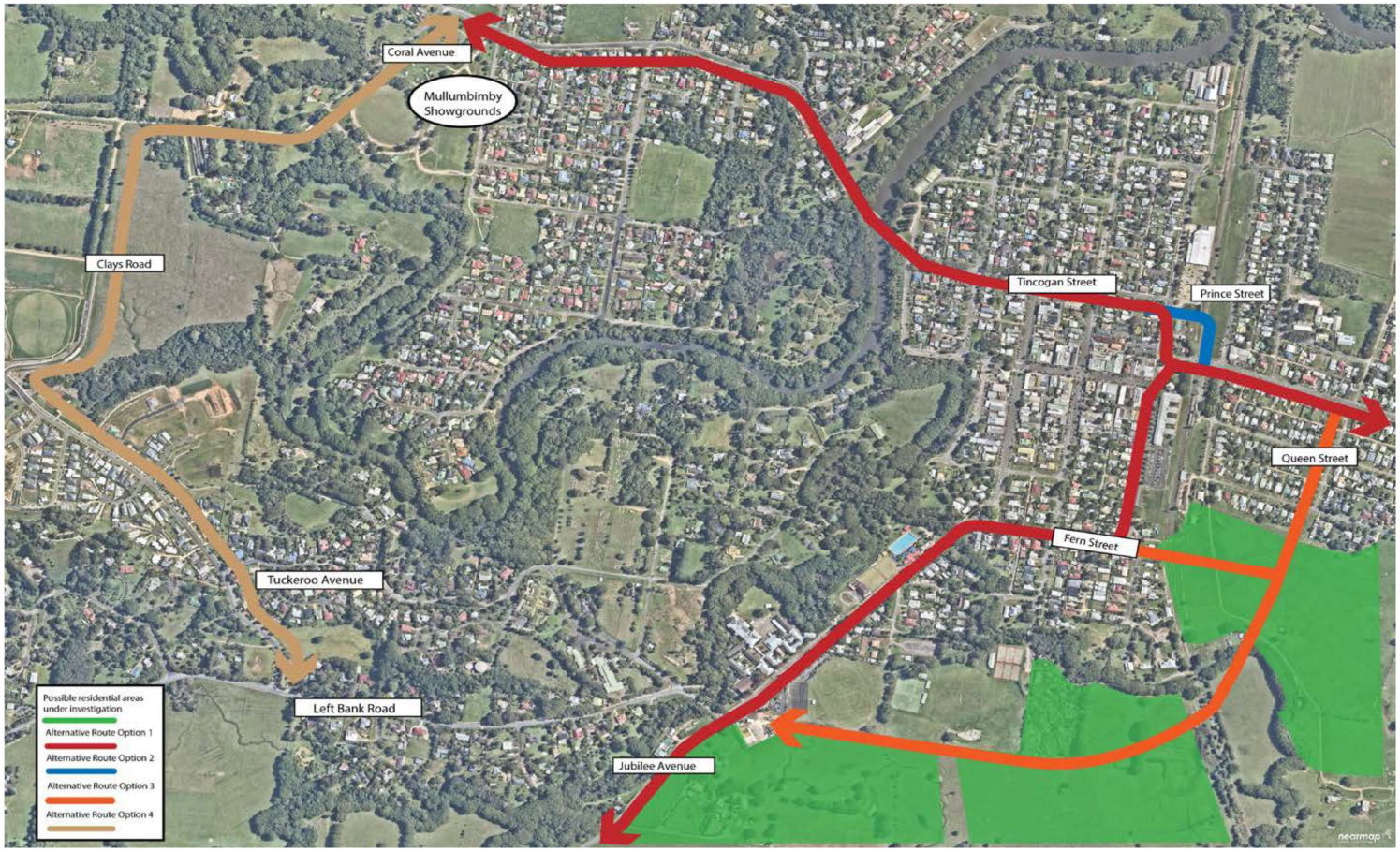


Figure 2-4 Mullumbimby town centre alternate route options

Source: Mullumbimby Movement Strategy, Byron Shire Council, 2018

2.2.3 Byron Shire Pedestrian Access & Mobility Plan (2019)

The Byron Shire Council Pedestrian Access and Mobility Plan (PAMP) provides a framework for developing and investing in safe, connected and convenient pedestrian routes within the LGA. The guiding philosophy for the development of the PAMP is to design a walk and roll environment for the most vulnerable user so that it is suitable for all. This especially includes users with impaired mobility, vision and/or hearing. Design principles that were adopted to support this philosophy are:

- Provide a convenient, safe and connected network that offers route choice; that links residential areas, key attractors and public transport facilities; that considers the needs of all users; that formalises existing pedestrian paths; that addresses existing hazards; and that reduces the need to cross roads
- Provide pedestrian crossings where the walk and roll network intersects with the road network that recognises that these locations are the most vulnerable parts of the pedestrian network
- Promote pedestrian priority where possible, where contextually appropriate and where the strategic intent of the pedestrian link is advanced.

Figure 2-5 shows the existing and proposed walk and roll network for the Mullumbimby town centre. Issues and opportunities for the cycle network are shown in **Table 2-4**.

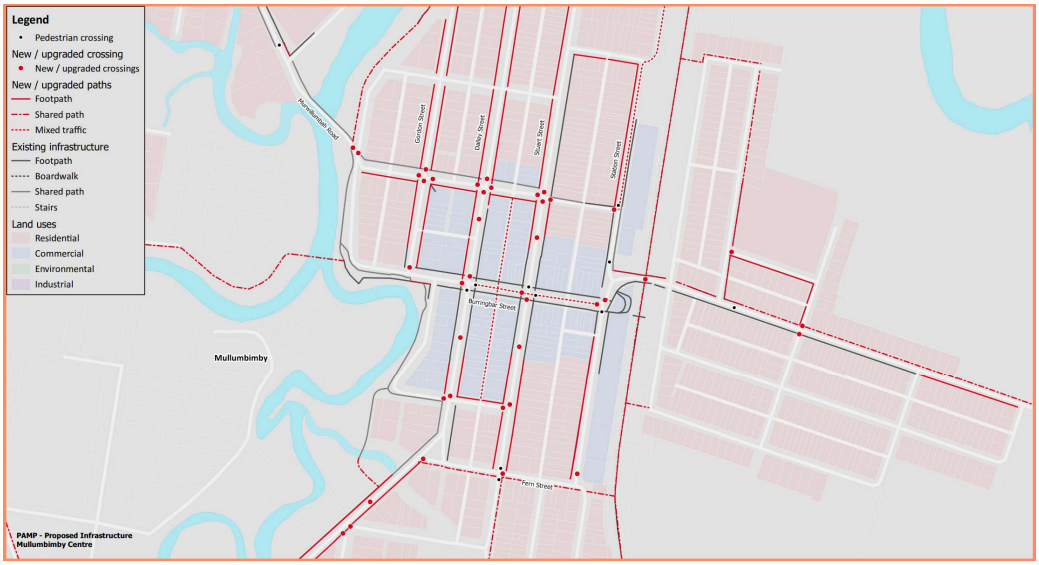


Figure 2-5 Existing and proposed pedestrian infrastructure

Source: Byron Shire Pedestrian Access & Mobility Plan, 2019

Table 2-4 Walk and roll issues and opportunities in Mullumbimby (Byron Shire PAMP)

Issues	Opportunities
▪ High volume of vehicles in close proximity to pedestrians and areas of high pedestrian activity ▪ High number of tourists unfamiliar with local area ▪ Limited walk and roll network in some locations outside of the town centre ▪ Generally poor network quality with low level of accessibility for vulnerable users ▪ Large number of residential streets currently lack footpaths and kerb and channel ▪ Large residential lots to the west affect walkability	▪ Existing compact and walkable town centre with residential areas and attractors within close proximity ▪ Existing high rates of pedestrian activity concentrated in the town centre ▪ Existing wide streets and paths ▪ Topography generally conducive to pedestrian movements for all ages and abilities ▪ Proximity to key attractors and natural assets (for example, rivers and parks) to support recreational walks ▪ Established culture of walking with above average proportion of residents who walk to work

2.2.4 Byron Shire Bike Plan (2019)

The Byron Shire Bike Plan is a ten-year plan that aims at increasing and enhancing ridership throughout the LGA. Similar to the Byron Shire PAMP, the guiding philosophy for the development of the future network was to design a cycle environment for the most vulnerable user so that it is suitable for all. Key design principals that support the philosophy are:

- Provide a convenient, safe and connected network that offers route choice; that links residential areas, key attractors and public transport facilities; that considers the needs of all users; that plans for where cyclists actually want to go rather than where they should go; that addresses existing hazards; and that reduces the need to cross roads
- Provide suitable crossings where the cycle network intersects with the road network that recognise that these locations are the most vulnerable parts of the cycle network
- Promote cycle priority where possible, where contextually appropriate and where the strategic intent of the cycle link is advanced
- Encourage the uptake of cycling across the Shire for residents and visitors by providing a coherent, direct, safe, attractive and comfortable network with sufficient end of trip facilities
- Provide a Shire-wide environment that encourages cycling as a form of transport, recreation and socialisation by promoting the cycle network and educating all road users on the safe use of the road system.

Figure 2-6 shows the existing and proposed cycle network for the Mullumbimby town centre. Issues and opportunities for the cycling network are shown in **Table 2-5**.

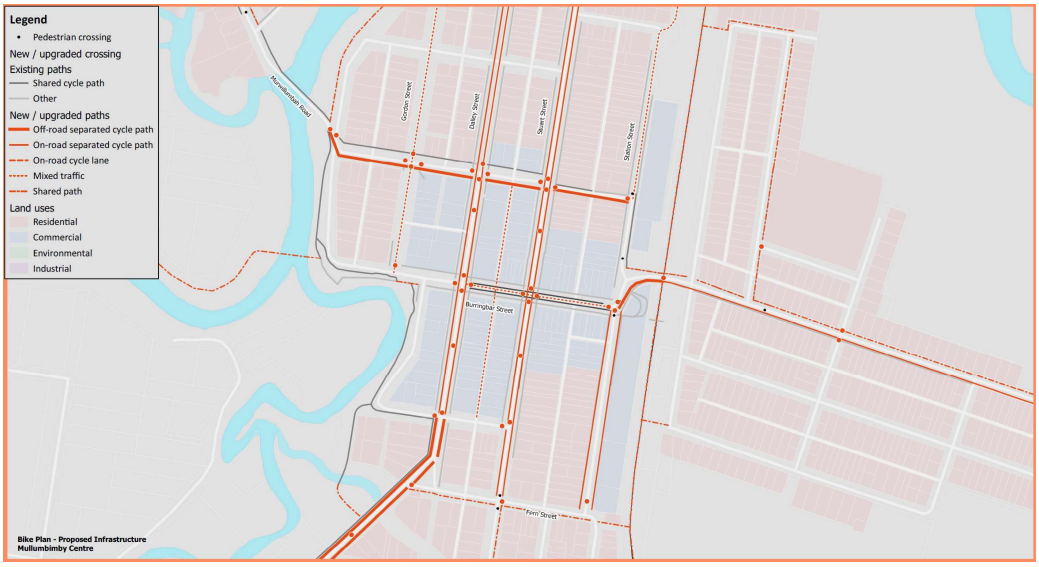


Figure 2-6 Existing and proposed cycling infrastructure

Source: Byron Shire Bike Plan, 2019

Table 2-5 Cycling issues and opportunities in Mullumbimby (Byron Shire Bike Plan)

Issues	Opportunities
▪ High volume of pedestrians and vehicles and regular car parking manoeuvres ▪ High number of tourists unfamiliar with local area ▪ Limited cycle network outside of the town centre	▪ Compact town centre with residential areas and attractors within close proximity ▪ Established network of on-road cycle paths in the town centre, servicing a number of key attractors ▪ Existing wide streets provide opportunities for more cycle paths ▪ Topography generally conducive to cycle movements for all ages and abilities

Issues	Opportunities
	▪ Proximity to key attractors and natural assets (for example, rivers and parks) to support recreational cycling

2.2.5 Byron Shire Residential Strategy (2020)

The Byron Shire Residential Strategy documents Council's policy framework and action plan guiding residential development in urban areas for both infill and new release areas for the next 20 years. The Strategy supports the following vision for Byron Shire:

> Byron Shire towns and villages will offer a diversity of housing to meet the needs of its community both now and in the future.
>
> Residents will be able to find housing that suits their current and future needs in terms of type, tenure, size, and cost. More diverse housing such as town houses, units and apartments will be located in locations with convenient access to shops, services, transport, and open space, where it is easy to walk or cycle.
>
> Greater housing diversity will create a more self-sufficient Shire so that residents do not have to move outside the Shire to find the housing they want.

Residential development policy aims to:

- Maintain community diversity and social cohesion by providing housing for a range of lifestyle choices, household types and life stages
- Respect local character while supporting a housing shift away from detached dwellings and towards more diverse types
- Manage tourism in a way that has a positive impact for locals.

Housing affordability is emerging as a key issue across the Shire and in Mullumbimby. Mullumbimby is projected to accommodate the largest number and percentage of additional dwellings and potential residents, equating to 39 per cent of the total urban population.

Relevant directions outlined in the Strategy for housing policy are:

- The majority of our Shire's future housing will be in urban towns and villages
- New subdivisions and infill will support the attributes of liveable neighbourhoods
- Respect the current and/or emerging character and values
- Maintain and enhance the sense of community.

2.2.6 Byron Shire Business and Industrial Lands Strategy (2020)

The Byron Shire Business and Industrial Lands Strategy aims to guide future business and industrial zoned land and to ensure that business centres and industrial areas work for people, commerce and the environment.

Mullumbimby has existing business and industrial areas and acts as the core service centre for much of the Shire. Floor space use (from 2017) is shown in **Figure 2-7**. Currently, Mullumbimby town centre provides around 31,600 square metres of retail and commercial floor space. The town centre catchment generates an estimated demand for around 25,435 square metres of floor space. This results in an oversupply of around 6,165 square metres of floor space in the centre. Projected over/ under supply of floor space by 2041 within the town centre is shown in **Figure 2-8**.

● Hotel – providing a mix of temporary or short term accommodation as well as entertainment and commercial services.

▌ Includes active commercial space at ground floor with residential above

Note: Figure categories the largest floor space use on a lot.

Figure 2-7 Mullumbimby town centre's predominant floor space use (in November 2017)

Source: Byron Shire Business and Industrial Lands Strategy, 2020

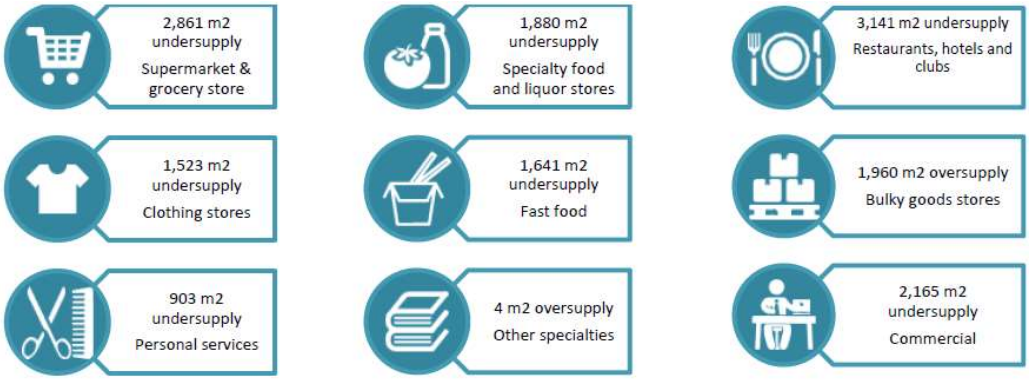


Figure 2-8 Projected floor space 2041

Source: Byron Shire Business and Industrial Lands Strategy, 2020

Strengths, opportunities and challenges for the Mullumbimby town centre are shown in **Table 2-6**.

Table 2-6 Business and industrial land – strengths, opportunities and challenges

Strengths/ opportunities	Challenges
▪ Anchor tenants in Woolworths and the Council Administration building ▪ The second largest retail and commercial centre within the Shire (with 10.1 hectares of business zoned land) ▪ Possible opportunity to use the Mullumbimby surplus rail corridor lands for mixed use purposes ▪ Opportunity to leverage infill residential growth as well as potential new release Residential areas ▪ Capacity for redevelopment and densification in parts of the centre as well as Expansion of business centre zone boundary on the southern edge of Tincogan Street ▪ Seen increased diversification and unique identity formation, with the emergence of cafes, boutique clothing and homewares stores ▪ A compact and walkable grid layout with relatively flat terrain. ▪ Opportunities to improve the look, feel and functionality of laneways to integrate Better with the main street.	▪ Fragmented ownership and limited vacant land for redevelopment ▪ Is covered by heritage conservation regulation and has heritage items ▪ Is partially flood prone and has acid sulphate soil-affected land ▪ Achieved community consensus on the type and scale of development appropriate to strengthen and grow the centre ▪ Is car focused, with resulting issues of traffic movement and parking.

Recommended actions from the *Byron Shire Business and Industrial Lands Strategy* relevant for Mullumbimby are:

> 4. Undertake an urban design review to determine appropriate building heights and floor space ratios for the Mullumbimby town centre, with a view to supporting the viability of the business centre.

> 5. Consider landowner planning investigations for an additional small-scale supermarket in the Mullumbimby town centre.

> 6. Consider landowner planning investigations for an extension of the Mullumbimby town centre, consistent with urban design principles.

> 13. Consider landowner planning investigations for possible new industrial areas as identified in the strategy at Area 2 Mullumbimby expansion

> 15. Amend the Byron LEP 2014 - B7 Business Park Zone objectives to extend consideration to the retail function of Mullumbimby town centre and Brunswick Heads village centre.

> 19. Investigate the implementation of active frontage planning provisions for Brunswick Heads, Mullumbimby and Ocean Shores business centres to enable mixed use development and to promote uses that attract pedestrian traffic along certain ground floor street frontages enhancing public security, passive surveillance and encourage pedestrian activity.

3 Existing conditions

Analysis of existing conditions is informed by a number of sources of information including a site visit of the study area on Thursday 26 May 2022 and Friday 27 May 2022, background information review, survey analysis and online data sources provided by Council and the state government. Data sources are indicated where applicable.

3.1 Population and demographics

The Australian Bureau of Statistics (ABS) Census survey collects population data across Australia every five years, the most recent of which was conducted in 2021. The geographical area of the suburb of Mullumbimby referenced in this section is shown in **Figure 3-1**.

General demographic information for the suburb is shown in **Table 3-1**. In comparison to NSW, Mullumbimby's median age is higher, average number of people per household is slightly higher, and median weekly income is lower.

Figure 3-1 Mullumbimby suburb area

Source: 2021 ABS QuickStats

Table 3-1 Mullumbimby suburb general information

Characteristic	Mullumbimby suburb – 2021	New South Wales – 2021
Population	4,180 (47.1% male and 52.9% female)	8,072,161 (49.4% male and 50.6% female)
Median age	45	39
Average number of people per household	2.5	2.6
Median weekly household income	$1,355	$1,829

Source: 2021 ABS QuickStats

The age profile of residents living in Mullumbimby suburb, NSW and Australia is shown in **Figure 3-2**. In comparison to NSW and Australia, residents in the suburb of Mullumbimby are generally older, with higher percentages of people over the age of 40, and lower percentages of people between 20 and 39.

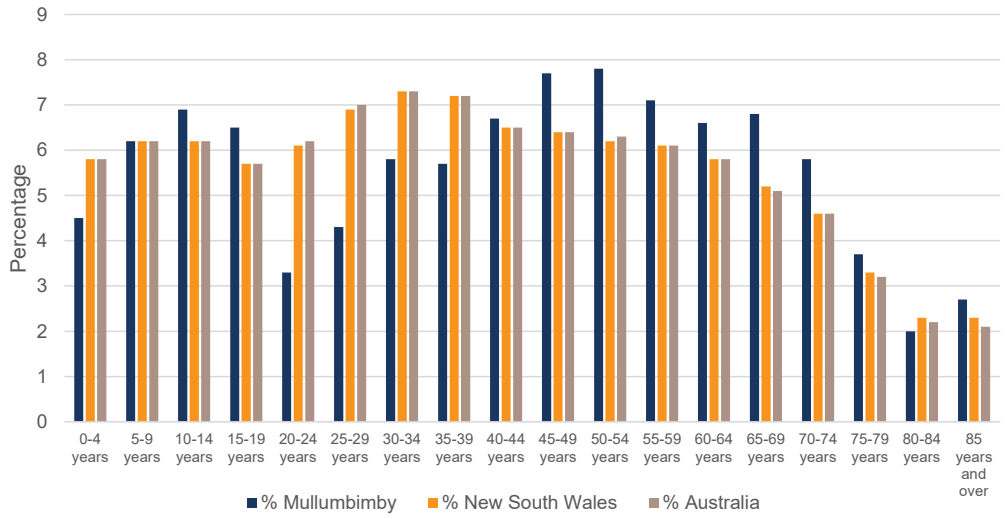


Figure 3-2 Mullumbimby suburb age profile (2021)

Source: 2021 ABS QuickStats

ABS data reveals information about the number of registered motor vehicles per household, as shown in **Table 3-2**. Data reveals that the percentage of households that own zero motor vehicles is almost half the amount in NSW. In comparison to NSW, Mullumbimby had slightly higher percentages of households owning one, two, three or more vehicles.

Table 3-2 Number of registered motor vehicles

	Percentage of occupied private dwellings		
	% Mullumbimby	% NSW	% Australia
None	4.8	9	7.3
1 motor vehicle	38.5	37.8	36.2
2 motor vehicles	36.4	34.1	36.3
3 or more vehicles	18.4	17.5	18.8
Number of motor vehicles not stated	2	1.5	1.5

Source: 2021 ABS QuickStats

3.1.2 Future population

The *Byron Shire Residential Strategy* (Byron Shire Council, December 2020) lists the existing and projected population and number of dwellings for Mullumbimby in 2016 and 2036, respectively. **Table 3-3** shows the population and dwelling growth projections, and the calculated increase in population and dwellings.

Table 3-3 Byron Shire Residential Strategy population and dwelling growth projections

Mullumbimby	2016	2036	Growth (2016-2036)	Increase (2016-2036)
Population	3,781	6,645	2,864	76%
Dwellings	1,774	3,076	1,302	73%

Source: Byron Shire Residential Strategy, Byron Shire Council, December 2020

3.2 Land use

Tourism focused land uses majorly contribute to Byron Shire's economy. Council's Business and Industrial Land Use Strategy indicates that in 2016/17, tourism and hospitality generated 23% of our Shire's jobs (3,506 jobs), and that more than 2 million tourists visit the Shire each year.

The study area mainly consists of residential land uses around the Mullumbimby town centre along the boundary of the study area. Retail and commercial land uses can be found in the centre of the study area along Stuart Street, Burringbar Street and Dalley Street. On Station Street, Woolworths supermarket is located north of Argyle Street and the Mullumbimby train station is to the south of Argyle Street.

Outside of the study area, recreational land uses are located south-west, including swimming pool, parks and bowling clubs. Access to nature is provided north-west of the study area along the Brunswick River, with a boat ramp and picnic area. Mullumbimby Public School is located east of the study area on Brown Street. These locations create key desire lines for both walking and cycling from within the study area and outside.

Land uses within and outside of the study area are shown in **Figure 3-3**.

Information from Byron Shire's Business and Industrial Land Use Strategy is provided in **Section 2.2.6**.

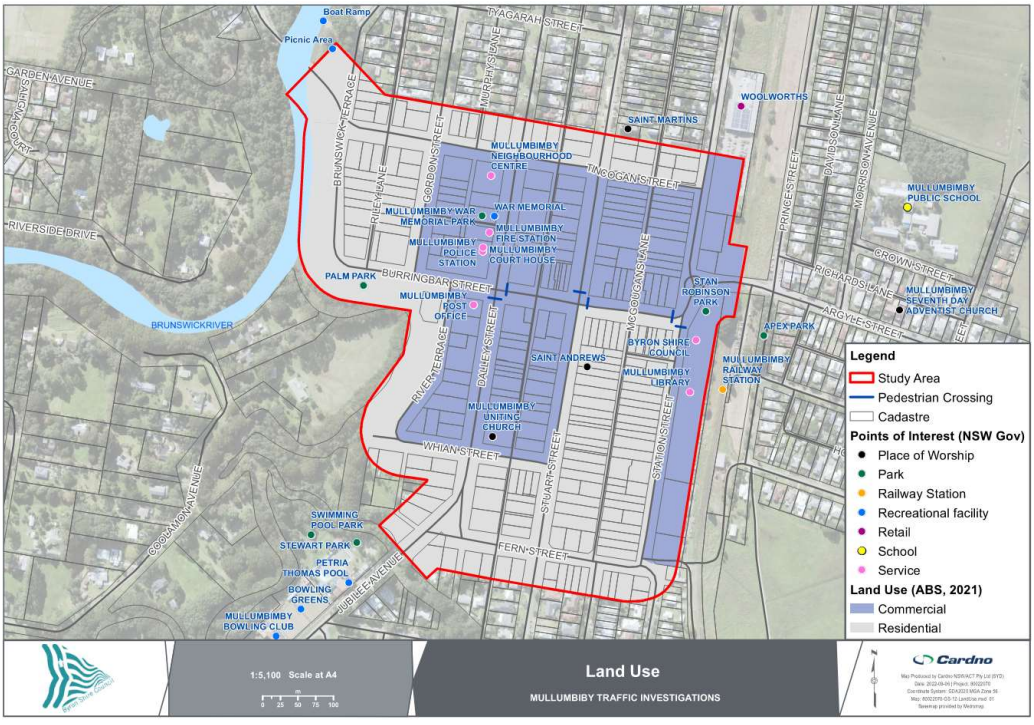


Figure 3-3 Land use

3.3 Transport network

3.3.1 Pedestrian

Mullumbimby town is generally flat, making it ideal for walking and cycling uptake for people of all ages and abilities, as well as participation in street-life. However, infrastructure within the town is more favourable towards vehicles with wide roads, wide turning radii, angle parking, gaps in paths, and footpath maintenance issues. As a result of this, residents and visitors to the town centre are reliant on private vehicles.

Consultation undertaken for the Mullumbimby Movement Strategy showed that the community desires a safe and accessible centre where pedestrians are prioritised and people are able to navigate the network safely and efficiently.

Footpaths are provided along most local roads in the study area, with the exception of Fern Street and Whian Street. Footpaths are limited to one side of the road in some locations such as on Stuart Street near Fern Street, Station Street south of the Mullumbimby Library and on Tincogan Street.

The majority of pedestrians were observed on Burringbar Street, Dalley Street and Stuart Street. During site visit inspection, pedestrians were noted to cross Burringbar Street where convenient rather than at the dedicated pedestrian crossings.

The existing pedestrian network defined by the Byron Shire PAMP is shown in **Figure 3-4**.

Figure 3-4 Existing pedestrian network – Mullumbimby town centre

Source: Byron Shire Pedestrian Access & Mobility Plan, 2019

3.3.2 Cycling

Consultation undertaken for the Mullumbimby Movement Strategy showed that the community strongly supports the need for a comprehensive and connected cycling network that is safe, accessible and enjoyable for people of all ages and abilities. Currently, poor quality infrastructure and car dominance within the town centre contributes to low ridership despite adequate cycle catchments.

Cycle catchment mapping from the Movement Strategy shows that all of the central established area of the town and peripheral areas including Left Bank Road, Coolamon Scenic Drive, Main Arm Road and Mullumbimby Road can be accessed within a ten minute cycling trip, and areas in large lot residential pockets at Brushbox Drive and Tristran Parade to the south west, Gulgan Road to the east, Coolamon Scenic Drive to the north and Main Arm Road to the north west are accessible in a 15 minute catchment.

Cycleways are provided within the town centre along Stuart Street, Dalley Street and Burringbar Street. The cycleways are alongside general traffic and linemarked, which results in cyclists riding between parked cars and moving vehicles.

A limited number of cyclists were observed during the site visit, with two recorded in the AM peak and one in the PM peak. Of the AM peak cyclists, one was observed to use the footpath instead of the on-road cycleway.

The existing cycle network as defined by the Byron Shire Bike Plan is shown in **Figure 3-5**.

Figure 3-5 Existing cycle network - Mullumbimby town centre

Source: Byron Shire Council Bike Plan, 2019

3.3.3 Public transport

Two regular bus routes operate through the study area. Additionally, two temporary flood recovery shuttle services operate through the study area during the modelled date. **Table 3-4** lists the bus routes in the study area. **Figure 3-6** shows the bus routes and stops.

No rail service is provided within Mullumbimby.

Table 3-4 Bus routes

Route	Description
640	Ballina to Mullumbimby
642	Billinudgel to Mullumbimby (Flood Recovery Shuttle)
645	Byron Bay to Ocean Shores
698	Mullumbimby to Upper Wilsons Creek

Figure 3-6 Bus routes and stops

3.3.4 Roads and private vehicles

Private vehicle is the current preferred mode choice in Mullumbimby, and this is estimated to continue into the future. The centre hosts many essential services and retail destinations, and therefore attract trips from surrounding towns within the Byron Shire Council including Ocean Shores, Billinudgel and Brunswick Heads.

Access to the west across the Brunswick River is limited to the Murwillumbah Road Bridge, and access to the east is limited to the Argyle Street connection due to the presence of the railway corridor.

Key streets in the network as outlined by the *Mullumbimby Movement Strategy* are described in **Table 3-5**.

Table 3-5 Key road network

Key road	Description
Burringbar Street	Burringbar Street is Mullumbimby's main street which enables east-west movements and supports a range of active land uses. The street is an important spine of the town with an interesting built form and scale that celebrates the way of life, culture and history of the town.
Argyle Street	Argyle Street is the entry point to the town centre from the eastern approach. Argyle Street extends over the rail line to terminate at the roundabout where Station Street runs north-south and Burringbar Street forms the western continuation.
Tincogan Street	Tincogan Street is predominantly a residential street that takes a significant amount of traffic due to its connection to Murwillumbah Road and role as an informal bypass around Mullumbimby. The street is well positioned to take a greater volume of traffic and has been identified as suitable to become a formal 'alternative route' that would see major through traffic diverted using the link. While an increase in traffic volumes would be an outcome of a future alternative route on Tincogan Street, the community would also like to see this managed with pedestrian and community needs in mind.

Source: Mullumbimby Movement Strategy, Byron Shire Council

Poor maintenance of town roads that have potholes, poor surfacing and uneven verges was indicated in *Mullumbimby Immersion* as a major issue.

3.3.5 Parking

The core town centre is dominated by car parking and creates a poor environment for walking and cycling. However, convenient parking is highly regarded by residents as outlined in the Movement Strategy. Timed restrictions are currently operating within the immediate vicinity to Burringbar Street, with two-hour provision or less in some locations.

It is recommended in the Mullumbimby Movement Strategy that parking is redistributed to the periphery for longer term stay parking.

An electric vehicle charging station is provided at the car park on Station Street.

3.3.6 Heavy vehicles and freight

There are currently no restrictions on heavy vehicles within the Mullumbimby town centre. Key land uses requiring heavy vehicle access include Woolworths and BWS on Station Street, Liberty Petrol Station at the intersection of Dalley Street and Tincogan Street, and other bulky goods retail land uses.

Mullumbimby Immersion outcomes revealed that the community are interested in diverting heavy vehicles from the town centre to an alternate traffic route. Options for this are shown in **Figure 2-4**.

3.3.7 Pavement conditions

Cardno has undertaken an assessment of the general pavement conditions in the Mullumbimby town centre. A detailed assessment has been provided in **Appendix D**. The pavement conditions assessment findings are summarised in **Table 3-6** below.

Table 3-6 Pavement conditions summary

Road	Condition	Comment	Recommendations
Tincogan St - West	Good	• Some longitudinal cracking • Crocodile cracking and ravelling on the pavement edges • No kerb and gutter on the pavement edges.	Longitudinal cracks should be sealed to ensure no water ingress into the existing pavement. Upon review of pavement design and as built drawings, consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage of overall road alignment, shoulder sealing and repair of edge breaks and crocodile cracking.
Tincogan St - East	Good	▪ Edge Break was observed at Stuart Street intersection ▪ Some longitudinal cracking was observed ▪ No kerb and gutter present for majority of section.	Longitudinal cracks should be sealed to ensure no water ingress into the existing pavement. Upon review of pavement design and as built drawings, consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage of overall road alignment, shoulder sealing and repair of edge breaks.
Brunswick Terrace	Poor	▪ Multiple potholes ▪ Various cracking including some minor crocodile cracking ▪ Edge break ▪ Deformed surface.	Mill and reinstate pothole and crocodile cracking locations. Visible meandering cracks should be sealed. Consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage on over all road alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine structural rehabilitation requirements.
River Terrace	Very Poor	▪ Severe successive Potholes (>1m wide) ▪ Uneven road surface, extensive crocodile cracking and shoving, and transverse cracking	It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine suitable pavement rehabilitation or reconstruction options.
Dalley Street – North	Fair	▪ Some crocodile cracking and potholes (remediated) visible. ▪ Block cracking observed.	Mill and reinstate pothole and crocodile cracking locations. Visible cracks should be sealed. Consideration should be given to subsoil drainage (if not

Road	Condition	Comment	Recommendations
		▪ Crocodile cracking, meandering cracking was observed at the intersection of Dalley Street / Burringbar Street	present) to improve the drainage on over all road alignment. Extensive crocodile cracking was observed on several locations. Consideration should be given to structural rehabilitation of these sections of the alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine pavement rehabilitation / resurfacing options.
Dalley Street – South	Fair	▪ Observed to be in good condition in general ▪ Crocodile cracking, block cracking and longitudinal cracking observed at Whian Street intersection.	Visible transverse and longitudinal cracks should be sealed. Consideration should be given to subsoil drainage (if not present) to improve the drainage on over all road alignment. Extensive crocodile cracking was observed on several locations. Consideration should be given to structural rehabilitation of these sections of the alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine pavement rehabilitation / resurfacing options
Burringbar St East and West	Fair	▪ Some crocodile cracking and longitudinal cracking observed. ▪ Some minor transverse cracking observed. Textured surface.	Mill and reinstate crocodile cracking locations. Visible cracks should be sealed. Review pavement history to determine surfacing age and need for resurfacing.
Stuart St	Good	▪ Minor longitudinal cracking and minor stripping of asphalt was observed, top layer of asphalt beginning to ravel in some sections. ▪ Rubbish and vegetation on road.	Sealing of longitudinal cracks and continued monitoring of Stuart Street can be undertaken. Review pavement history to determine surfacing age and need for resurfacing. Mill and reinstate asphalt wearing course to remediate the ravelling of asphalt.
Station St (North of Roundabout)	Very Good	▪ Crocodile cracking observed at the entry and exit of roundabout. ▪ Recently repaved, smooth pavement, minor longitudinal cracking observed.	Mill and reinstate crocodile cracking locations. Visible cracks should be sealed. Asphalt thickness to be designed for up to 20 year traffic loading.
Station St (South of Roundabout)	Poor	▪ Some remediated potholes, patching, crocodile cracking and ravelling was observed. ▪ No kerb and gutter was observed.	It is recommended to structurally rehabilitate one lane along Station street. Where crocodile cracking is observed on the right hand lane, mill and reinstation of pavement should be undertaken. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine rehabilitation design options.
Whian St	Very Good	▪ Some longitudinal cracking (minor). Even surface, dirty markings from trucks. ▪ No kerb and gutter were observed.	Consideration should be given to installation of kerb and gutter and subsoil drainage, and sealing of shoulders to improve the drainage of overall road alignment. Visible cracks should be sealed. Review pavement history to determine surfacing age and need for resurfacing.
Fern St	Good	▪ Depression at one location was observed. ▪ Rare small longitudinal cracking was observed. Dirt wheel tracks being embedded into asphalt. ▪ No kerb and gutter.	Consideration should be given to installation of kerb and gutter, subsoil drainage and sealing of shoulders to improve the drainage of overall road alignment. Visible cracks should be sealed.

3.4 Method of travel to work

The method of travel to work for residents living in the Mullumbimby suburb as defined by the ABS Census (2016) is shown in **Figure 3-7**. The per cent of residents cycling to work on the census day in 2016 was over three times that of the NSW and Australian figures. This suggests that residents do have an appetite to cycle and enhance conditions and safety may increase this proportion further. Additionally, walking trips was found to be a higher proportion than in NSW and Australia.

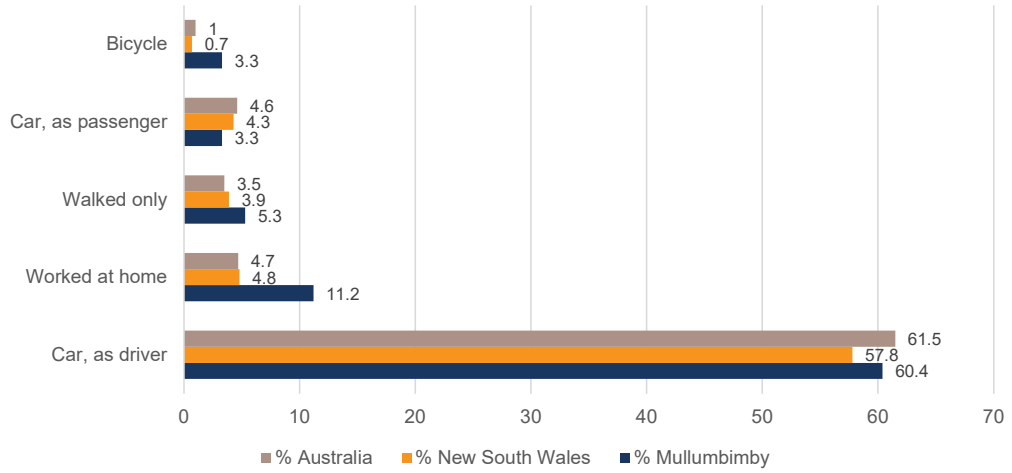


Figure 3-7 Method of travel to work – Mullumbimby suburb

Source: ABS Census, 2016

4 Summary of issues and barriers

- Heavy reliance on private vehicles including for short distance trips to the town centre
- High levels of interactions of pedestrians and cyclists with vehicles within the town centre
- High occupancy of parking within the town centre
- Large residential lots affect pedestrian permeability
- Traffic congestion within the centre from vehicles searching for parking spaces
- Lack of safe, connected and accessible active and public transport infrastructure and services
- Higher than NSW average number of motor vehicles per household
- Road and infrastructure maintenance issues
- Separation of heavy vehicles from the town centre while maintaining economic activity
- Population growth in the North Coast Region, with a focus on Mullumbimby
- Retaining the towns' country feel and eclectic character while growing in population and prosperity
- Resilience to extreme weather events
- Housing affordability
- Ageing population and rapid socio-economic change

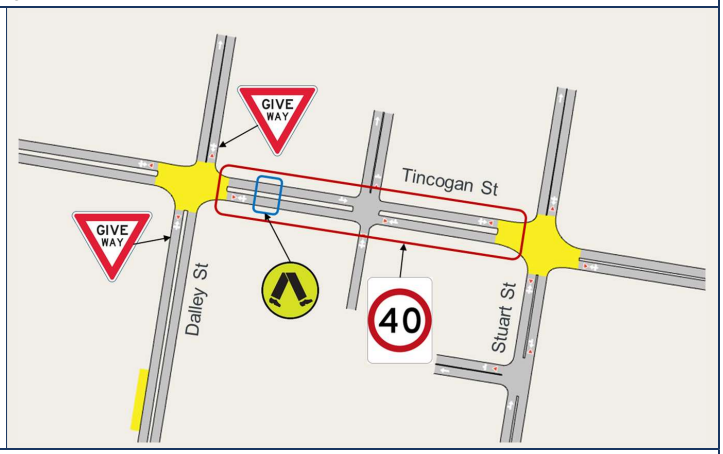
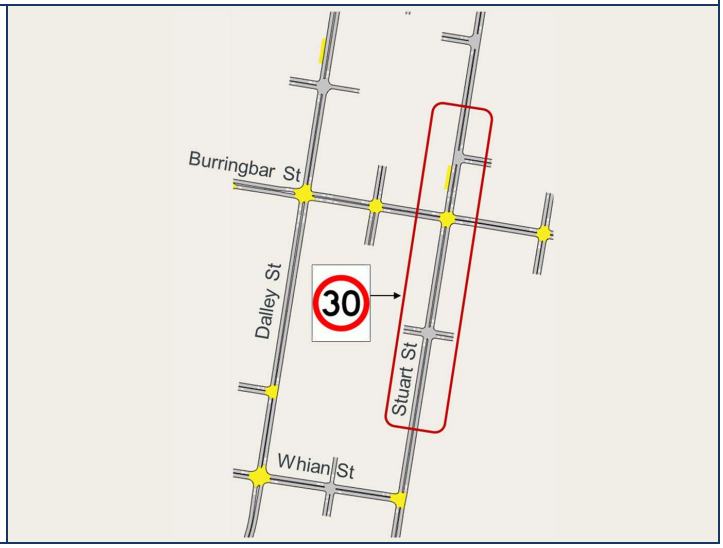
5 Option testing

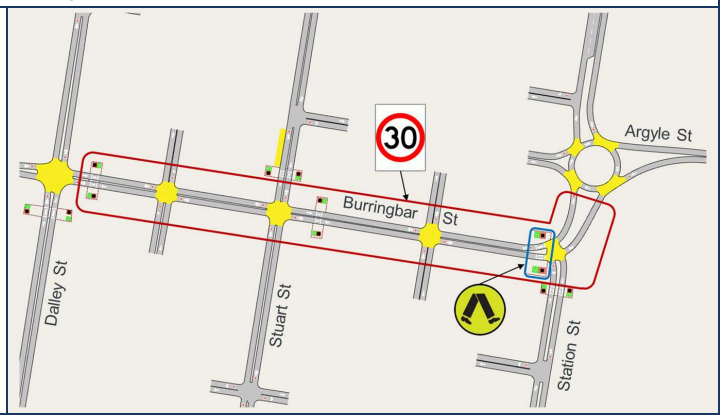
This section outlines the infrastructure changes included in the future models, the scenarios assessed, and the assessment years and time periods modelled.

5.1 Future infrastructure

Infrastructure changes were considered across the study area for the future year modelling. **Table 5-1** lists the upgrades that were considered in the future-year scenarios.

Table 5-1 Summary of future infrastructure changes

#	Description	Configuration
1	Tincogan Street intersection upgrades	
	▪ Speed limit on Tincogan Street reduced to 40 kilometres per hour between Stuart Street and Dalley Street ▪ Additional pedestrian crossing on Tincogan Street between Dalley Street and Stuart Street. ▪ Traffic priority at Tincogan Street / Dalley Street and Tincogan Street / Stuart Street changed from north-south to east-west	
2	Speed reductions associated with Stuart Street Green Spine	
	▪ Speed limit on Stuart Street set to 30 kilometres per hour between 45 metres north of Whian Street and 90 metres north of Burringbar Street	

#	Description	Configuration
3	Burringbar Street Talking Streets design	
	▪ Speed limit on Burringbar Street set to 30 kilometres per hour between Dalley Street and Argyle Street ▪ Additional pedestrian crossing on Burringbar Street west of Station Street	

5.2 Assessment scenarios

The following six scenarios were assessed:

- Existing Base Model
- Do Minimum
- Option 1
- Option 2
- Option 3
- Option 4.

Each of these scenarios is described below:

5.2.1 Existing Base Model

The Existing Base Model (the Base Model) was developed using data inputs from traffic surveys conducted in June 2022. The Base Model represents the existing conditions of the Mullumbimby town centre during the typical weekday AM and weekday PM peak periods. The model was calibrated and validated in accordance with the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). Further details of the model development, calibration and validation process have been documented in the *Base Model Development Report* (Cardno, August 2022), provided in **Appendix A**.

5.2.2 Do Minimum

The Do Minimum scenario includes the existing network state, along with any committed infrastructure upgrades within the study area. The committed infrastructure upgrades result in the following changes to the network described in **Section 5.1**:

- Speed reductions associated with Tincogan Street intersection upgrades
- Speed reductions associated with Stuart Street Green Spine
- Burringbar Street Talking Streets design
- Tincogan Street pedestrian crossing. In order to remain conservative, the crossing was modelled near to the intersection with Dalley Street as this would cause a more significant impact to general traffic.
  - From both the perspectives of safety and traffic performance, installing a pedestrian crossing in the mid-block of Tincogan Street will provide better outcomes than installing at the intersection with Dalley Street.

This scenario applies the future-year demand from background growth as explained in **Section 9**.

5.2.3 Option 1

The Option 1 scenario includes the same infrastructure upgrades and future-year traffic demands as the Do Minimum scenario.

The Option 1 heavy vehicle route is implemented in this scenario, with heavy vehicles restricted to Dalley Street, Burringbar Street east of Dalley Street, and Tincogan Street west of Dalley Street. **Figure 5-1** shows the Option 1 heavy vehicle route.

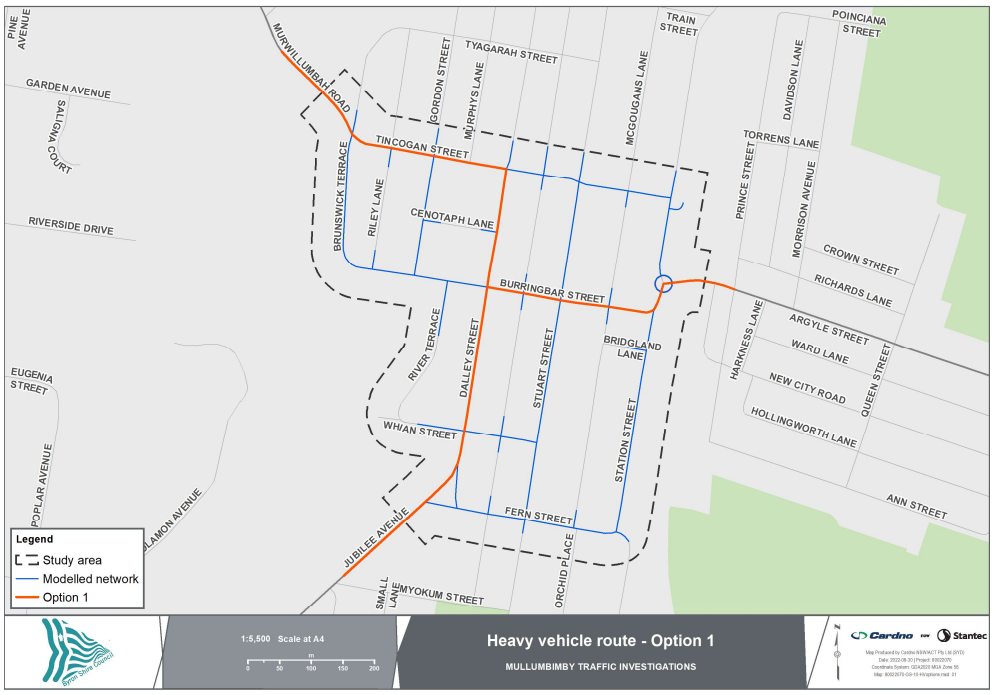


Figure 5-1 Heavy vehicle route – Option 1

5.2.4 Option 2

The Option 2 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario.

The Option 2 heavy vehicle route is implemented in this scenario, with heavy vehicles restricted to Tincogan Street, Station Street and Fern Street. **Figure 5-2** shows the Option 2 heavy vehicle route.

Figure 5-2 Heavy vehicle route – Option 2

5.2.5 Option 3

The Option 3 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario.

The Option 3 heavy vehicle route is implemented in this scenario, with heavy vehicles restricted to Stuart Street, Burringbar Street east of Stuart Street, Tincogan Street west of Stuart Street and Fern Street west of Stuart Street. **Figure 5-3** shows the Option 3 heavy vehicle route.

Figure 5-3 Heavy vehicle route – Option 3

5.2.6 Option 4

The Option 4 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario.

The Option 4 heavy vehicle route is implemented in this scenario, with heavy vehicles restricted to Burringbar Street, Brunswick Terrace and Dalley Street south of Burringbar Street. **Figure 5-4** shows the Option 4 heavy vehicle route.

Figure 5-4 Heavy vehicle route – Option 4

5.2.7 Scenario summary

Table 5-2 provides a summary of the traffic demand and infrastructure assumptions for each scenario.

Table 5-2 Summary of scenario infrastructure upgrades, traffic demands and heavy vehicle routes

Description	Scenario				
	Do Minimum	Option 1	Option 2	Option 3	Option 4
Infrastructure upgrades					
Tincogan Street intersection upgrades	✓	✓	✓	✓	✓
Speed reductions associated with Stuart Street Green Spine	✓	✓	✓	✓	✓
Burringbar Street Talking Streets design	✓	✓	✓	✓	✓
Traffic demand					
Background growth	✓	✓	✓	✓	✓
Heavy vehicle route					
Option 1	-	✓	-	-	-
Option 2	-	-	✓	-	-
Option 3	-	-	-	✓	-
Option 4	-	-	-	-	✓

5.3 Assessment years and time periods

Table 5-3 summarises the scenarios and years assessed. Each scenario was assessed for the two peak periods consistent with the Base Model:

> AM peak: 8:00am to 10:00am

> PM peak: 3:00pm to 5:00pm

Table 5-3 Summary of assessment years and time periods

Model scenario	2022		2032	
	AM	PM	AM	PM
Base Model	✓	✓	-	-
Do Minimum	-	-	✓	✓
Option 1	-	-	✓	✓
Option 2	-	-	✓	✓
Option 3	-	-	✓	✓
Option 4	-	-	✓	✓
Preferred Option	-	-	✓	✓

6 Safe system assessment

This section outlines the Safe System Assessment (SSA) of various existing road segments and intersections along the proposed heavy vehicle routes to measure how well they align with Safe System principles. The SSA is to also examine the proposed design options to gauge how much impact they will have on road safety along the proposed heavy vehicle routes.

The SSA has been prepared in accordance with Austroads Safe System Assessment Framework (AP-R509-16) with the aim to enable the project to meet TfNSW's Towards Zero goal, and is provided in detail in **Appendix C**.

6.1 Safe system principles

The basic principles of the Safe System are that:

- People are human and sometimes make mistakes – a simple mistake shouldn't cost anyone their life.
- Roads, roadsides and vehicles need to be designed to minimise crashes or reduce forces if a crash happens.
- Road safety is a shared responsibility – everyone needs to make safe decisions on and around the road to prioritise safety.

The four goals of the Safe System Assessment are to encourage an environment that leads to:

1. **Safe Roads** that mean that if a driver or rider makes a mistake, road infrastructure can significantly reduce the chance that it will result in a fatality or serious injury.
2. **Safe Speeds** in regard to the speed at which vehicles are likely to travel on the road. Speed limits are set so vehicles travelling at the speed limit are able to safely respond to potential risks in the road environment. Ultimately it is a driver's speed that will determine the outcome.
3. **Safe People** in terms of the road user behaviour, including training, license and education, and making safe choices.
4. **Safe Vehicles** in relation to the safety features of vehicles and smart systems that can help avoid crashes in the first place.

6.2 Road geometry issues

Council has provided Cardno with swept paths that consider the turning movements of a 19m semi-trailer design vehicle. The swept paths identified issues with the existing road geometry at the following locations:

- Intersection of Tincogan Street and Brunswick Terrace – narrow road may cause side swipes between turning vehicles (intersection-type accident)
- Intersection of Tincogan Street and Station Street – tight horizontal turn may cause mounting of the inside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident)
- Intersection of Burringbar Street and Dalley Street – tight horizontal turn may cause mounting of the inside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident)
- Intersection of Burringbar Street and Stuart Street – tight horizontal turn may cause collisions between turning vehicles (intersection-type accident)
- Intersection of Fern Street and Dalley Street – narrow road width may cause mounting of the inside curve (pedestrian-type accident)
- Intersection of Fern Street and Station Street – tight horizontal turn may cause mounting of the outside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident).

Further information regarding the recommended infrastructure mitigation is provided in **Appendix C**.

6.3 Safe System Assessment methodology

The SSA has been prepared based on the following assessment and reporting steps:

- Define project need and scope
- Site Inspection
- Document Safe System Matrix Results
- Consideration of other Safe System pillars
- Identification of treatments to improve Safe System alignment.

6.3.1 Assessment matrix

In order to assess the existing conditions and proposed design options, and ensure that Safe System elements are considered, or alternatively to measure the how well a project aligns with the Safe System principles, a matrix assessment is used.

The purpose of the Safe System matrix is to adopt a risk assessment approach focused on seven major crash types against the exposure to that crash risk, the likelihood of the crash occurring and the severity of the crash outcome if it were to occur. Scores are given based on the likelihood and severity, with higher scores representing more unsafe conditions. The aim of the safe system matrix is to provide clarity on the design option that provides the safest conditions i.e., the lowest score overall.

The seven major crash types that reflect the main crash and road user types that contribute to fatalities and serious injuries are listed below:

- Run-off Road
- Head-on
- Intersection (vehicles from near or far side)
- Other (all vehicles in same direction, maneuvering, overtaking, and miscellaneous crashes)
- Pedestrian
- Cyclist
- Motorcyclist.

Further details regarding the qualitative assessment criteria are provided in **Appendix C**.

6.3.2 Heavy vehicle route assessment

In order to analyse each of the route options in terms of road safety, the study roads have been separated into different road segments and intersections and analysed individually. This method will allow Council to analyse which road segments and intersections are positively or negatively impacting each route's Safe System score. The 14 road segments and 11 intersections which have been assessed are shown in **Figure 6-1**.

For each of the four proposed heavy vehicle routes, the road segments and intersections most impacted by an increase in heavy vehicles have been assessed in terms of their safety and alignment with Safe System principles. The following factors have been considered due to the higher percentage of heavy vehicles:

- Increased severity of run-off road accidents, head-on accidents, and other accidents (i.e., now more likely to result in a fatality or serious injury due to greater chance of higher force in crashes)
- Increased likelihood and severity of cyclist accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)
- Increased likelihood and severity of motorcyclist accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)
- Increased likelihood and severity of pedestrian accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)

For further information regarding the scores of each section and intersection, please refer to **Appendix C.**

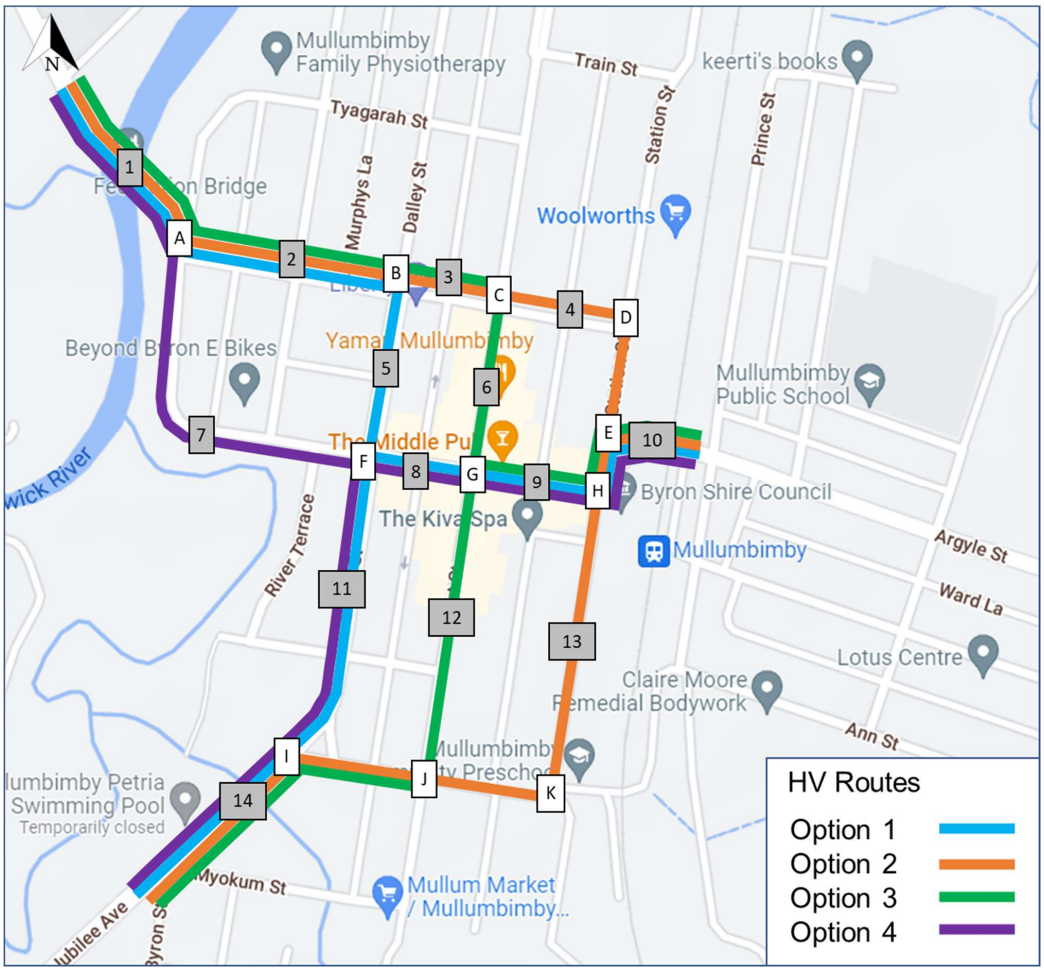


Figure 6-1 Road Segments and Intersections

6.4 Heavy vehicle route summary

A summary of the Safe System scores is provided below in **Table 6-1** based on each route becoming the heavy vehicle route. Scores are separated into the sum of all segments and the sum of all intersections. Higher scores are indicative of a less safe road environment.

Table 6-1 Heavy vehicle Route Summary

Route	Road Segments	Average Segment Score	Intersections	Average Intersection Score	Total
1	1, 2, 5, 8, 9, 10, 11, 14	**78/320**	A, B, E, F, G, H, I	**47/128**	**125/448**
2	1, 2, 3, 4, 10, 13, 14	**75/320**	A, B, C, D, E, H, I, J, K	**41/128**	**116/448**
3	1, 2, 3, 6, 9, 10, 12, 14	**72/320**	A, B, C, E, G, H, I, J	**45/128**	**117/448**
4	1, 7, 8, 9, 10, 11, 14	**76/320**	A, E, F, G, H, I	**47/128**	**123/448**

The results show that Route 2 is the favoured heavy vehicle route. This route is supported as it redirects heavy vehicles away from the pedestrian and cyclist-friendly town centre (i.e., Burringbar Street and Stuart Street).

Route 3 is the second safest route, as this route includes the smallest portion of Burringbar Street other than Option 2. Options 4 and 1 score the lowest due to the inclusion of all of Burringbar Street; however, Option 4 ranks safer than Option 1 due to the Jubilee Avenue to Murwillumbah Road route avoiding the town centre by using Brunswick Terrace.

7 Our Mullumbimby Masterplan objectives assessment

This section assesses the impacts of the proposed heavy vehicle routes against the three relevant objectives from the *Our Mullumbimby Masterplan* (Byron Shire Council, 2019). Findings from the Safe Systems Assessment summarised in **Section 6** and provided in detail in **Appendix C** have been used to support this assessment and includes further details on infrastructure upgrade treatments recommended for the study area.

7.1 Masterplan action item 2: Argyle Street to Jubilee Avenue via Fern Street

As discussed in **Section 2.2.1** and in **Table 2-2**, one of the priority projects of the Masterplan seeks to formalise a number of alternative routes in the town centre including the route between Argyle Street and Jubilee Avenue via Station Street and Fern Street. Of the four proposed heavy vehicle routes, Options 3 and 4 directly interact with this route and their impacts are summarised in **Table 7-1** below.

Table 7-1 Heavy vehicle route impacts on action item 2

Option	Impacts
Option 2	▪ Heavy vehicles will travel along Station Street and Fern Street when travelling between Argyle Street and Jubilee Avenue, using the entire route highlighted for Action Item 2. ▪ Intersection of Fern Street and Station Street – tight horizontal turn may cause mounting of the outside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident). – Intersection widening may be required to allow for a sufficient turning path to avoid mounting the kerb or crossing another vehicle's path
Option 3	▪ Heavy vehicles will travel along Fern Street west of Stuart Street to access Jubilee Avenue. ▪ Intersection of Fern Street and Stuart Street – swept paths show a 19m design vehicle would cross over the pedestrian refuge island. – Intersection widening may be required to allow for a sufficient turning path to avoid mounting the pedestrian refuge

7.2 Masterplan action item 3: Tincogan Street from Argyle Street to Murwillumbah Road

Action item 3 seeks to formalise Tincogan Street between Murwillumbah Road to Station Street and Station Street to Argyle Street. Of the four proposed heavy vehicle routes, Options 1, 2 and 3 directly interact with this route and their impacts are summarised in **Table 7-2** below.

Table 7-2 Heavy vehicle route impacts on action item 3

Option	Impacts
Option 1	▪ Heavy vehicles will use Tincogan Street via Dalley Street to travel between the town centre and Murwillumbah Road ▪ This Option avoids the new pedestrian crossing on Tincogan Street and does not require turning movements at Tincogan Street / Murwillumbah Road, resulting in low impacts for action item 3.
Option 2	▪ Option 2 will consider heavy vehicles assigned to the full route identified in action item 3. ▪ Intersection of Tincogan Street and Station Street – tight horizontal turn may cause mounting of the inside curve and/or collisions between turning vehicles – Widening of the intersection would be required to safely allow heavy vehicles to turn between Tincogan Street and Station Street ▪ Heavy vehicles will travel through the reduced speed section of Tincogan Street between Stuart Street and Dalley Street, which is proposed to introduce a new pedestrian crossing. Pedestrian safety will be reduced with the introduction of the heavy vehicle route.
Option 3	▪ In Option 3, heavy vehicles will use Tincogan Street and Stuart Street to travel between the town centre and Murwillumbah Road. ▪ Heavy vehicles will travel through the reduced speed section of Tincogan Street between Stuart Street and Dalley Street, which is proposed to introduce a new pedestrian crossing. Pedestrian safety will be reduced with the introduction of the heavy vehicle route.

7.3 Masterplan action item 6: Turn Burringbar Street into a 'Talking Street'

Action item 6 of the Masterplan seeks to turn Burringbar Street into a 'Talking Street' that encourages social, cultural, environmental and economic sustainability. Emphasis is placed on creating a safe environment for pedestrians and cyclists and to encourage active transport for residents accessing the town centre. Of the four proposed heavy vehicle routes, Options 1, 3 and 4 directly interact with this route and their impacts are summarised in **Table 7-3** below.

Table 7-3 Heavy vehicle route impacts on action item 6

Option	Impacts
Option 1	▪ Heavy vehicles will use Tincogan Street via Dalley Street to travel between the town centre and Murwillumbah Road ▪ Intersection of Burringbar Street and Dalley Street – tight horizontal turn may cause mounting of the inside curve causing a hazard for pedestrians and/or collisions between turning vehicles – Widening of the intersection would be required to safely allow heavy vehicles to turn between Burringbar Street and Dalley Street ▪ Heavy vehicles will be travelling through the 'Talking Street' sections of Burringbar Street, creating an unsafe environment for pedestrians and cyclists between Dalley Street and Station Street.
Option 3	▪ In Option 3, heavy vehicles will use Tincogan Street and Stuart Street to travel between the town centre and Murwillumbah Road. ▪ Intersection of Burringbar Street and Stuart Street – tight horizontal turn may cause collisions between turning vehicles (intersection-type accident) – Widening of the intersection would be required to safely allow heavy vehicles to turn between Burringbar Street and Stuart Street ▪ Pedestrian safety will be reduced with the introduction of the heavy vehicle route. ▪ Heavy vehicles will be travelling through the 'Talking Street' sections of Burringbar Street, creating an unsafe environment for pedestrians and cyclists between Stuart Street and Station Street. ▪ The reduced speed areas of Stuart Street will be used by heavy vehicles in this Option, creating additional risks for pedestrians and cyclists.
Option 4	▪ In Option 4, heavy vehicles will travel along the entirety of Burringbar Street and Brunswick Terrace to travel to Murwillumbah Road. ▪ Heavy vehicles will be travelling through the 'Talking Street' sections of Burringbar Street, creating an unsafe environment for pedestrians and cyclists between Stuart Street and Station Street. ▪ Increased heavy vehicles including B-doubles through the town centre will affect the perceived character and accessibility of Burringbar Street by active transport users.

8 Modelling assumptions

This section outlines the assumptions underlying the Future Models and the metrics for assessing network and intersection performance.

8.1 Future model assumptions

- The Future Models were developed atop the calibrated and validated 2022 Base Model. Further details can be found in the *Base Model Development Report* (Cardno, August 2022) provided in **Appendix A**
- The Aimsun Next 22.0.1 software package was used to develop the Future Models, consistent with the Base Model
- All bus routes and timetables were assumed to remain the same as in the Base Model
- The peak hours for the AM and PM peaks were assumed to remain consistent with the Base Model for each peak
- The traffic profile for the Future Models was assumed to remain consistent with the Base Model
- The posted speed limits in the Future Models were kept the same as in the Base Model, except for the road sections outlined in **Section 5.1**
- Parking turnover on Burringbar Street, Dalley Street, Fern Street, Station Street and Tincogan Street was assumed to remain the same as in the Base Model, as the number of on-street parking spaces are anticipated to be the same in the modelled future year.
- The Future Models retained the vehicle composition used in the Base Model, which included the following three vehicle types:
  - Light vehicles
  - Rigid heavy vehicles
  - Articulated heavy vehicles
  - Buses.
- Assessment of intersections and travel times not calibrated in the Base Model is not recommended.

8.2 Performance metrics

Aimsun modelling results were interrogated to understand the future network performance. Measures used to assess future network performance were identified by:

- Network performance
- Intersection performance
- Travel times

This section outlines the performance metrics used for assessing the Base and Future Models.

8.2.1 Network performance metrics

Model operation is quantified based on a number of statistical outputs. **Table 8-1** provides a summary of the network performance statistics for this study.

Table 8-1 Network performance metrics

Metric	Unit	Description
All vehicles		
Total traffic demand	veh	> The total number of trips that enter the network during the modelled hour
Vehicle kilometres travelled (VKT)	km	> The distance travelled by all vehicles in the network > Useful for identifying savings in road user and external costs
Vehicle hours travelled (VHT)	hrs	> The total travel time of all vehicles across the network > Useful for identifying network efficiency and performance, possible congestion issues and future travel time savings
Total number of stops	stops	> The number of times a vehicle stops, summed across all vehicles in the network
Averages per vehicle		
Average time travelled in network	sec	> Average time spent in the network across all vehicles
Average number of stops	stops	> Average number of stops per vehicle
Average speed	km/h	> Average speed for all vehicles in the network > Equivalent to VKT divided by VHT
Unreleased demand		
Unreleased demand	veh	> The number of vehicles that were unable to enter the modelled network during the modelled period > Unreleased demand is caused by queueing that extends to the edge of the modelled network
Proportion of demand unreleased	%	> The proportion of unreleased vehicles from the total demand > Useful for understanding the significance of the number of unreleased vehicles

8.2.2 Intersection performance criteria

The following performance metrics were used in the analysis of intersections:

> Delay time: Average delay experienced by vehicles at the intersection

> Level of service (LoS): An intersection performance measure that is based on delay per vehicle.

> Queue lengths: The maximum queue lengths observed on each approach to an intersection.

Table 8-2 shows the level of service categories for intersections in NSW from the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002).

For unsignalised intersections (priority intersections and roundabouts), level of service is based on the maximum average delay of all movements.

Intersections operating at LoS C or better are considered satisfactory. LoS D indicates that the intersection is approaching capacity and an accident study may be required. LoS E indicates that the intersection is at capacity, and this level of service is generally unsuitable for unsignalised intersections. LoS F indicates that the intersection is failing and requires additional capacity.

Table 8-2 Level of Service criteria

Level of Service	Average delay per vehicle (sec)	Traffic signal and roundabout operation	Give way and stop sign operation
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	At capacity, requires other control mode
F	>70	Unsatisfactory and requires additional capacity	Unsatisfactory and requires additional capacity

Source: Guide to Traffic Generating Developments (Roads and Traffic Authority, 2002)

8.2.3 Travel times

Travel time data was used to validate the Base Model. It provides an indication of congestion hotspots along a particular route within a network and can also be used to compare the performance of future options.

Figure 8-1 shows the travel time routes that were used to validate the Base Model. Future travel times on these routes have been assessed for each option:

- Travel time route one along Tincogan Street and Murwillumbah Road
- Travel time route two along Dalley Street
- Travel time route three along Burringbar Street, Brunswick Terrace and Argyle Street
- Travel time route four along Station Street and Fern Street.

Speed ratio is calculated by dividing the average speed on a route by the posted speed limit. To assist with comparing and identifying the performance of travel time routes, in this report, Cardno has used the colour code shown in **Table 8-3**.

Table 8-3 Travel time route speed ratio colour code

Speed ratio					
Less than 0.30	0.30 – 0.40	0.40 – 0.50	0.50 – 0.67	0.67 – 0.80	Greater than 0.80

Based on Highway Capacity Manual midblock level of service criteria (Transportation Research Board, 2016)

Figure 8-1 Travel time routes

9 Future demand development

This section describes the procedure for future-year demand estimation. The future traffic demands were based on the following inputs:

> Demands from the Base Model developed using classified intersection counts, automatic tube counts, origin-destination data and pedestrian survey data

> Background growth based on the *Byron Shire Residential Strategy* (Byron Shire Council, December 2020)

9.1 Background growth

The *Byron Shire Residential Strategy* (Byron Shire Council, December 2020) was used to determine the background growth rate. Table 6 (page 56) of the *Byron Shire Residential Strategy* lists the existing and projected population and number of dwellings for Mullumbimby in 2016 and 2036, respectively. **Table 9-1** shows the population and dwelling growth projections, and the calculated increase in population and dwellings.

Table 9-1 Byron Shire Residential Strategy population and dwelling growth projections

Mullumbimby	2016	2036	Growth (2016-2036)	Increase (2016-2036)	Increase per annum (2016-2036)
Population	3781	6645	2864	76%	3.8%
Dwellings	1774	3076	1302	73%	3.7%

9.2 Future traffic demand estimation methodology

The methodology to develop the future year traffic demands is outlined below.

1. The existing and projected population and number of dwellings between 2016 and 2036 were linearly interpolated to find the population and number of dwellings in the base year (2022) and the future year (2032). **Table 9-2** shows the base year and future year population and dwelling growth projections.

Table 9-2 Base year and future year population and dwelling growth projections

Mullumbimby	2022	2032	Growth (2022-2032)	Increase (2022-2032)
Population	4640	6072	1432	31%
Dwellings	2165	2816	651	30%

2. The increase in population (31%) between the base year and future year is projected to be higher than the increase in dwellings (30%). To remain conservative, the higher of these two increases was adopted as the background growth rate. Therefore, the increase in population was adopted as the background growth rate between the base year and future year.
3. The 31% background growth was applied to the 2022 Base Model Aimsun traffic demand matrices to create the 2032 Future Model Aimsun traffic demand matrices.
4. The future-year demand was profiled according to the 15-minute profile for each peak from the Existing Base Model.

As the background growth rate does not distinguish between vehicle types, the articulated heavy vehicle, rigid heavy vehicle and light vehicle matrices were obtained by applying the traffic composition percentages from the corresponding peak hour in the Base Model to the future-year matrices.

9.2.2 Aimsun traffic demand summary

Figure 9-1 shows the Aimsun traffic demand for each peak. The demands shown are two-hour demands and represent all vehicles. The same demand was applied to all future scenarios.

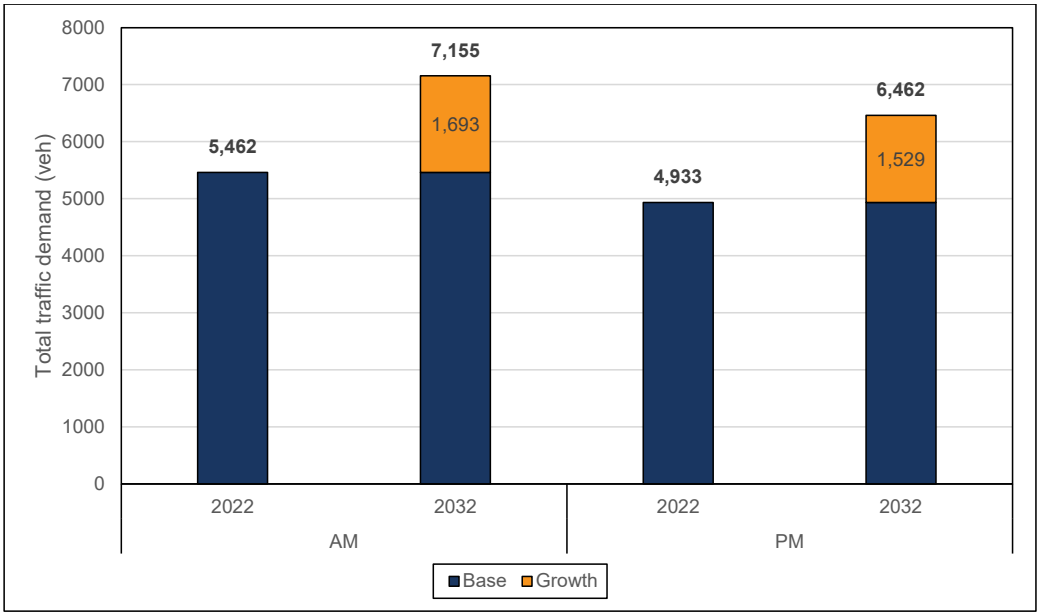


Figure 9-1 Aimsun traffic demand summary

9.3 Future pedestrian demand estimation methodology

The methodology to develop the future year pedestrian crossing demands is outlined below.

1. The 31% background growth was applied to the 2022 Base Model Aimsun pedestrian crossing demand matrices to find the 2032 pedestrian crossing volumes for the existing pedestrian crossings along Burringbar Street, Dalley Street, Stuart Street and Station Street
2. As outlined in **Section 5.1**, additional pedestrian crossings on Tincogan Street and Burringbar Street west of Station Street are introduced in the future-year scenarios. These new pedestrian crossings require additional pedestrian demands to be coded into the future model, as pedestrians will have the right-of-way over general traffic and any disruptions to traffic flow need to be captured in the model. In the Base Model these crossings are informal, and pedestrians will generally wait for a gap in traffic before crossing, thereby not causing disruption to traffic performance.
    a. Pedestrian volumes on Tincogan Street were recorded in pedestrian surveys conducted in June 2022. **Figure 9-2** shows the zones along Tincogan Street in which pedestrians were surveyed. It was assumed that pedestrians in Zone 2 and Zone 3 would use the new Tincogan Street pedestrian crossing, while pedestrians in Zone 1 and Zone 4 would use the pedestrian refuges. The Zone 2 and Zone 3 volumes were combined, and 31% background growth was applied to the volumes to find the volumes for the pedestrian crossing at Tincogan Street in 2032.
    b. Pedestrian volumes at Burringbar Street west of Station Street were recorded in traffic and pedestrian surveys conducted in June 2022. The 31% background growth was applied to these volumes to find the volumes for the pedestrian crossing at Burringbar Street, west of Station Street in 2032
3. The pedestrian volumes calculated in previous steps were combined to create the 2032 Aimsun Future pedestrian demand matrices.

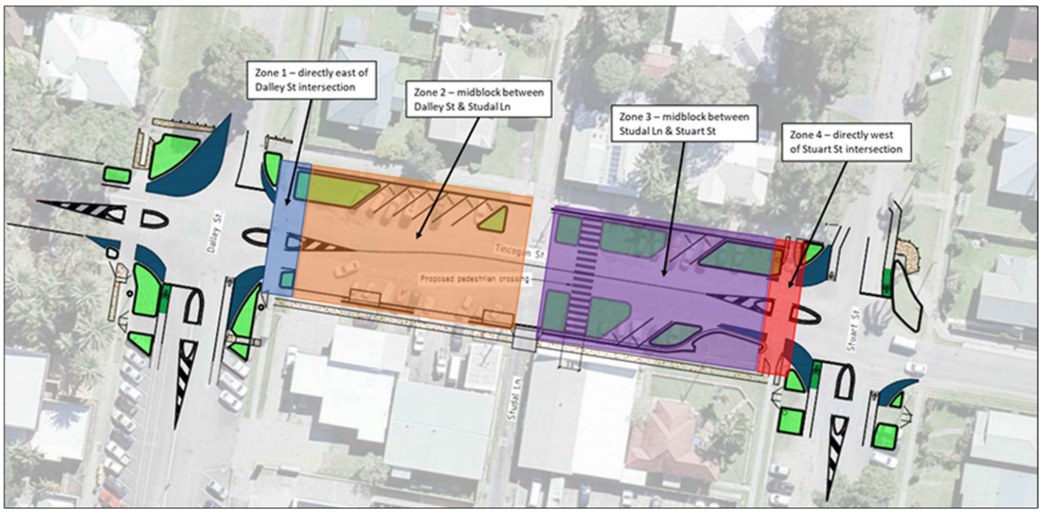


Figure 9-2 Pedestrian count locations on Tincogan Street

9.3.2 Aimsun pedestrian demand summary

Figure 9-3 shows the Aimsun pedestrian demand for each peak. The demands are divided into three categories:

- Base: the base year demands at existing pedestrian crossings along Burringbar Street, Dalley Street, Stuart Street and Station Street
- Growth: the future year growth in demand at the existing pedestrian crossings
- Additional pedestrian crossings: the future year demand at the new pedestrian crossings on Tincogan Street and Burringbar Street west of Station Street.

The demands shown are two-hour demands and represent all pedestrians. The same demand was applied to all future scenarios.

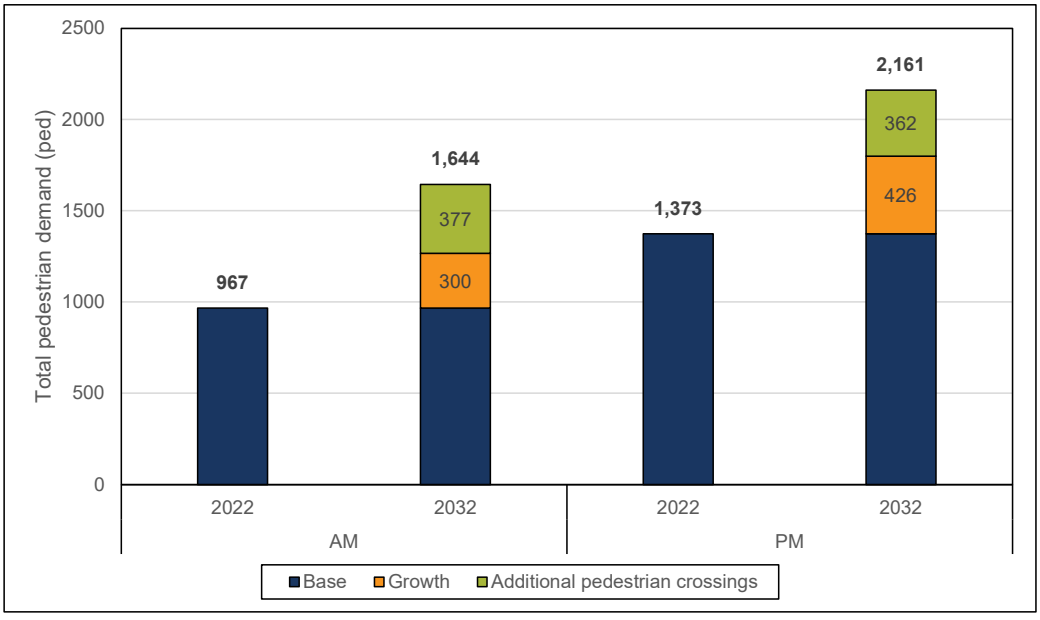


Figure 9-3 Aimsun pedestrian demand summary

10 Base Model operational results

This section outlines the Base Model operational results. The development, calibration and validation of the Base Model was previously reported in the *Base Model Development Report* (Cardno, August 2022), provided in **Appendix A**. The results presented in this section establish the base case for comparative assessment with future options scenarios.

10.1 Data inputs

The Base Model was developed using the following inputs:

- Classified intersection counts
- Automatic tube counts
- Travel time data
- Origin-destination data
- Public transport operations from local bus timetables.

10.2 Model specification and assumptions

The Base Model was calibrated and validated to the network conditions observed in June 2022. The settings and parameters of note from the Base Model are:

- Aimsun Next 22.0.1 was used to develop the Base Model
- The modelled peak hours were identified from classified intersection counts to be:
  - Typical weekday (Friday 17 June 2022)
    - AM peak: 8:00am to 10:00am
    - PM peak: 3:00pm to 5:00pm

The Base Model was developed in accordance with the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). A statistical analysis of stability indicated an acceptable degree of confidence in the results. The calibration and validation results show:

- Network-wide calibration criteria were achieved at all locations, indicating a realistic replication of traffic volumes across the model area, with 100% of turns achieving a GEH of less than 10 and over 85 per cent of turning movements having a GEH of less than five
- High statistical correlation between modelled and observed turning volumes with R2 > 0.947 across all modelled peaks
- Strong correlation between modelled and observed travel times, indicating that traffic behaviour and congestion patterns are realistically replicated across the model area
- Sufficient representation of observed congestion across the study area.

The Base Model met the calibration and validation targets set out in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013) and therefore was considered fit-for-purpose for assessing existing and future network performance.

The model development process, data inputs, assumptions, calibration and validation results were presented in further detail in the *Base Model Development Report* (Cardno, August 2022) which has been provided in **Appendix A**.

10.3 Existing network performance

Table 10-1 summarises the Base Model network performance results for both peaks. The results indicate that:

- The AM peak is the critical peak, with the highest traffic demand, VKT and VHT
- Network performance is comparable between the AM and PM peaks. Average travel times, average speeds and average delay are similar between both peaks.
- There are no unreleased vehicles in both the AM and PM peaks of the Base Model.

Table 10-1 2022 Base Model network performance

Network performance metric		2022 Base Model	
		AM peak	PM peak
All vehicles			
Total demand	veh	5462	4933
Vehicle kilometres travelled	km	5676	4808
Vehicle hours travelled	hr	186	158
Total number of stops	stop	9367	8265
Averages per vehicle			
Average travel time in network	sec	124.52	114.35
Average number of stops	stop	1.74	1.66
Average speed	km/h	30.46	30.38
Unreleased demand			
Unreleased vehicles	veh	0	0
Proportion of demand unreleased	%	0%	0%

10.4 Existing intersection performance

Table 10-2 and **Table 10-3** show the Base Model intersection performance results for the AM peak and PM peak, respectively. **Figure 10-1** shows the Base Model intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Dalley Street / Whian Street operates at LoS D in the second hour of the AM peak.
  - This result is due a high average delay for vehicles turning right from Dalley Street north to Whian Street west. Due to the low volume of vehicles performing this movement, the random occurrence of delay events for street parking encountered by these vehicles significantly affects the average delay recorded by vehicles on this movement.
  - All other movements at the intersection operate at LoS B or above in both hours of the AM peak.
- Burringbar Street / Dalley Street operates at LoS D in the first hour of the PM peak.
  - Vehicles turning right from Burringbar Street into Dalley Street give way to vehicles along Dalley Street, and experience delays from on-street parking manoeuvres.
- Tincogan Street / Dalley Street operates at LoS F in the second hour of the PM peak.
  - Similarly, to Dalley Street / Whian Street, a low volume of vehicles on the right turn from Tincogan Street east to Dalley Street north experience delays due to an increase in traffic on the eastern approach coupled with delays from on-street street parking manoeuvres, which adversely affects the average delay for this movement.
- All other intersections operate satisfactorily at LoS C or better in all modelled peaks and hours.
- Long queues are modelled at the intersections of Tincogan Street / Dalley Street, Burringbar Street / Dalley Street, Burringbar Street / Station Street and Dalley Street / Whian Street. This is because the model considers vehicles slowed by on-street parking as part of the queue, and frequent parking manoeuvres were observed on site at Dalley Street, Station Street and Burringbar Street.

- Queues of more than 20 vehicles were observed on the Dalley Street south approach to Burringbar St / Dalley St. High volumes of vehicles performing the right turn from Dalley Street south to Burringbar Street west give way to vehicles from Dalley Street north. On-street parking delays also contribute to queuing.
- Queues on Dalley Street southbound and Burringbar Street westbound also reach over 20 vehicles, due to high volumes of vehicles affected by frequent on-street parking delays.

Table 10-2 2022 Base AM peak intersection performance

Intersection	2022 Base AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1121	11	A	4	1027	14	B	8
Tincogan St / Gordon St	995	20	B	10	884	7	A	2
Tincogan St / Dalley St	988	42	C	17	891	41	C	17
Tincogan St / Stuart St	655	23	B	14	643	21	B	12
Tincogan St / Station St	610	3	A	3	675	3	A	8
Woolworths carpark / Station Street	718	3	A	3	813	4	A	3
Burringbar Street / River Terrace	218	16	B	5	206	13	A	4
Burringbar St / Dalley St	897	22	B	23	828	28	C	26
Burringbar St / Stuart St	669	24	B	16	589	32	C	13
Burringbar St / Station St	892	30	C	13	795	33	C	15
Argyle St / Station St	1530	7	A	9	1455	6	A	7
Dalley St / Whian St	918	25	B	17	816	43	D	17
Stuart St / Whian St	248	4	A	4	131	3	A	1
Jubilee Ave / Fern St	1208	13	A	8	1014	8	A	4
Stuart St / Fern St	330	3	A	3	245	4	A	2

Table 10-3 2022 Base PM peak intersection performance

Intersection	2022 Base PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	675	9	A	6	633	11	A	6
Tincogan St / Gordon St	598	5	A	1	590	17	B	2
Tincogan St / Dalley St	632	34	C	9	611	70	F	12
Tincogan St / Stuart St	439	26	B	9	539	34	C	16
Tincogan St / Station St	432	3	A	3	548	3	A	4
Woolworths carpark / Station Street	744	1	A	3	878	2	A	2
Burringbar Street / River Terrace	115	8	A	3	116	14	A	3
Burringbar St / Dalley St	914	50	D	23	732	27	B	17
Burringbar St / Stuart St	711	27	B	17	620	30	C	16
Burringbar St / Station St	808	51	D	21	767	37	C	13
Argyle St / Station St	1442	7	A	6	1465	6	A	6
Dalley St / Whian St	959	33	C	21	773	30	C	18
Stuart St / Whian St	65	4	A	1	52	3	A	1
Jubilee Ave / Fern St	1130	14	A	6	946	6	A	3
Stuart St / Fern St	195	3	A	1	171	2	A	0

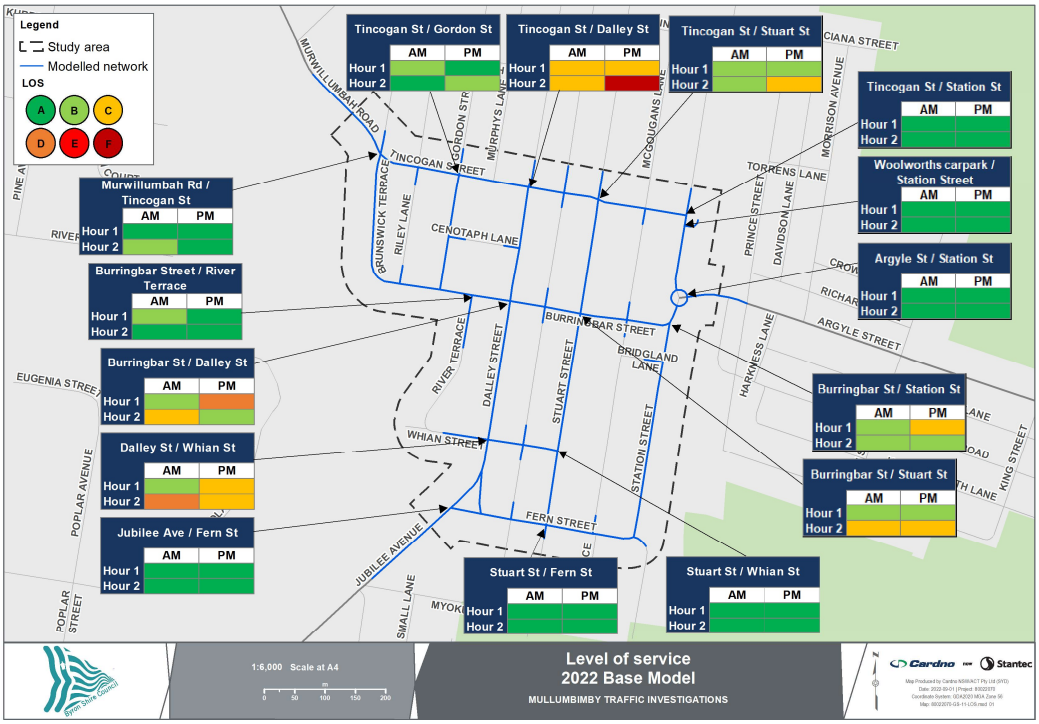


Figure 10-1 2022 Base Model intersection level of service

10.5 Existing travel times

Table 10-4 and **Table 10-5** show the existing travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**. The results indicate:

- Average speeds are at or below 35 kilometres per hour on all routes in all modelled peaks and hours
  - This reflects the low-speed environment of the Mullumbimby town centre resulting from the low-density residential land use and local centre retail activity
- Average speeds on Dalley Street northbound are at or below 20 kilometres per hour in both hours of the AM and PM peaks
  - Frequent on-street parking manoeuvres between Burringbar Street and Tincogan Street, along with delays for the right turn from Dalley Street northbound to Burringbar Street eastbound result in slow speeds along this route in both peaks.
- Average speeds on Burringbar Street eastbound fall to 17 kilometres per hour in the second hour of the AM peak and 18 kilometres per hour in the first hour of the PM peak
  - Vehicles along this route give way at the Dalley Street intersection, and experience frequent on-street parking manoeuvres between Dalley Street and Station Street.
- Average speeds are similar across both peaks.

Table 10-4 2022 Base Model AM peak travel times and average speeds

	Route	Dir.	2022 Base Model AM peak			
			Travel time (mm:ss)		Average speed (km/hr)	
			8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
1	Tincogan St	EB	01:39	01:21	27	33
		WB	01:27	01:28	31	30
2	Dalley Street	NB	01:35	01:48	20	17
		SB	01:08	01:14	27	25
3	Burringbar Street	EB	02:09	02:56	23	17
		WB	02:00	02:13	24	22
4	Station Street	NB	01:45	01:55	28	26
		SB	01:32	01:26	33	35

Table 10-5 2022 Base Model PM peak travel times and average speeds

	Route	Dir.	2022 Base Model PM peak			
			Travel time (mm:ss)		Average speed (km/hr)	
			3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
1	Tincogan St	EB	01:30	01:25	30	31
		WB	01:17	01:18	35	34
2	Dalley Street	NB	01:37	01:35	19	20
		SB	01:30	01:24	21	22
3	Burringbar Street	EB	02:49	02:16	18	22
		WB	01:59	02:15	24	22
4	Station Street	NB	02:01	01:47	24	27
		SB	01:43	01:28	29	34

11 Do Minimum operational results

This section outlines the Do Minimum operational results. The Do Minimum model was used to assess future conditions without the implementation of a heavy vehicle route. The Do Minimum model includes committed infrastructure upgrades within the study area described in **Section 5**, and uses future-year demands from background growth explained in **Section 9**. The results of the Do Minimum scenario establish a reference case for options testing.

11.1 Do Minimum network performance

Table 11-1 summarises the Do Minimum network performance results for both peaks. Compared to the 2022 Base Model, the results indicate that:

- Between 2022 and 2032, the traffic demand within the Mullumbimby town centre increases by 1693 trips in the AM peak and 1529 trips in the PM peak
- In both peaks, the increase in VKT is similar in proportion to the increase in traffic demand, while VHT increases by a larger proportion than VKT. In the AM peak, VHT increases to 50% higher than that of the 2022 Base Model, indicating an increase in congestion in the network.
- The total number of stops increases by approximately 60% in the AM peak and approximately 50% in the PM peak.
- Average travel times increase by approximately 13% in the AM and PM peaks, and average speeds for each vehicle decrease by 11% in the AM peak and 10% in the PM peak.
  - Vehicles travelling between Jubilee Avenue and Argyle Street primarily travelled on Dalley Street and Burringbar Street in the Base scenario but change their routes in the Do Minimum scenario to avoid the 30 kilometre per hour zone on Burringbar Street, and travel via Fern Street and Station Street. These vehicles experience increased delay at the right turn movement from Station Street south to Station Street northeast.
  - Increased traffic volume from Murwillumbah Road along Tincogan Street, along with on-street parking delays on Tincogan Street between Dalley Street and Stuart Street lead to higher travel times and lower average speeds along Tincogan Street.

Table 11-1 2032 Do Minimum network performance

Network performance metric		2032 Do Minimum		Compared to 2022 Base	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	1693 (+31%)	1529 (+31%)
Vehicle kilometres travelled	km	7580	6303	1904 (+33.6%)	1495 (+31.1%)
Vehicle hours travelled	hr	280	230	94 (+50.4%)	72 (+45.2%)
Total number of stops	stop	14939	12389	5572 (+59.5%)	4124 (+49.9%)
Averages per vehicle					
Average travel time in network	sec	141	129	16 (+13%)	14 (+12.5%)
Average number of stops	stop	2.1	1.9	0.3 (+19.9%)	0.3 (+16.1%)
Average speed	km/h	27	27	-3 (-11.2%)	-3 (-9.7%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

11.2 Do Minimum intersection performance

Table 11-2 and **Table 11-3** show the Do Minimum intersection performance results for the AM peak and PM peak, respectively. **Figure 11-1** shows the Do Minimum intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates unsatisfactorily in future due to the increased traffic demands in 2032 and the change in priority rules to favour the east and west approaches. Delays at the southern approach result in LOS F during the AM peak period and LOS E during the first hour of the PM peak.
- Tincogan Street / Stuart Street degrades to LoS D in the first hour of the PM peak due to the change in priority rules at this location. Delays are experienced on Stuart Street as vehicles attempt to find a gap to enter Tincogan Street.
- Burringbar Street / Dalley Street performs at LOS D during the first hour of the PM peak period. This is caused by a small number of vehicles on the west approach waiting for a gap in traffic to turn right onto Dalley Street.
- Vehicles travelling between Jubilee Avenue and Argyle Street primarily travelled on Dalley Street and Burringbar Street in the Base scenario but change their routes in the Do Minimum scenario to avoid the 30 kilometre per hour zone on Burringbar Street. Instead, these vehicles travel via Station Street and Fern Street, resulting in changes in intersection performance:
  - Burringbar Street / Stuart Street and Burringbar Street / Station Street improve to LoS B in both hours of the AM and PM peak periods as less vehicles travel on Burringbar Street.
  - Dalley Street / Whian Street improves to LoS B in the PM peak, as a reduction in northbound traffic along Dalley Street reduces delay for right-turning vehicles from Dalley Street north to Whian Street west.
- All other intersections perform at LOS C or better in each peak period.

Table 11-2 2032 Do Minimum AM peak intersection performance

Intersection	2032 Do Minimum AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1510	14	A	6	1410	17	B	8
Tincogan St / Gordon St	1383	16	B	19	1330	8	A	1
Tincogan St / Dalley St	1404	79	F	16	1373	111	F	21
Tincogan St / Stuart St	845	27	B	11	874	16	B	19
Tincogan St / Station St	859	4	A	14	970	4	A	5
Woolworths carpark / Station Street	991	3	A	3	1134	4	A	3
Burringbar Street / River Terrace	258	15	B	4	198	23	B	4
Burringbar St / Dalley St	783	31	C	16	558	28	B	17
Burringbar St / Stuart St	190	19	B	8	185	20	B	9
Burringbar St / Station St	1137	20	B	10	1141	38	C	10
Argyle St / Station St	2014	9	A	12	2022	10	A	11
Dalley St / Whian St	691	21	B	17	537	35	C	11
Stuart St / Whian St	119	3	A	2	117	3	A	0
Jubilee Ave / Fern St	1567	15	B	17	1353	9	A	12
Stuart St / Fern St	945	14	B	15	846	11	A	7

Table 11-3 2032 Do Minimum PM peak intersection performance

Intersection	2032 Do Minimum PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	846	12	A	10	800	8	A	7
Tincogan St / Gordon St	643	4	A	2	736	4	A	2
Tincogan St / Dalley St	861	58	E	15	872	43	D	16
Tincogan St / Stuart St	672	55	D	11	727	32	C	13
Tincogan St / Station St	663	3	A	4	730	4	A	6
Woolworths carpark / Station Street	1043	5	A	5	1078	4	A	4
Burringbar Street / River Terrace	317	9	A	5	220	18	B	7
Burringbar St / Dalley St	670	54	D	21	522	21	B	14
Burringbar St / Stuart St	268	23	B	14	222	25	B	9
Burringbar St / Station St	1153	32	C	10	975	21	B	10
Argyle St / Station St	1899	9	A	6	1799	9	A	6
Dalley St / Whian St	700	21	B	16	583	25	B	14
Stuart St / Whian St	35	3	A	1	17	2	A	0
Jubilee Ave / Fern St	1492	13	A	9	1273	6	A	7
Stuart St / Fern St	836	12	A	2	658	5	A	2

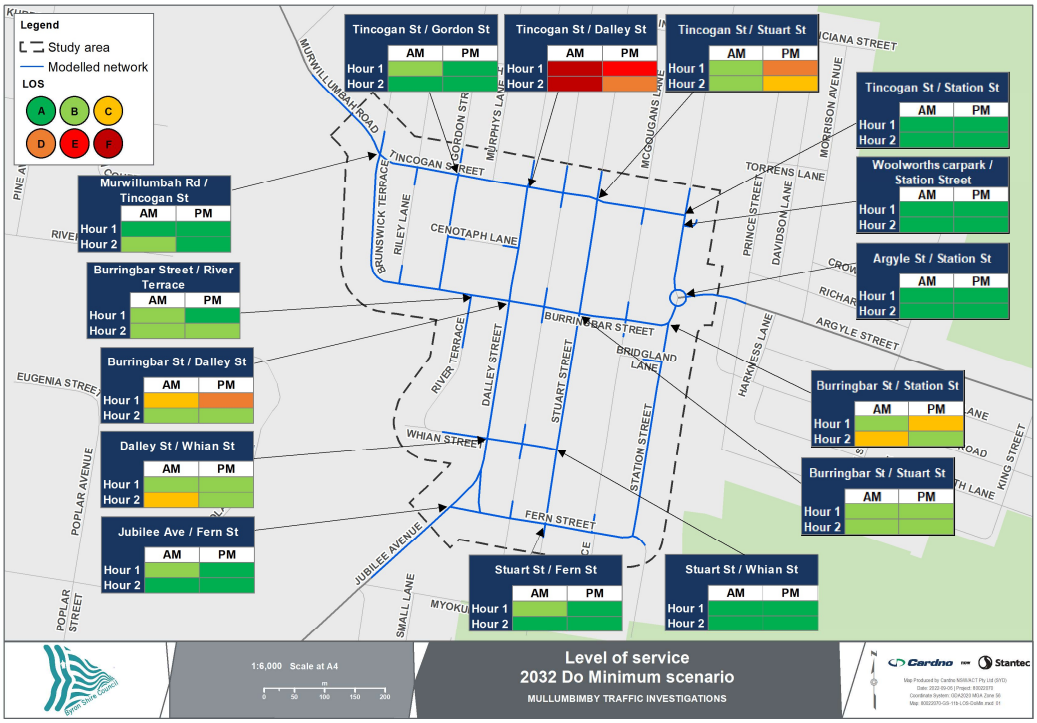


Figure 11-1 2032 Do Minimum intersection level of service

11.3 Do Minimum travel times

Table 11-4 and **Table 11-5** show the 2032 Do Minimum travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2022 Base Model. The results indicate:

- Travel times on Dalley Street northbound reduce by four seconds in the first hour of the AM peak. Vehicles from Jubilee Avenue which previously used Dalley Street to access Argyle Street change their routes to avoid the 30 kilometre per hour zone on Burringbar Street. Instead, these vehicles access Argyle Street via Station Street, reducing traffic volumes on Dalley Street northbound.
- Travel times on Station Street northbound increase by over 40 seconds in the first hour of the AM peak and over one minute in the first hour of the PM peak, due to the rerouting of vehicles from Jubilee Avenue to Argyle Street outlined above.
- Travel times on Burringbar Street eastbound decrease in both hours of the PM peak and Burringbar Street westbound travel times decrease in the second hour of the PM peak. The reduction in traffic volumes caused by the rerouting of vehicles between Jubilee Avenue and Argyle Street reduces travel times along the route.
- Travel times on Tincogan Street eastbound increase by over 30 seconds in the first hour of the AM peak and over two minutes in the first hour of the PM peak. Increased traffic volumes and the change in priority rules result in vehicles taking more time to turn right into Dalley and Stuart Street as the opposing traffic flow now has the right-of-way, resulting in slow travel times.

Table 11-4 2032 Do Minimum AM peak travel times and average speeds

Route		Dir.	Travel time (mm:ss)				Average speed (km/hr)	
			2032 Do Minimum AM		Compared to 2022 Base		2032 Do Minimum AM	
			8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
1	Tincogan St	EB	02:16	01:39	+00:36	+00:18	20	27
		WB	01:20	01:44	-00:07	+00:17	33	26
2	Dalley Street	NB	01:31	01:56	-00:04	+00:08	21	16
		SB	01:13	01:18	+00:05	+00:04	26	24
3	Burringbar Street	EB	02:15	03:05	+00:06	+00:09	22	16
		WB	02:01	02:15	+00:01	+00:02	24	21
4	Station Street	NB	02:28	02:29	+00:43	+00:34	20	20
		SB	01:38	01:32	+00:06	+00:05	31	33

Table 11-5 2032 Do Minimum PM peak travel times and average speeds

Route		Dir.	Travel time (mm:ss)				Average speed (km/hr)	
			2032 Do Minimum PM		Compared to 2022 Base		2032 Do Minimum PM	
			3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
1	Tincogan St	EB	04:16	01:42	+02:46	+00:17	10	26
		WB	01:36	01:31	+00:19	+00:13	28	29
2	Dalley Street	NB	01:58	01:37	+00:20	+00:03	16	19
		SB	01:42	01:28	+00:13	+00:03	18	21
3	Burringbar Street	EB	02:32	01:45	-00:17	-00:31	19	28
		WB	02:14	02:08	+00:15	-00:06	22	23
4	Station Street	NB	03:04	02:15	+01:02	+00:28	16	22
		SB	02:01	01:39	+00:17	+00:11	25	30

12 Option operational results

12.1 Overview

This section outlines the operational results for the four Option scenarios described in **Section 5.2**, with all results compared against the Do Minimum scenario. All five scenarios have been assessed for the typical weekday AM and PM peak periods during the forecast year of 2032, with the demands developed as explained in **Section 9**.

12.2 Option 1

As discussed in **Section 5.2.3**, the Option 1 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario. Heavy vehicles are restricted to the Option 1 heavy vehicle route, which includes Dalley Street, Burringbar Street east of Dalley Street, and Tincogan Street west of Dalley Street.

12.2.1 Option 1 network performance

Table 12-1 summarises the Option 1 network performance for all peak periods. Compared to the 2032 Do Minimum model, the results indicate that:

- The traffic demand is the same as the Do Minimum scenario
- VHT rises by 4.8% in the AM peak and 1.4% in the PM peak, while VKT is almost unchanged, indicating an increase in congestion when compared with the Do Minimum scenario. This is caused by assigning all heavy vehicles to a single travel route instead of allowing them to decide the best route by themselves, leading to additional congestion in the network.
- The total number of stops increase by 5% in the AM peak and 2% in the PM peak, while average speeds decrease by 4% in the AM peak and 1% in the PM peak.
- The introduction of the Option 1 heavy vehicle route results in an increase in heavy vehicle volumes along Burringbar Street between Dalley Street and Station Street, where the 30 kilometre per hour zone results in an increase in travel times.
- In the AM peak, increased delay is observed on Dalley Street northbound and Tincogan Street eastbound on the approaches to the Dalley Street / Tincogan Street intersection, as more heavy vehicles travel between Dalley Street south and Tincogan Street east, leading to increased delay and travel times.
- There are no unreleased vehicles in both peaks of the Option 1 scenario, indicating that the network is servicing all traffic demand.

Table 12-1 2032 Option 1 network performance

Network performance metric		2032 Do Minimum		Compared to 2022 Base	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7587	6310	7 (+0.1%)	7 (+0.1%)
Vehicle hours travelled	hr	294	233	13 (+4.8%)	3 (+1.4%)
Total number of stops	stop	15729	12655	790 (+5.3%)	266 (+2.1%)
Averages per vehicle					
Average travel time in network	sec	147	130	7 (+4.8%)	2 (+1.4%)
Average number of stops	stop	2.2	2.0	0.1 (+5.3%)	0.0 (+2.2%)
Average speed	km/h	26	27	-1 (-4.5%)	0 (-1.3%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

12.2.2 Option 1 intersection performance

Table 12-2 and **Table 12-3** show the Option 1 intersection performance results for the AM peak and PM peak, respectively. **Figure 12-1** shows the Option 1 intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates at LoS F in both hours of the AM peak, and operates at LoS E in the first hour of the PM peak
  - Vehicles on the Dalley Street south approach give way to vehicles on the Tincogan Street east and west approaches, resulting in long queues and delays.
- Tincogan Street / Stuart Street operates at LOS D during the first hour of the PM peak.
  - Vehicles at the west approach of Tincogan Street / Stuart Street experience difficulty finding a gap in traffic to turn right onto Stuart Street, leading to delays at this approach.
- Burringbar St / Dalley St operates at LoS F during the second hour of the AM peak and LOS D in the first hour of the PM peak
  - Movements on the northern approach to the intersection are frequently blocked by queues along Dalley Street southbound and Burringbar Street eastbound exits of the intersection.
- Dalley Street / Whian Street operates at LOS F during the second hour of the AM peak
  - A small number of vehicles turning right into River Terrace from the north approach of Dalley Street experience difficulty finding a gap in northbound traffic, leading to an LOS F.
- All other intersections operate at LOS C or better in all modelled time periods.

Table 12-2 2032 Option 1 AM peak intersection performance

Intersection	2032 Option 1 AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1489	16	B	6	1431	24	B	11
Tincogan St / Gordon St	1346	25	B	23	1336	14	A	21
Tincogan St / Dalley St	1365	104	F	23	1391	205	F	29
Tincogan St / Stuart St	811	23	B	10	879	19	B	16
Tincogan St / Station St	824	4	A	14	979	3	A	6
Woolworths carpark / Station Street	955	2	A	3	1144	6	A	4
Burringbar Street / River Terrace	252	14	B	4	221	19	B	6
Burringbar St / Dalley St	828	33	C	27	621	81	F	21
Burringbar St / Stuart St	265	16	B	10	249	19	B	9
Burringbar St / Station St	1157	25	B	10	1150	31	C	11
Argyle St / Station St	2004	8	A	8	2031	10	A	12
Dalley St / Whian St	725	23	B	21	600	72	F	22
Stuart St / Whian St	132	2	A	1	120	3	A	1
Jubilee Ave / Fern St	1547	14	B	15	1378	12	A	13
Stuart St / Fern St	891	14	B	2	804	13	A	5

Table 12-3 2032 Option 1 PM peak intersection performance

Intersection	2032 Option 1 PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	848	12	A	11	799	8	A	7
Tincogan St / Gordon St	665	5	A	3	674	19	B	5
Tincogan St / Dalley St	862	59	E	13	825	42	C	15
Tincogan St / Stuart St	644	45	D	13	715	25	B	13
Tincogan St / Station St	645	3	A	3	724	4	A	3
Woolworths carpark / Station Street	1034	4	A	3	1061	4	A	4
Burringbar Street / River Terrace	299	8	A	4	288	18	B	8
Burringbar St / Dalley St	688	48	D	21	529	32	C	15
Burringbar St / Stuart St	309	24	B	15	205	25	B	12
Burringbar St / Station St	1169	34	C	10	978	19	B	10
Argyle St / Station St	1901	9	A	8	1793	8	A	8
Dalley St / Whian St	713	18	B	13	565	27	B	14
Stuart St / Whian St	51	2	A	1	23	3	A	1
Jubilee Ave / Fern St	1493	14	B	11	1272	6	A	7
Stuart St / Fern St	831	9	A	7	677	7	A	2

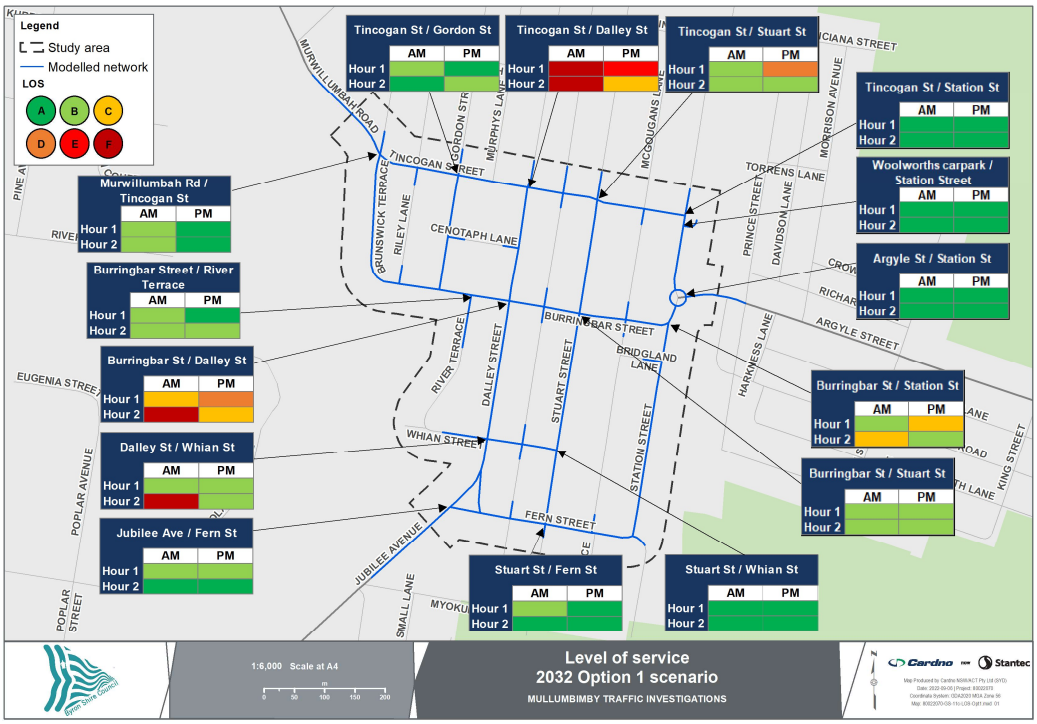


Figure 12-1 2032 Option 1 intersection level of service

12.2.3 Option 1 travel times

Table 12-4 and **Table 12-5** show the 2032 Option 1 travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2032 Do Minimum model. The results indicate:

- Travel times on Tincogan Street eastbound increase by up to 22 seconds in the first hour of the AM peak and perform similarly to the Do Minimum in the PM peak. Increased traffic volumes and the change in priority rules result in vehicles taking more time to turn right into Dalley and Stuart Street, which has a particular impact in the AM peak due to the high amount of traffic travelling in the opposing direction.
- Tincogan Street westbound travel times remain similar between the Do Minimum and Option 1 models.
- Travel times on Dalley Street northbound increase by up to 99 seconds in the AM peak. This is due to the additional heavy vehicles using Dalley Street as part of Option 1, adding to the delays at Tincogan Street / Dalley Street intersection modelled in the Do Minimum model. Dalley Street southbound shows an increase of up to 32 seconds during the AM peak.
- Travel times on Burringbar Street increase in both hours of the AM peak in both directions. The PM peak shows improvement in the eastbound direction and longer travel times in the westbound direction. The congestion on Dalley Street offsets the reduced travel times caused by the rerouting of vehicles between Jubilee Avenue and Argyle Street reduces travel times along the route during the AM peak; however, these benefits are still observed in the PM peak for eastbound vehicles due to the lower congestion levels through the town centre.
- Travel times on Station Street are improved during the AM peak as heavy vehicles are assigned to Burringbar Street instead, unlike in the Do Minimum scenario where they reroute to Station Street. Northbound travel times in the PM peak increase in the first hour as vehicles are required to give way to the additional heavy vehicles on Burringbar Street.
- The heavy vehicle route performance is worst on routes that include Dalley Street. This includes heavy vehicle trips between Argyle Street and Murwillumbah Road, as well as northbound from Jubilee Avenue

to Argyle Street in the AM peak. Southbound trips to Jubilee Avenue operate satisfactorily in both peak periods.

Table 12-4 2032 Option 1 AM peak travel times and average speeds

Route	Dir.	2032 Option 1 AM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 1 AM peak Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	02:01	01:52	+00:05	+00:22	22	24
	WB	01:16	01:26	+00:00	-00:05	35	31
Dalley Street	NB	02:21	04:12	+00:28	+01:39	13	7
	SB	01:31	01:48	+00:12	+00:32	21	17
Burringbar Street	EB	02:49	03:14	+00:21	+00:17	18	15
	WB	02:01	02:54	+00:00	+00:32	24	17
Station Street	NB	02:20	02:50	-00:15	-00:34	21	17
	SB	01:35	01:33	-00:05	-00:01	32	32
HV Option 1 - Argyle St to Murwillumbah Rd	WB	03:29	07:13	-	-	22	10
HV Option 1 - Murwillumbah Rd to Argyle St	EB	03:48	05:35	-	-	20	14
HV Option 1 - Jubilee Ave to Murwillumbah Rd	NB	04:00	05:54	-	-	25	17
HV Option 1 - Jubilee Ave to Argyle St	NB	03:45	03:51	-	-	25	25
HV Option 1 - Argyle St to Jubilee Ave	SB	03:11	03:27	-	-	29	27
HV Option 1 - Murwillumbah Rd to Jubilee Ave	SB	03:32	04:01	-	-	29	25

Table 12-5 2032 Option 1 PM peak travel times and average speeds

Route	Dir.	2032 Option 1 PM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 1 PM peak Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:46	01:29	-00:10	+00:01	25	30
	WB	01:11	01:19	+00:00	-00:02	38	34
Dalley Street	NB	01:54	01:47	+00:02	-00:03	16	17
	SB	01:42	01:29	-00:13	+00:04	18	21
Burringbar Street	EB	02:38	02:34	-00:31	-00:19	19	19
	WB	02:21	02:43	+00:02	+00:31	21	18
Station Street	NB	04:19	02:22	+00:31	+00:00	11	21
	SB	02:00	01:39	+00:02	+00:00	25	30
HV Option 1 - Argyle St to Murwillumbah Rd	WB	03:08	03:36	-	-	24	21
HV Option 1 - Murwillumbah Rd to Argyle St	EB	03:06	03:11	-	-	25	24
HV Option 1 - Jubilee Ave to Murwillumbah Rd	NB	03:36	03:22	-	-	28	30
HV Option 1 - Jubilee Ave to Argyle St	NB	03:22	03:18	-	-	28	29
HV Option 1 - Argyle St to Jubilee Ave	SB	03:20	03:05	-	-	28	30
HV Option 1 - Murwillumbah Rd to Jubilee Ave	SB	03:25	03:14	-	-	30	31

12.3 Option 2

As discussed in **Section 5.2**, the Option 2 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario. Heavy vehicles are restricted to the Option 2 heavy vehicle route, which includes Station Street, Fern Street and Tincogan Street.

12.3.1 Option 2 network performance

Table 12-6 summarises the Option 2 network performance for all peak periods. Compared to the 2032 Do Minimum model, the results indicate that:

- The traffic demand is the same as the Do Minimum scenario
- VHT rises around 17% in the AM peak and 6% in the PM peak while VKT is almost unchanged, indicating an increase in congestion when compared with the Do Minimum scenario. This is caused by assigning all heavy vehicles to a single, longer travel route instead of allowing them to decide the best route by themselves, leading to additional congestion in the network.
- Additional heavy vehicles on Tincogan Street as part of Option 2 reduce the available gaps for traffic to leave Dalley Street and Stuart Street to enter Tincogan Street. Northbound heavy vehicles on Station Street south of Burringbar Street add to the modelled congestion present in the 2032 Do Minimum model, leading to increase VHT and travel times.
- The total number of stops increase by 15.9% in the AM peak and 4.7% in the PM peak, while average speeds decrease by 14.2% in the AM peak and 5.6% in the PM peak.
- There are no unreleased vehicles in both peaks of the Option 2 scenario, indicating that the network is servicing all traffic demand.

Table 12-6 2032 Option 2 network performance

Network performance metric		2032 Option 2		Compared to 2032 Do Minimum	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7602	6322	22 (+0.3%)	19 (+0.3%)
Vehicle hours travelled	hr	328	244	47 (+16.9%)	14 (+6.3%)
Total number of stops	stop	17320	12966	2381 (+15.9%)	577 (+4.7%)
Averages per vehicle					
Average travel time in network	sec	165	137	24 (+16.9%)	8 (+6.3%)
Average number of stops	stop	2.4	2.0	0.3 (+15.9%)	0.1 (+4.6%)
Average speed	km/h	23	26	-4 (-14.2%)	-2 (-5.6%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

12.3.2 Option 2 intersection performance

Table 12-7 and **Table 12-8** show the Option 2 intersection performance results for the AM peak and PM peak, respectively. **Figure 12-2** shows the Option 2 intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates at LoS F in both hours of the AM peak, and operates at LoS F in the first hour of the PM peak
  - Vehicles on the Dalley Street south approach give way to vehicles on the Tincogan Street east and west approaches, resulting in long queues and delays.
- Tincogan Street / Stuart Street operates at LOS D during the first hour of the PM peak.
  - Vehicles at the west approach of Tincogan Street / Stuart Street experience difficulty finding a gap in traffic to turn right onto Stuart Street, leading to delays at this approach.
- Burringbar St / Dalley St operates at LoS F during the second hour of the AM peak and LOS D in the first hour of the PM peak
  - Movements on the northern approach to the intersection are frequently blocked by queues along Dalley Street southbound and Burringbar Street eastbound exits of the intersection.
- Dalley Street / Whian Street operates at LOS D during the second hour of the AM peak
  - A small number of vehicles turning right into River Terrace from the north approach of Dalley Street experience difficulty finding a gap in northbound traffic, leading to an LOS F.
- All other intersections operate at LOS C or better in all modelled time periods.

Table 12-7 2032 Option 2 AM peak intersection performance

Intersection	2032 Option 2 AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1478	15	B	6	1443	22	B	13
Tincogan St / Gordon St	1347	36	C	21	1321	15	B	13
Tincogan St / Dalley St	1367	156	F	27	1375	266	F	25
Tincogan St / Stuart St	861	29	C	11	871	24	B	26
Tincogan St / Station St	876	3	A	10	984	4	A	5
Woolworths carpark / Station Street	1009	3	A	3	1153	5	A	4
Burringbar Street / River Terrace	252	14	A	3	237	23	B	5
Burringbar St / Dalley St	736	41	C	28	571	105	F	33
Burringbar St / Stuart St	196	20	B	8	194	22	B	9
Burringbar St / Station St	1141	21	B	14	1167	31	C	10
Argyle St / Station St	2014	9	A	14	2058	11	A	13
Dalley St / Whian St	667	24	B	15	533	47	D	13
Stuart St / Whian St	124	3	A	1	119	3	A	1
Jubilee Ave / Fern St	1556	15	B	22	1373	10	A	7
Stuart St / Fern St	954	13	A	14	859	16	B	8

Table 12-8 2032 Option 2 PM peak intersection performance

Intersection	2032 Option 2 PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	846	12	A	13	802	9	A	7
Tincogan St / Gordon St	663	23	B	2	684	16	B	5
Tincogan St / Dalley St	856	77	F	15	833	39	C	16
Tincogan St / Stuart St	683	54	D	11	738	26	B	13
Tincogan St / Station St	681	3	A	3	745	5	A	9
Woolworths carpark / Station Street	1068	4	A	4	1080	4	A	4
Burringbar Street / River Terrace	299	7	A	4	282	18	B	8
Burringbar St / Dalley St	622	45	D	20	503	25	B	17
Burringbar St / Stuart St	267	23	B	15	178	23	B	9
Burringbar St / Station St	1155	37	C	13	977	20	B	10
Argyle St / Station St	1906	9	A	9	1805	9	A	6
Dalley St / Whian St	668	19	B	12	553	26	B	14
Stuart St / Whian St	50	3	A	1	20	2	A	0
Jubilee Ave / Fern St	1492	14	A	13	1274	6	A	7
Stuart St / Fern St	876	13	A	2	689	7	A	4

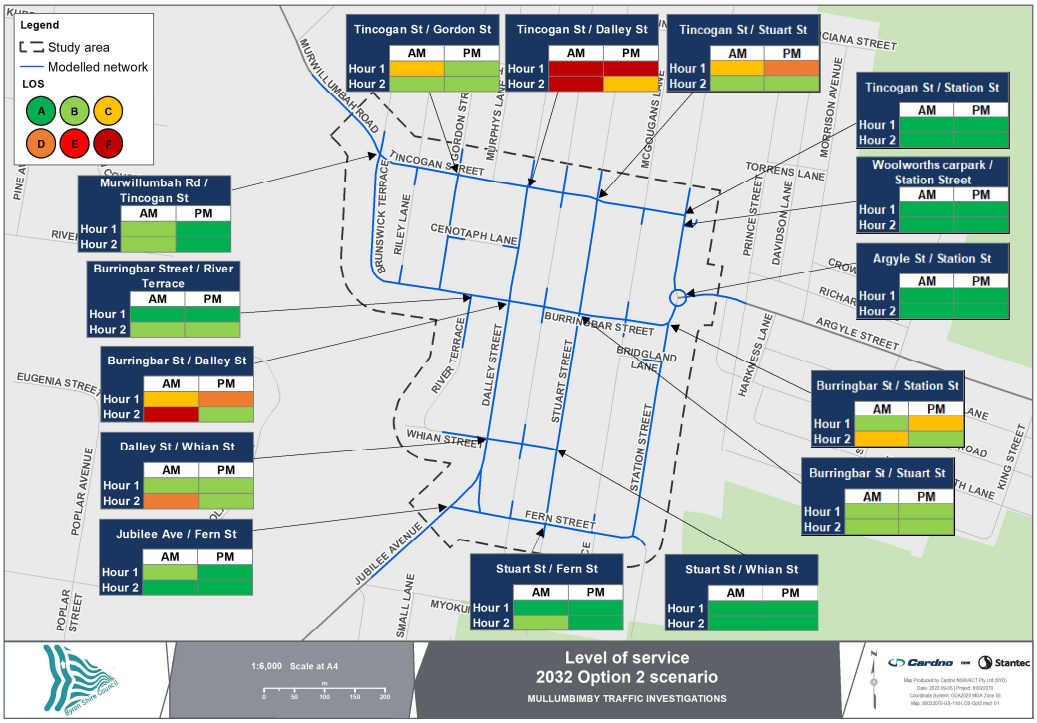


Figure 12-2 2032 Option 2 intersection level of service

12.3.3 Option 2 travel times

Table 12-9 and **Table 12-10** show the 2032 Option 2 travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2032 Do Minimum model. The results indicate:

- Travel times on Tincogan Street eastbound increase by up to 18 seconds in the first hour of the AM peak and perform similarly to the Do Minimum in the PM peak. Increased traffic volumes and the change in priority rules result in vehicles taking more time to turn right into Dalley and Stuart Street, which has a particular impact in the AM peak due to the high amount of traffic travelling in the opposing direction.
- Tincogan Street westbound travel times remain similar between the Do Minimum and Option 2 models.
- Travel times on Dalley Street northbound increase by up to 123 seconds in the AM peak. This is due to the additional heavy vehicles using Dalley Street as part of Option 2, adding to the delays at Tincogan Street / Dalley Street intersection modelled in the Do Minimum model. Dalley Street southbound shows an increase of up to 18 seconds during the AM peak.
- Travel times on Burringbar Street eastbound remain similar between the Option 2 and Do Minimum model, as the assigned heavy vehicle route does not interact with Burringbar Street. However, delays at the Tincogan Street intersections with Stuart Street and Dalley Street due to additional heavy vehicles on Tincogan Street leads to delays that impact westbound vehicles on Burringbar Street attempting to turn right. This leads to lengthened travel times in both peaks by up to 47 seconds.
- Travel times on Station Street are increased in both directions and in all hours due to the additional vehicles assigned to this route in Option 2.
- The heavy vehicle route performance is worst on routes that include Station Street south of Burringbar Street. This includes heavy vehicle trips from Jubilee Avenue to Argyle Street and Murwillumbah Road and is caused by the congestion at Station Street modelled in the Do Minimum being worsened with the extra heavy vehicle traffic.

Table 12-9 2032 Option 2 AM peak travel times and average speeds

Route	Dir.	2032 Option 2 AM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 2 AM peak Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	02:15	01:38	+00:18	+00:07	20	27
	WB	01:14	01:39	-00:02	+00:08	36	27
Dalley Street	NB	03:33	04:36	+01:39	+02:03	9	7
	SB	01:30	01:33	+00:10	+00:18	21	20
Burringbar Street	EB	02:23	03:01	-00:05	+00:03	21	16
	WB	02:30	03:09	+00:28	+00:47	19	15
Station Street	NB	02:51	04:43	+00:15	+01:19	17	10
	SB	01:42	01:36	+00:02	+00:02	29	31
HV Option 2 - Argyle St to Murwillumbah Rd	WB	01:57	02:24	-	-	37	30
HV Option 2 - Murwillumbah Rd to Argyle St	EB	02:58	02:27	-	-	24	28
HV Option 2 - Jubilee Ave to Murwillumbah Rd	NB	05:03	06:42	-	-	27	20
HV Option 2 - Jubilee Ave to Argyle St	NB	04:09	06:04	-	-	23	16
HV Option 2 - Argyle St to Jubilee Ave	SB	02:47	02:45	-	-	34	35
HV Option 2 - Murwillumbah Rd to Jubilee Ave	SB	05:24	04:24	-	-	25	31

Table 12-10 2032 Option 2 PM peak travel times and average speeds

Route	Dir.	2032 Option 2 PM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 2 PM peak Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:51	01:29	-00:05	+00:01	24	30
	WB	01:11	01:21	+00:00	-00:01	38	33
Dalley Street	NB	02:06	01:41	+00:14	-00:09	15	18
	SB	01:43	01:27	-00:12	+00:02	18	22
Burringbar Street	EB	02:43	02:33	-00:26	-00:20	18	19
	WB	02:16	02:35	-00:04	+00:23	21	19
Station Street	NB	05:03	02:49	+01:16	+00:25	10	17
	SB	02:08	01:39	+00:10	+00:00	23	30
HV Option 2 - Argyle St to Murwillumbah Rd	WB	01:53	01:59	-	-	38	36
HV Option 2 - Murwillumbah Rd to Argyle St	EB	02:31	02:11	-	-	28	32
HV Option 2 - Jubilee Ave to Murwillumbah Rd	NB	07:42	07:22	-	-	17	18
HV Option 2 - Jubilee Ave to Argyle St	NB	05:56	04:04	-	-	16	24
HV Option 2 - Argyle St to Jubilee Ave	SB	03:10	02:38	-	-	30	36
HV Option 2 - Murwillumbah Rd to Jubilee Ave	SB	04:50	05:38	-	-	28	24

12.4 Option 3

As discussed in **Section 5.2**, the Option 3 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario. Heavy vehicles are restricted to the Option 3 heavy vehicle route, which includes Burringbar Street east of Stuart Street, Stuart Street, Fern Street west of Stuart Street and Tincogan Street west of Stuart Street.

12.4.1 Option 3 network performance

Table 12-11 summarises the Option 3 network performance for all peak periods. Compared to the 2032 Do Minimum model, the results indicate that:

- The traffic demand is the same as the Do Minimum scenario
- VHT rises by 17.4% in the AM peak and 0.5% in the PM peak while VKT is almost unchanged, indicating an increase in congestion when compared with the Do Minimum scenario. This is caused by assigning all heavy vehicles to a single, longer travel route instead of allowing them to decide the best route by themselves, leading to additional congestion in the network.
- Additional heavy vehicles on Tincogan Street as part of Option 3 reduce the available gaps for traffic to leave Dalley Street to enter Tincogan Street. Southbound heavy vehicles on Stuart Street travel through a 30 km/hr zone which leads to an increase in travel time and VHT compared to the Do Minimum scenario.
- The total number of stops increase by 17.6% in the AM peak and 1.9% in the PM peak, while average speeds decrease by 14.5% in the AM peak and 0.3% in the PM peak.
- There are no unreleased vehicles in both peaks of the Option 3 scenario, indicating that the network is servicing all traffic demand.

Table 12-11 2032 Option 3 network performance

Network performance metric		2032 Option 3		Compared to 2032 Do Minimum	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7602	6317	21 (+0.3%)	14 (+0.2%)
Vehicle hours travelled	hr	329	231	49 (+17.4%)	1 (+0.5%)
Total number of stops	stop	17572	12624	2633 (+17.6%)	235 (+1.9%)
Averages per vehicle					
Average travel time in network	sec	165	129	24 (+17.4%)	1 (+0.5%)
Average number of stops	stop	2.5	2.0	0.4 (+17.6%)	0.0 (+1.9%)
Average speed	km/h	23	27	-4 (-14.5%)	0 (-0.3%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

12.4.2 Option 3 intersection performance

Table 12-12 and **Table 12-13** show the Option 3 intersection performance results for the AM peak and PM peak, respectively. **Figure 12-3** shows the Option 3 intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates at LoS F in both hours of the AM peak, and operates at LoS E and D in each respective hour of the PM peak
  - Vehicles on the Dalley Street south approach give way to vehicles on the Tincogan Street east and west approaches, resulting in long queues and delays. These delays are worsened by additional heavy vehicles on Tincogan Street as part of Option 3.
- Tincogan Street / Stuart Street operates at LOS F in the AM peak and LOS D during the first hour of the PM peak.
  - Vehicles at the west approach of Tincogan Street / Stuart Street experience difficulty finding a gap in traffic to turn right onto Stuart Street, leading to delays at this approach. Additional heavy vehicles on Stuart Street as part of Option 3 increase the congestion at this intersection, as heavy vehicles require a larger gap in traffic than light vehicles.
- Burringbar St / Dalley St operates at LoS F and LOS D during each respective hour of the AM peak and LOS D in the first hour of the PM peak
  - Movements on the northern approach to the intersection are frequently blocked by queues along Dalley Street southbound and Burringbar Street eastbound exits of the intersection.
- Murwillumbah Road / Brunswick Terrace / Tincogan Street shows an LOS D during the second hour of the AM peak.
  - Vehicles turning right from Tincogan Street west struggle to find a gap in traffic due to the increased heavy vehicles in the opposing direction on this road in Option 3.
- All other intersections operate at LOS C or better in all modelled time periods.

Table 12-12 2032 Option 3 AM peak intersection performance

Intersection	2032 Option 3 AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1476	25	B	5	1445	43	D	12
Tincogan St / Gordon St	1337	25	B	23	1325	20	B	24
Tincogan St / Dalley St	1350	171	F	28	1394	225	F	22
Tincogan St / Stuart St	850	72	F	23	892	76	F	24
Tincogan St / Station St	819	4	A	10	965	4	A	5
Woolworths carpark / Station Street	953	3	A	3	1141	6	A	4
Burringbar Street / River Terrace	254	12	A	4	234	18	B	5
Burringbar St / Dalley St	724	155	F	30	565	52	D	26
Burringbar St / Stuart St	292	17	B	9	253	25	B	10
Burringbar St / Station St	1156	28	C	10	1180	33	C	10
Argyle St / Station St	1999	9	A	9	2056	10	A	13
Dalley St / Whian St	648	23	B	19	545	25	B	14
Stuart St / Whian St	216	3	A	2	159	3	A	1
Jubilee Ave / Fern St	1547	15	B	16	1380	10	A	8
Stuart St / Fern St	973	29	C	15	857	18	B	4

Table 12-13 2032 Option 3 PM peak intersection performance

Intersection	2032 Option 3 PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	848	12	A	10	799	9	A	8
Tincogan St / Gordon St	668	13	A	2	670	11	A	5
Tincogan St / Dalley St	863	68	E	15	822	42	D	15
Tincogan St / Stuart St	688	47	D	12	736	30	C	13
Tincogan St / Station St	648	3	A	3	723	4	A	5
Woolworths carpark / Station Street	1036	5	A	4	1052	4	A	4
Burringbar Street / River Terrace	298	8	A	4	294	19	B	8
Burringbar St / Dalley St	627	51	D	21	512	24	B	15
Burringbar St / Stuart St	337	23	B	15	216	25	B	11
Burringbar St / Station St	1172	34	C	10	970	18	B	10
Argyle St / Station St	1905	8	A	7	1781	9	A	8
Dalley St / Whian St	664	18	B	13	561	28	C	14
Stuart St / Whian St	92	3	A	1	35	2	A	0
Jubilee Ave / Fern St	1492	14	A	10	1273	7	A	7
Stuart St / Fern St	872	17	B	3	679	7	A	2

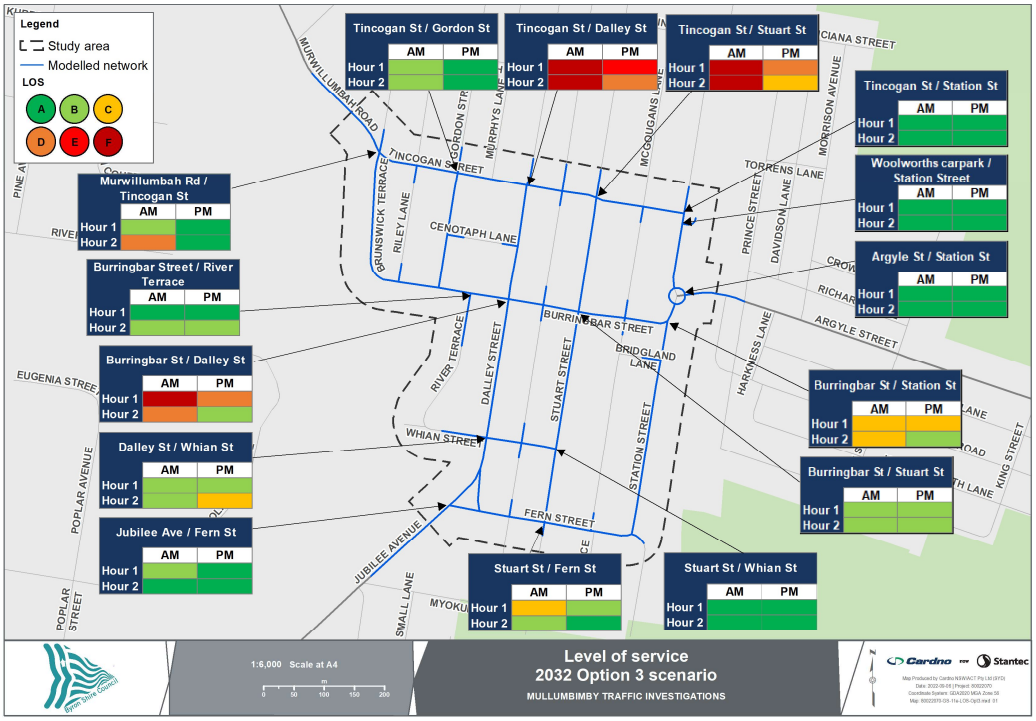


Figure 12-3 2032 Option 3 intersection level of service

12.4.3 Option 3 travel times

Table 12-14 and **Table 12-15** show the 2032 Option 3 travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2032 Do Minimum model. The results indicate:

- Travel times on Tincogan Street eastbound increase by up to one minute in the AM peak and perform similarly to the Do Minimum in the PM peak. Increased heavy vehicle traffic volumes and the change in priority rules result in vehicles taking more time to turn right into Dalley and Stuart Street, which has a particular impact in the AM peak due to the high amount of traffic travelling in the opposing direction.
- Tincogan Street westbound travel times remain similar between the Do Minimum and Option 3 models.
- Travel times on Dalley Street northbound increase by up to 136 seconds in the AM peak. This is due to the additional heavy vehicles using Tincogan Street as part of Option 3, reducing the available gap for vehicles on Stuart Street to turn onto Tincogan Street when compared to the Do Minimum model.
- Travel times on Burringbar Street eastbound improve in the PM peak under the Option 3 and Do Minimum model, as the assigned heavy vehicle route removes traffic from with Burringbar Street. However, delays at the Tincogan Street intersection with Stuart Street and Dalley Street due to additional heavy vehicles leads to delays that impact westbound vehicles on Burringbar Street attempting to turn right. This leads to lengthened travel times in both peaks by up to 71 seconds.
- Travel times on Station Street are increased in the second hour of the AM peak by up to 22 seconds due to downstream delays on Burringbar Street westbound. Travel times remain similar to the Do Minimum during the other modelled peak hours.
- The heavy vehicle route performance is worst on routes that include Tincogan Street due to delays associated with movements to Stuart Street and in the reverse direction. This includes heavy vehicle trips between Murwillumbah Road and Argyle Street as well as Jubilee Avenue.

Table 12-14 2032 Option 3 AM peak travel times and average speeds

Route	Dir.	2032 Option 3 AM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 3 AM peak Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	02:31	02:31	+00:35	+01:00	18	18
	WB	01:23	01:38	+00:07	+00:07	32	27
Dalley Street	NB	04:10	03:28	+02:16	+00:55	7	9
	SB	01:47	01:43	+00:27	+00:27	18	18
Burringbar Street	EB	02:31	02:58	+00:03	+00:01	20	17
	WB	03:14	02:30	+01:11	+00:08	15	19
Station Street	NB	02:28	03:47	-00:08	+00:22	20	13
	SB	01:35	01:32	-00:06	-00:02	32	33
HV Option 3 - Argyle St to Murwillumbah Rd	WB	02:40	03:52	-	-	28	20
HV Option 3 - Murwillumbah Rd to Argyle St	EB	04:14	04:34	-	-	18	17
HV Option 3 - Jubilee Ave to Murwillumbah Rd	NB	03:29	05:34	-	-	33	21
HV Option 3 - Jubilee Ave to Argyle St	NB	03:43	03:19	-	-	26	29
HV Option 3 - Argyle St to Jubilee Ave	SB	03:21	03:25	-	-	28	28
HV Option 3 - Murwillumbah Rd to Jubilee Ave	SB	05:20	04:34	-	-	22	26

Table 12-15 2032 Option 3 PM peak travel times and average speeds

Route	Dir.	2032 Option 3 PM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 3 PM peak Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:53	01:30	-00:03	+00:02	24	30
	WB	01:11	01:22	+00:00	+00:00	38	33
Dalley Street	NB	02:01	01:46	+00:09	-00:04	15	18
	SB	01:48	01:28	-00:07	+00:02	17	21
Burringbar Street	EB	02:36	02:29	-00:32	-00:24	19	20
	WB	02:18	02:37	-00:02	+00:25	21	19
Station Street	NB	03:55	02:20	+00:07	-00:04	13	21
	SB	02:00	01:39	+00:02	-00:00	25	30
HV Option 3 - Argyle St to Murwillumbah Rd	WB	02:26	03:25	-	-	31	22
HV Option 3 - Murwillumbah Rd to Argyle St	EB	04:18	03:01	-	-	18	25
HV Option 3 - Jubilee Ave to Murwillumbah Rd	NB	03:28	03:11	-	-	34	36
HV Option 3 - Jubilee Ave to Argyle St	NB	03:23	02:59	-	-	28	32
HV Option 3 - Argyle St to Jubilee Ave	SB	03:28	03:06	-	-	27	31
HV Option 3 - Murwillumbah Rd to Jubilee Ave	SB	04:02	05:33	-	-	29	21

12.5 Option 4

As discussed in **Section 5.2**, the Option 4 scenario includes the same infrastructure upgrades and future-year demands as the Do Minimum scenario. Heavy vehicles are restricted to the Option 4 heavy vehicle route, which includes Burringbar Street and Dalley Street.

12.5.1 Option 4 network performance

Table 12-16 summarises the Option 4 network performance for all peak periods. Compared to the 2032 Do Minimum model, the results indicate that:

- The traffic demand is the same as the Do Minimum scenario
- VHT and VKT remain almost unchanged compared to the Do Minimum model, with VHT rises of 1% in the AM peak and 0.2% in the PM peak. This indicates that assigning heavy vehicles to Burringbar Street and Dalley Street south of Burringbar Street introduces minimal congestion when compared to the Do Minimum scenario.
- The total number of stops remains similar to the Do Minimum model, with increases of 1.5% in the AM peak and 1% in the PM peak.
- The average travel speed is nearly identical to the Do Minimum model, with decreases of 1% in the AM peak and 0.1% in the PM peak.
- There are no unreleased vehicles in both peaks of the Option 4 scenario, indicating that the network is servicing all traffic demand.

Table 12-16 2032 Option 4 network performance

Network performance metric		2032 Option 4		Compared to 2032 Do Minimum	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7584	6310	4 (+0%)	7 (+0.1%)
Vehicle hours travelled	hr	283	230	3 (+1%)	1 (+0.2%)
Total number of stops	stop	15161	12515	222 (+1.5%)	126 (+1%)
Averages per vehicle					
Average travel time in network	sec	142	129	1 (+1%)	0 (+0.3%)
Average number of stops	stop	2.1	1.9	0.0 (+1.5%)	0.0 (+1%)
Average speed	km/h	27	27	0 (-1%)	0 (-0.1%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

12.5.2 Option 4 intersection performance

Table 12-17 and **Table 12-18** show the Option 4 intersection performance results for the AM peak and PM peak, respectively. **Figure 12-4** shows the Option 4 intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates at LoS F in both hours of the AM peak, and operates at LoS E and D in each respective hour of the PM peak
  - Vehicles on the Dalley Street south approach give way to vehicles on the Tincogan Street east and west approaches, resulting in long queues and delays.
- Tincogan Street / Stuart Street operates at LOS D in the first hour of the PM peak.
  - Vehicles at the west approach of Tincogan Street / Stuart Street experience difficulty finding a gap in traffic to turn right onto Stuart Street, leading to delays at this approach.
- Burringbar St / Dalley St operates at LOS D during the first hour of the PM peak.
  - Movements on the northern approach to the intersection are frequently blocked by queues along Dalley Street southbound and Burringbar Street eastbound exits of the intersection. Additional heavy vehicle routes heading east and west through the intersection add to the delays.
- Dalley Street / Whian Street operates at LOS D during the second hour of the AM peak
  - A small number of vehicles turning right into River Terrace from the north approach of Dalley Street experience difficulty finding a gap in northbound traffic, leading to an LOS F.
- All other intersections operate at LOS C or better in all modelled time periods.

Table 12-17 2032 Option 4 AM peak intersection performance

Intersection	2032 Option 4 AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1507	15	B	8	1415	21	B	12
Tincogan St / Gordon St	1322	27	B	15	1275	18	B	9
Tincogan St / Dalley St	1355	113	F	24	1324	117	F	20
Tincogan St / Stuart St	827	27	B	11	850	19	B	13
Tincogan St / Station St	838	4	A	16	955	4	A	6
Woolworths carpark / Station Street	968	4	A	3	1119	4	A	3
Burringbar Street / River Terrace	299	18	B	4	255	26	B	6
Burringbar St / Dalley St	847	34	C	26	607	26	B	15
Burringbar St / Stuart St	265	20	B	9	243	19	B	9
Burringbar St / Station St	1152	24	B	10	1166	32	C	10
Argyle St / Station St	2010	9	A	11	2024	9	A	13
Dalley St / Whian St	746	18	B	17	574	44	D	12
Stuart St / Whian St	132	2	A	1	120	3	A	1
Jubilee Ave / Fern St	1557	16	B	12	1365	9	A	7
Stuart St / Fern St	888	8	A	6	812	11	A	5

Table 12-18 2032 Option 4 PM peak intersection performance

Intersection	2032 Option 4 PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	848	12	A	12	799	8	A	7
Tincogan St / Gordon St	628	5	A	2	673	10	A	1
Tincogan St / Dalley St	826	48	D	13	817	39	C	15
Tincogan St / Stuart St	650	45	D	12	710	23	B	13
Tincogan St / Station St	649	3	A	4	721	3	A	3
Woolworths carpark / Station Street	1039	4	A	3	1058	4	A	4
Burringbar Street / River Terrace	334	9	A	4	289	20	B	7
Burringbar St / Dalley St	682	49	D	20	533	25	B	15
Burringbar St / Stuart St	312	25	B	15	212	25	B	12
Burringbar St / Station St	1173	33	C	10	975	19	B	10
Argyle St / Station St	1909	8	A	8	1789	9	A	8
Dalley St / Whian St	709	20	B	17	570	26	B	14
Stuart St / Whian St	55	3	A	1	23	2	A	0
Jubilee Ave / Fern St	1493	14	B	11	1273	7	A	7
Stuart St / Fern St	835	9	A	7	674	6	A	2

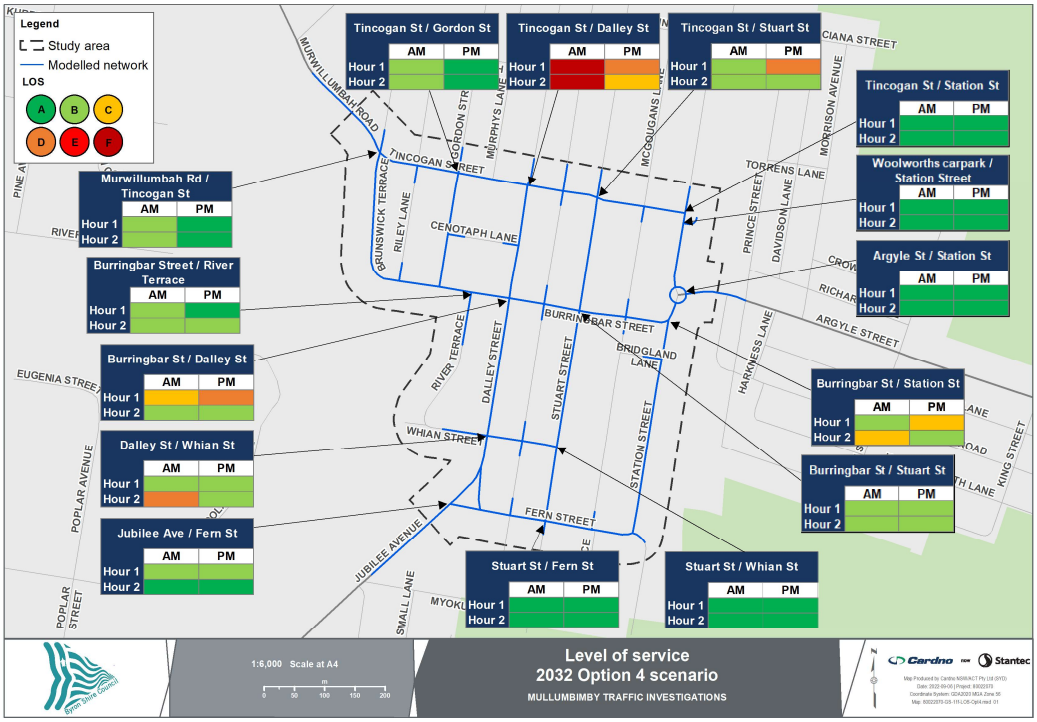


Figure 12-4 2032 Option 4 intersection level of service

12.5.3 Option 4 travel times

Table 12-19 and **Table 12-20** show the 2032 Option 4 travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2032 Do Minimum model. The results indicate:

- Travel times on Tincogan Street remain similar in Option 4 and the Do Minimum models, with the greatest change of a 14-second improvement modelled in the eastbound direction during first hour of the PM peak. The improvement in Tincogan Street travel times is due to the removal of heavy vehicles along this route, as in Option 4 heavy vehicles are assigned to Burringbar Street instead.
- Travel times on Dalley Street northbound increase by up to 33 seconds in the AM peak. This is due to the additional heavy vehicles using Burringbar Street as part of Option 4, reducing the available gap for vehicles on Dalley Street to turn onto Burringbar Street when compared to the Do Minimum model.
- Travel times on Burringbar Street increase in the AM peak due to the additional heavy vehicles on this route as part of Option 4. The PM peak shows improvement in the eastbound direction due to reduced congestion on Stuart Street and Dalley Street, allowing vehicles to depart from Burringbar Street with lower waiting times and improving the overall performance.
- Travel times on Station Street are increased in the second hour of the PM peak by up to 25 seconds due to the additional traffic using Burringbar Street under Option 4, requiring northbound vehicles on Station Street to give way. Travel times remain similar to the Do Minimum in the southbound direction.
- The heavy vehicle route performance is worst on routes that include the Burringbar Street / Tincogan Street intersection due to delays associated with the right-turn movements. This includes heavy vehicle trips between Murwillumbah Road and Argyle Street.

Table 12-19 2032 Option 4 AM peak travel times and average speeds

Route	Dir.	2032 Option 4 AM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 4 AM peak Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	01:53	01:36	-00:03	+00:06	24	28
	WB	01:15	01:25	-00:01	-00:05	36	31
Dalley Street	NB	02:27	02:36	+00:33	+00:03	13	12
	SB	01:22	01:14	+00:02	-00:01	23	25
Burringbar Street	EB	02:57	03:12	+00:29	+00:14	17	15
	WB	02:16	02:39	+00:13	+00:17	21	18
Station Street	NB	02:31	03:19	-00:04	-00:06	19	15
	SB	01:36	01:30	-00:05	-00:03	31	33
HV Option 4 - Argyle St to Murwillumbah Rd	WB	03:08	03:18	-	-	24	23
HV Option 4 - Murwillumbah Rd to Argyle St	EB	04:01	04:12	-	-	19	18
HV Option 4 - Jubilee Ave to Murwillumbah Rd	NB	02:55	03:11	-	-	34	31
HV Option 4 - Jubilee Ave to Argyle St	NB	03:45	03:36	-	-	25	26
HV Option 4 - Argyle St to Jubilee Ave	SB	03:07	03:17	-	-	30	28
HV Option 4 - Murwillumbah Rd to Jubilee Ave	SB	03:43	03:55	-	-	27	26

Table 12-20 2032 Option 4 PM peak travel times and average speeds

Route	Dir.	2032 Option 4 PM peak Travel time (mm:ss)		Compared to the 2032 Do Minimum Travel time (mm:ss)		2032 Option 4 PM peak Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:42	01:26	-00:14	-00:02	26	31
	WB	01:11	01:19	-00:00	-00:02	38	34
Dalley Street	NB	01:43	01:45	-00:09	-00:05	18	18
	SB	01:48	01:26	-00:07	+00:01	17	22
Burringbar Street	EB	02:26	02:45	-00:42	-00:08	20	18
	WB	02:12	02:36	-00:08	+00:25	22	19
Station Street	NB	04:12	02:18	+00:25	-00:05	12	21
	SB	02:01	01:38	+00:03	-00:01	25	31
HV Option 4 - Argyle St to Murwillumbah Rd	WB	02:28	02:58	-	-	30	25
HV Option 4 - Murwillumbah Rd to Argyle St	EB	03:15	03:18	-	-	23	23
HV Option 4 - Jubilee Ave to Murwillumbah Rd	NB	02:57	03:16	-	-	34	30
HV Option 4 - Jubilee Ave to Argyle St	NB	03:17	03:20	-	-	29	28
HV Option 4 - Argyle St to Jubilee Ave	SB	03:20	03:05	-	-	28	30
HV Option 4 - Murwillumbah Rd to Jubilee Ave	SB	03:38	03:09	-	-	28	32

12.6 Preferred Option

12.6.1 Options impacts

Table 12-21 summarises the impacts of the four heavy vehicle Options in terms of traffic performance, safety and the Masterplan action items. The results informing these outcomes have been previously presented in **Sections 12**, **6** and **7** of this report respectively.`

Table 12-21 Options outcome comparison

Criteria	Assessment findings
Traffic performance	***Intersection performance*** ▪ Intersection performance shows the highest delays in the town centre under Options 1 and 3, with three intersections operating at LOS F during the AM peak. Options 2 and 4 provide lower impacts across both peak periods compared to Options 1 and 3. ***General traffic travel times*** ▪ Travel times for general traffic on Tincogan Street and Dalley Street are lowest under Option 4. ▪ Options 2 and 4 provide lower travel times for general traffic on Burringbar Street, with the exception of westbound in the AM peak. ▪ Northbound travel times for general traffic on Station Street are highest with Option 2. Southbound travel times remain similar across Options ***Heavy vehicle travel times*** ▪ Option 2 provides the lowest travel times between Murwillumbah Road and Argyle Street. ▪ Option 2 provides the quickest travel time for heavy vehicles heading southbound from Argyle Street to Jubilee Avenue. However, congestion on Station Street northbound results in Option 2 providing longer travel times for northbound heavy vehicles. ▪ Option 3 provides the lowest travel times for heavy vehicles heading northbound from Jubilee Avenue to Argyle Street. ▪ Heavy vehicles travelling between Jubilee Avenue and Murwillumbah Street showed the lowest travel times under Option 4, as this route avoids the town centre and low speeds in Options 1 and 3 as well as the longer route in Option 2.
Safety and design	▪ Option 2 provided the safest results, due to this route containing no interaction with the high pedestrian and cyclist activity areas of Burringbar Street and Stuart Street. ▪ Option 3 ranked second in the safe system assessment, as it includes the second-lowest interaction with the town centre. ▪ While Option 4 provided unsatisfactory results overall, the route between Murwillumbah Road and Jubilee Avenue avoids Burringbar Street and Stuart Street leading to a safer route for this movement.
Implications on the Masterplan	***Action item 2*** ▪ Options 1 and 4 will have the least impact to the Masterplan action item 2 relating to Station Street and Fern Street, as these roads are not included in the routes. ▪ Options 2 and 3 both include impacts to action item 2, at Fern Street / Station Street and Fern Street / Stuart Street respectively. Swept paths indicate that heavy vehicles may have difficulty turning through these intersections with the current proposed designs ***Action item 3*** ▪ Options 2 and 3 will include vehicles travelling through the new pedestrian crossing and reduced speed area on Tincogan Street. ▪ Options 1 and 4 have minimal impacts for action item 3, as Option 1 avoids the pedestrian area and Option 4 avoids Tincogan Street up to the intersection with Murwillumbah Road. ***Action item 6*** ▪ Option 2 will have the least impact on action item 6 as this route does not include Burringbar Street or Stuart Street. ▪ Options 1, 3 and 4 negatively impact the rationale behind action item 6 as these routes include heavy vehicles travelling along Burringbar Street.

12.6.2 Preferred Option

As shown previously in **Table 12-21**, all four of the proposed heavy vehicle route Options have advantages and disadvantages depending on the assessment criteria. Cardno has developed the Preferred Option in consultation with Council using a combination of the strengths of two different options to provide the best possible outcome for all road users.

The recommended Preferred Option is shown in **Figure 12-5** and is comprised of the following routes:

- Option 2 for heavy vehicles travelling between Argyle Street and Murwillumbah Road
- Option 2 for heavy vehicles travelling between Argyle Street and Jubilee Avenue
- Option 4 for heavy vehicles travelling between Murwillumbah Road and Jubilee Avenue.

Figure 12-5 Preferred Option heavy vehicle route

Using the Preferred Option layout, the following benefits will be observed:

- Fastest travel time routes for heavy vehicles travelling between Argyle Street and Murwillumbah Road, Jubilee Avenue and Murwillumbah Road and Argyle Street to Jubilee Avenue southbound
- Improved travel times for general traffic on Tincogan Street and Burringbar Street
- Improved intersection performance results when compared to the outcomes in Options 1 and 3.
- Optimal safety results as no heavy vehicles will need to travel through the town centre on Stuart Street, Dalley Street or Burringbar Street, which supports the Our Mullumbimby Masterplan action item 6

The impacts associated with the Preferred Option include the following:

- Slower travel times for vehicles heading northbound on Station Street due to the additional heavy vehicles on this route.
  - This impact allows for the safest heavy vehicle route option which avoids the high pedestrian activity areas. Travel times for general traffic on Burringbar Street and Stuart Street are also improved when heavy vehicles are assigned to Station Street.

- Heavy vehicles using Station Street will require further investigation to accommodate for B-doubles to safely turn through the intersection with Fern Street and at Tincogan Street. The Safe System Assessment also identified the intersection of Tincogan Street / Murwillumbah Road as requiring intervention to allow heavy vehicles to turn right through the intersection, which would be required as part of the Preferred Option
  - Alternative routes would require further investigation into a combination of intersections within the town centre at Burringbar Street / Dalley Street, Burringbar Street / Stuart Street, Tincogan Street / Dalley Street and Tincogan Street / Stuart Street. Intersection upgrades to allow for heavy vehicle movements at these locations may detract from the character of the town centre and create an appearance of 'movement' being the priority over 'place'.
- Heavy vehicles travelling along Tincogan Street will pass through the reduced speed area and new pedestrian crossing between Stuart Street and Dalley Street, reducing pedestrian safety at this location.
  - The alternative heavy vehicle routes would involve sending vehicles through Burringbar Street, Dalley Street and Stuart Street – streets which comprise the heart of the town centre and have a greater pedestrian priority than on Tincogan Street.

12.6.3 Preferred Option network performance

Table 12-22 summarises the Preferred Option network performance for all peak periods. Compared to the 2032 Do Minimum model, the results indicate that:

- The traffic demand is the same as the Do Minimum scenario
- VHT and VKT remain almost unchanged compared to the Do Minimum model, with VHT reductions of 0.2% in the AM peak and 0.1% in the PM peak.
- The VHT reduces in both peak periods by 5.4% and 1.4% in the AM and PM peaks respectively. This indicates that assigning heavy vehicles to the outside of the town centre helps to reduce congestion for general traffic, particularly on Burringbar Street, Dalley Street and Stuart Street.
- The total number of stops reduces in comparison to the Do Minimum model, with decreases of 8.4% in the AM peak and 4.2% in the PM peak. This is reflective of the reduction in congestion and VHT after assigning heavy vehicles to the boundary of the town centre.
- The average travel speed improves compared to the Do Minimum model, with increases of 5.4% in the AM peak and 1.3% in the PM peak.
- There are no unreleased vehicles in both peaks of the Preferred Option scenario, indicating that the network is servicing all traffic demand.

Table 12-22 2032 Preferred Option network performance

Network performance metric		2032 Preferred Option		Compared to 2032 Do Minimum	
		AM peak	PM peak	AM peak	PM peak
All vehicles					
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7561	6299	-19 (-0.2%)	-3 (-0.1%)
Vehicle hours travelled	hr	265	227	-15 (-5.4%)	-3 (-1.4%)
Total number of stops	stop	13685	11863	-1254 (-8.4%)	-526 (-4.2%)
Averages per vehicle					
Average travel time in network	sec	133	127	-8 (-5.5%)	-2 (-1.3%)
Average number of stops	stop	1.9	1.8	-0.2 (-8.5%)	-0.1 (-4.2%)
Average speed	km/h	29	28	1 (+5.4%)	0 (+1.3%)
Unreleased demand					
Unreleased vehicles	veh	0	0	0	0
Proportion of demand unreleased	%	0.00%	0.00%		

12.6.4 Preferred Option intersection performance

Table 12-23 and **Table 12-24** show the Preferred Option intersection performance results for the AM peak and PM peak, respectively. **Figure 12-6** shows the Preferred Option intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- Tincogan Street / Dalley Street operates at LoS E in both hours of the AM peak, and operates at LoS F and D in each respective hour of the PM peak
  - Vehicles on the Dalley Street south approach give way to vehicles on the Tincogan Street east and west approaches, resulting in long queues and delays.
- Tincogan Street / Stuart Street operates at LOS D in the first hour of the PM peak.
  - Vehicles at the west approach of Tincogan Street / Stuart Street experience difficulty finding a gap in traffic to turn right onto Stuart Street, leading to delays at this approach.
- Burringbar St / Dalley St operates at LOS F during the first hour of the PM peak.
  - Movements on the northern approach to the intersection are frequently blocked by queues along Dalley Street southbound and Burringbar Street eastbound exits of the intersection.
- All other intersections operate at LOS C or better in all modelled time periods.

Table 12-23 2032 Preferred Option AM peak intersection performance

Intersection	2032 Preferred Option AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1511	19	B	17	1409	17	B	20
Tincogan St / Gordon St	956	5	A	8	962	6	A	1
Tincogan St / Dalley St	1051	69	E	8	1060	65	E	10
Tincogan St / Stuart St	842	34	C	10	876	16	B	9
Tincogan St / Station St	861	3	A	5	986	4	A	5
Woolworths carpark / Station Street	970	4	A	3	1123	5	A	4
Burringbar Street / River Terrace	668	27	B	7	536	36	C	7
Burringbar St / Dalley St	824	30	C	10	600	20	B	9
Burringbar St / Stuart St	171	15	B	8	187	19	B	10
Burringbar St / Station St	1129	19	B	10	1104	28	C	10
Argyle St / Station St	1998	9	A	14	1987	9	A	11
Dalley St / Whian St	723	18	B	17	567	18	B	9
Stuart St / Whian St	104	2	A	1	138	2	A	2
Jubilee Ave / Fern St	1569	16	B	23	1352	9	A	10
Stuart St / Fern St	902	13	A	3	841	11	A	4

Table 12-24 2032 Preferred Option PM peak intersection performance

Intersection	2032 Preferred Option PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	845	11	A	13	802	11	A	15
Tincogan St / Gordon St	522	4	A	2	546	7	A	1
Tincogan St / Dalley St	851	131	F	17	741	54	D	10
Tincogan St / Stuart St	776	50	D	10	734	28	C	11
Tincogan St / Station St	697	4	A	5	731	3	A	4
Woolworths carpark / Station Street	971	4	A	3	1032	4	A	3
Burringbar Street / River Terrace	437	29	C	6	417	17	B	6
Burringbar St / Dalley St	698	72	F	13	533	27	B	11
Burringbar St / Stuart St	178	29	C	14	138	24	B	9
Burringbar St / Station St	1057	21	B	10	928	21	B	10
Argyle St / Station St	1803	9	A	6	1747	8	A	7
Dalley St / Whian St	739	22	B	23	569	31	C	16
Stuart St / Whian St	33	2	A	1	14	2	A	0
Jubilee Ave / Fern St	1493	25	B	17	1271	24	B	8
Stuart St / Fern St	796	8	A	5	675	5	A	4

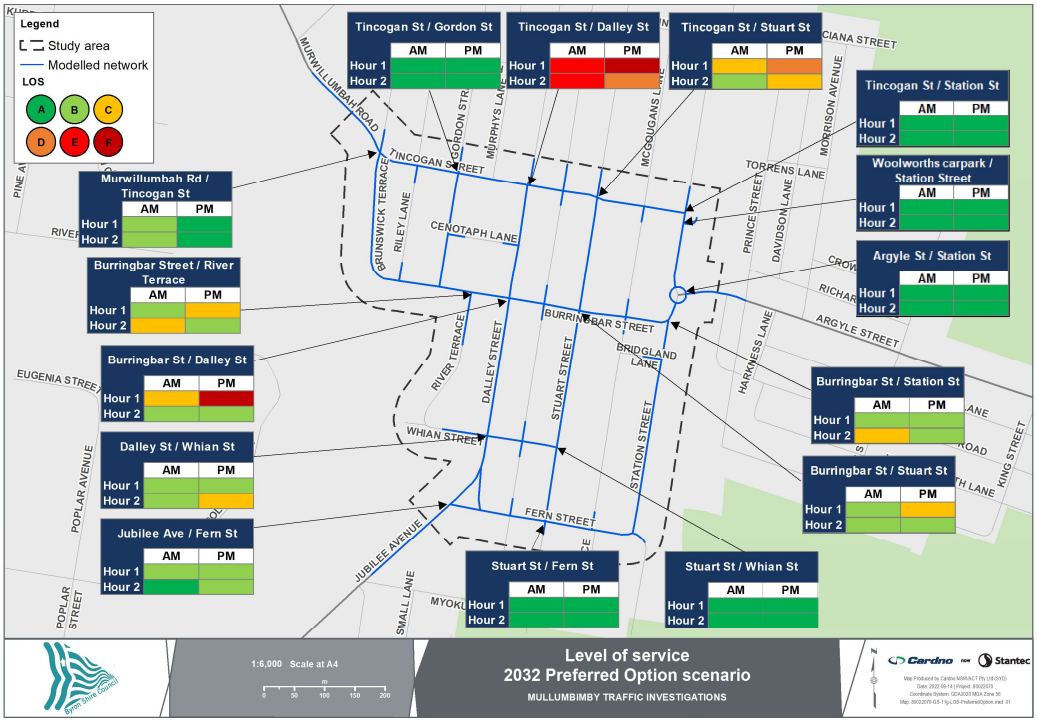


Figure 12-6 2032 Preferred Option intersection level of service

12.6.5 Preferred Option travel times

Table 12-25 and **Table 12-26** show the 2032 Preferred Option travel times and average speeds for each two-hour peak on the travel time routes described in **Section 8.2.3**, alongside a comparison to the 2032 Do Minimum model. The results indicate:

- Travel times on Tincogan Street are reduced compared to the Do Minimum model during the AM peak. This is because the assigned heavy vehicle route avoids right turns on Tincogan Street, whereas in the Do Minimum some heavy vehicles will need to wait for a gap in traffic.
- Travel times on Dalley Street northbound increase by up to 20 seconds in the first hour of the PM peak. This is due to the additional heavy vehicles using Burringbar Street as part of Preferred Option, reducing the available gap for vehicles on Dalley Street to turn onto Burringbar Street when compared to the Do Minimum model.
- Travel times on Burringbar Street increase in the AM peak due to the additional heavy vehicles on this route heading south at Dalley Street as part of Preferred Option. The PM peak shows improvement in the eastbound direction due to reduced congestion on Stuart Street and Dalley Street as no heavy vehicles are on these streets, allowing vehicles to depart from Burringbar Street with lower waiting times and improving the overall performance.
- Travel times on Station Street are improved in both peak periods, as there are fewer conflicting vehicles on Burringbar Street to cause delays for Station Street traffic than in the Do Minimum with the Preferred Option heavy vehicle routes.
- The heavy vehicle route performance is worst for northbound vehicles between Jubilee Avenue and Argyle Street due to congestion on Station Street. Delays for southbound vehicles for Murwillumbah Road were modelled for heavy vehicles as they wait for a gap to turn right onto Dalley Street.

Table 12-25 2032 Preferred Option AM peak travel times and average speeds

Route	Dir.	2032 Preferred Option AM peak		Compared to the 2032 Do Minimum		2032 Preferred Option AM peak	
		Travel time (mm:ss)		Travel time (mm:ss)		Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	01:39	01:26	-00:17	-00:04	27	31
	WB	01:13	01:27	-00:03	-00:04	37	31
Dalley Street	NB	01:55	02:12	+00:02	-00:21	16	14
	SB	01:13	01:15	-00:07	-00:01	26	25
Burringbar Street	EB	03:05	03:01	+00:37	+00:03	16	16
	WB	02:13	02:31	+00:10	+00:09	22	19
Station Street	NB	02:27	02:35	-00:08	-00:50	20	19
	SB	01:40	01:30	-00:00	-00:03	30	33
HV Preferred Option - Argyle St to Murwillumbah Rd	WB	01:56	02:09	-	-	39	35
HV Preferred Option - Murwillumbah Rd to Argyle St	EB	02:23	02:11	-	-	32	35
HV Preferred Option - Jubilee Ave to Murwillumbah Rd	NB	03:03	03:02	-	-	33	33
HV Preferred Option - Jubilee Ave to Argyle St	NB	03:48	03:54	-	-	25	24
HV Preferred Option - Argyle St to Jubilee Ave	SB	02:50	02:39	-	-	33	35
HV Preferred Option - Murwillumbah Rd to Jubilee Ave	SB	04:02	03:40	-	-	25	27

Table 12-26 2032 Preferred Option PM peak travel times and average speeds

Route	Dir.	2032 Preferred Option PM peak		Compared to the 2032 Do Minimum		2032 Preferred Option PM peak	
		Travel time (mm:ss)		Travel time (mm:ss)		Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:55	01:27	-00:01	-00:01	20	31
	WB	01:15	01:21	+00:04	-00:00	36	33
Dalley Street	NB	02:12	01:37	+00:20	-00:13	9	19
	SB	02:13	01:31	+00:18	+00:05	14	21
Burringbar Street	EB	03:03	02:45	-00:05	-00:08	16	18
	WB	02:05	02:07	-00:15	-00:05	23	23
Station Street	NB	02:59	02:23	-00:48	-00:00	22	21
	SB	01:50	01:36	-00:08	-00:04	27	31
HV Preferred Option - Argyle St to Murwillumbah Rd	WB	01:53	02:00	-	-	40	37
HV Preferred Option - Murwillumbah Rd to Argyle St	EB	02:51	02:08	-	-	27	36
HV Preferred Option - Jubilee Ave to Murwillumbah Rd	NB	02:57	02:58	-	-	34	34
HV Preferred Option - Jubilee Ave to Argyle St	NB	03:29	03:34	-	-	27	27
HV Preferred Option - Argyle St to Jubilee Ave	SB	02:51	02:33	-	-	33	36
HV Preferred Option - Murwillumbah Rd to Jubilee Ave	SB	03:49	03:17	-	-	26	31

13 Option operational comparison

This section provides a comparison of the network and intersection performance of the Do Minimum and Options scenarios described in **Sections 11** and **12**. The comparison statistics used are:

- Network performance statistics
- Travel times and average speeds
- Intersection performance statistics.

All scenarios have been assessed for the typical weekday AM and PM peak periods for the forecast year of 2032, with the future year demands developed using a growth rate of 3.1% per annum as explained in **Section 9.**

13.1 Network performance comparison

The network performance statistics for the AM and PM peak periods are shown in **Table 13-1** and **Table 13-2,** respectively. The network statistics show the following:

- The VKT in 2032 is similar across all six scenarios in both the AM and PM peak periods, with the only reduction in distance travelled shown in the Preferred Option. This is because general traffic experienced less congestion in the town centre and were less likely to take detours to avoid congestion, as heavy vehicles were assigned to the perimeter of the study area.
- The VHT shows increases in the Options compared to the Do Minimum with the exception of the Preferred Option. This is because the Preferred Option sends heavy vehicles away from the town centre in two separate routes, allowing congestion levels to remain lower than in the Options models.
- In the Do Minimum PM peak, travel patterns are more evenly distributed throughout the network and the overall congestion is lower than in the AM peak. In these conditions, allocating heavy vehicles to specific routes for Options 1-4 results in a minor increase in the overall VHT in comparison with the Do Minimum. Option 4 provides the lowest VHT results apart from the Preferred Option in both peak periods, as assigning heavy vehicles to travel along Burringbar Street east of Dalley Street produces the least impact to vehicle operation through the busier parts of the town centre.
- The average number of stops increases in the Options scenarios in line with the increase in VHT during both peaks, indicating that the increase in delay in the network is leading to more vehicles stopping in the town centre. The Preferred Option shows a reduction in the number of stops in both peak periods.
- The average vehicle speeds reduce by up to 16.6% as modelled during the AM peak under Option 2, with Option 3 showing a similar reduction of 14.7%. Options 1 and 4 show much less reduction in comparison to the Do Minimum at 5.2% and 1%, respectively.
- The Preferred Option shows an increase in average speed of 5.4% in the Am peak and 1.3% in the PM peak.
- There are no unreleased vehicles modelled in any scenario.

Table 13-1 2032 AM peak network performance results comparison

Network Statistics	AM Peak Option Results					Compared to the Do Minimum Model				
	Option 1	Option 2	Option 3	Option 4	Preferred Option	Option 1	Option 2	Option 3	Option 4	Preferred Option
All vehicles										
Total traffic demand (veh)	7155	7155	7155	7155	7155	0 *(0%)*	0 *(0%)*	0 *(0%)*	0 *(0%)*	0 *(0%)*
Total vehicle kilometres travelled (km)	7587	7602	7602	7584	7561	7 *(0.1%)*	22 *(0.3%)*	21 *(0.3%)*	4 *(0%)*	-19 *(-0.2%)*
Total vehicle travel time (hrs)	294	328	329	283	265	13 *(4.1%)*	47 *(14.4%)*	49 *(17.2%)*	3 *(1%)*	-15 *(-5.4%)*
Total number of stops	15729	17320	17572	15161	13685	790 *(4.6%)*	2381 *(13.5%)*	2633 *(17.4%)*	222 *(1.5%)*	-1254 *(-8.4%)*
Averages per vehicle										
Average time travelled in network (sec)	147.5	164.5	165.1	142.2	133.0	6.8 *(4.1%)*	23.8 *(14.4%)*	24.4 *(17.2%)*	1.5 *(1%)*	-7.7 *(-5.5%)*
Average number of stops	2.19	2.42	2.45	2.11	1.91	0.1 *(4.6%)*	0.3 *(13.5%)*	0.4 *(17.4%)*	0.0 *(1.5%)*	-0.2 *(-8.5%)*
Average speed (km/hr)	25.8	23.2	23.1	26.8	28.5	-1.2 *(-5.2%)*	-3.8 *(-16.6%)*	-3.9 *(-14.7%)*	-0.3 *(-1%)*	1.5 *(5.4%)*
Unreleased demand										
Latent demand (veh)	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0

Table 13-2 2032 PM peak network performance results comparison

Network Statistics	PM Peak Option Results					Compared to the Do Minimum Model				
	Option 1	Option 2	Option 3	Option 4	Preferred Option	Option 1	Option 2	Option 3	Option 4	Preferred Option
All vehicles										
Total traffic demand (veh)	6462	6462	6462	6462	6462	0 *(0%)*	0 *(0%)*	0 *(0%)*	0 *(0%)*	0 *(0%)*
Total vehicle kilometres travelled (km)	6310	6322	6317	6310	6299	7 *(0.1%)*	19 *(0.3%)*	14 *(0.2%)*	7 *(0.1%)*	-3 *(-0.1%)*
Total vehicle travel time (hrs)	233	244	231	230	227	3 *(1.3%)*	14 *(6.3%)*	1 *(0.5%)*	1 *(0.2%)*	-3 *(-1.4%)*
Total number of stops	12655	12966	12624	12515	11863	266 *(2.1%)*	577 *(4.6%)*	235 *(1.9%)*	126 *(1%)*	-526 *(-4.2%)*
Averages per vehicle										
Average time travelled in network (sec)	130.4	136.7	129.2	128.9	126.9	1.8 *(1.3%)*	8.1 *(6.3%)*	0.6 *(0.5%)*	0.3 *(0.3%)*	-1.7 *(-1.3%)*
Average number of stops	1.97	2.01	1.96	1.95	1.84	0.0 *(2.1%)*	0.1 *(4.6%)*	0.0 *(1.9%)*	0.0 *(1%)*	-0.1 *(-4.2%)*
Average speed (km/hr)	27.1	25.9	27.4	27.4	27.8	-0.4 *(-1.4%)*	-1.5 *(-5.7%)*	-0.1 *(-0.3%)*	0.0 *(-0.1%)*	0.4 *(1.3%)*
Unreleased demand										
Latent demand (veh)	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0

13.1.2 Vehicle hours travelled

Vehicle hours travelled is a measure of the travel time for all vehicles in the network. This is useful for identifying network efficiency and performance, possible congestion issues and future travel time savings. **Figure 13-1** provides a comparison of the VHT in both scenarios.

- VHT increases into the future years for the Do Minimum and four Options in both peak periods.
- VHT increases most significantly in the AM Peak, indicating that the AM peak remains the most critical period in all scenarios.
- Option 2 shows the largest VHT in both peak periods. This is due to the additional congestion caused by sending heavy vehicles along Tincogan Street to access Argyle Street, and on Station Street from Jubilee Avenue. The route is also the longest of the four Options, adding to the total travel time in the network.
- The Preferred Option shows the lowest increase in travel time. This is because this option splits the heavy vehicle demands into two separate routes through the study area that avoid the main congestion locations. The Preferred Option also avoids speed reduced areas on Burringbar Street and Stuart Street.

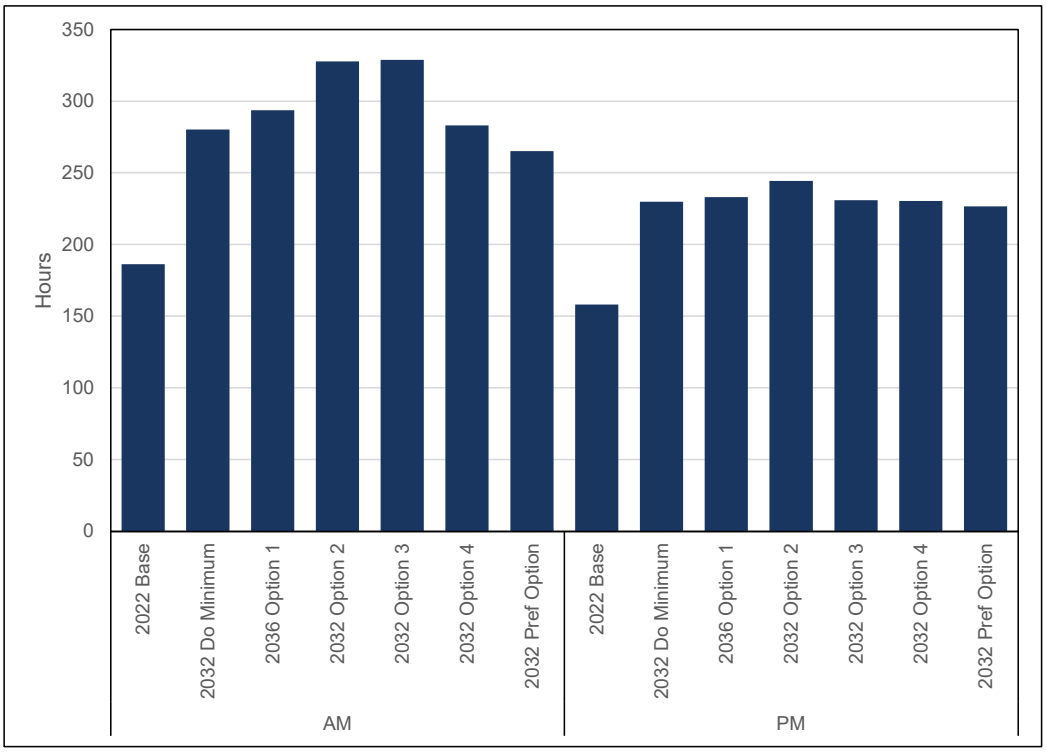


Figure 13-1 VHT comparison

13.1.3 Vehicle kilometres travelled

Vehicle kilometres travelled is a measure of the total distance travelled by all vehicles in the network. It is useful for identifying savings in road user and external costs.

Figure 13-2 shows a comparison of the VKT between the Do Minimum and four Option scenarios. As there is no change in infrastructure in the model, the change in VKT is largely representative in the change in route choice as a result of the prescribed heavy vehicle routes in each Option.

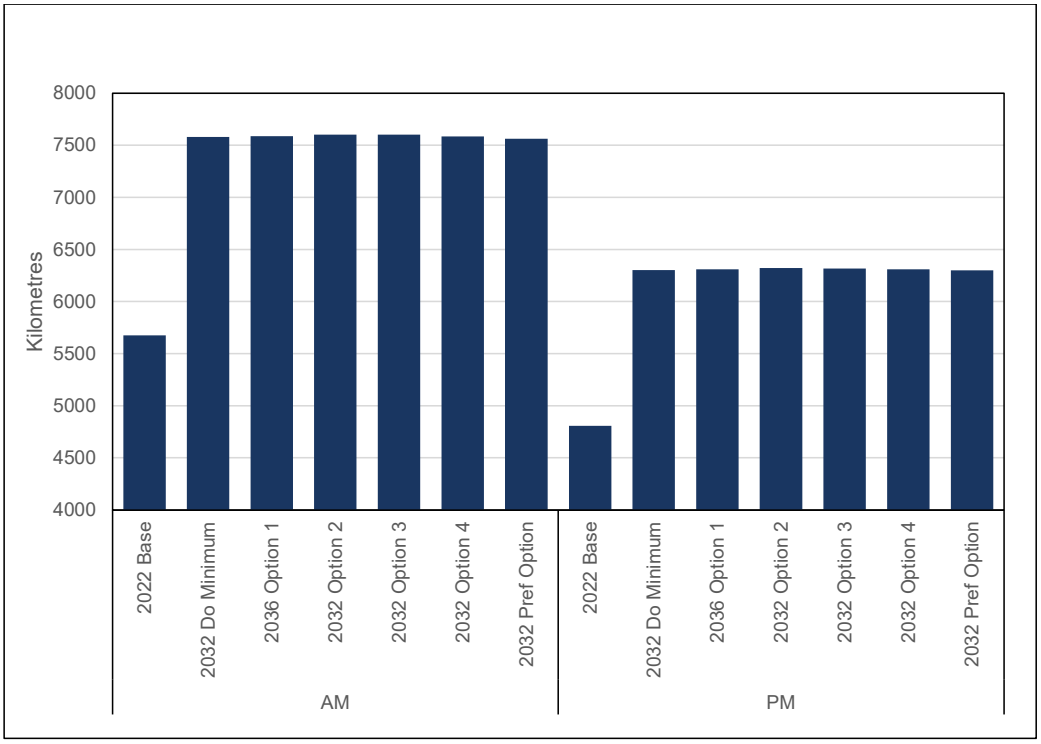


Figure 13-2 VKT comparison

Note: Y-axis begins at 4,000 kilometres to provide a clearer indication of the differences in results from each scenario

13.1.4 Network average speed

Network average speed is the average speed of all vehicles in the network. It provides an indication of the amount of congestion in the model. **Figure 13-3** provides a comparison of the network average speed for all peaks.

- In all future year scenarios, the average travel speed is lower than in the 2022 Base model due to the additional traffic in the network.
- Under the Option scenarios, network average speed decreases when compared to the Do Minimum scenario in 2032 during both peak periods with the exception of the Preferred Option. This is especially evident during the AM peak, whereas the PM peak speeds are only slightly lower than the Do Minimum under Options 1, 3 and 4.
- Travel speeds are higher in the Do Minimum model as heavy vehicles have the freedom to choose the least congested route to reach their destination. Under the Options scenarios, heavy vehicles must follow the specified route regardless of delays present along the way. The exception to this is the Preferred Option, which splits the heavy vehicles into two directions around the perimeter of the study area. This way, the number of heavy vehicles assigned to each route is not significant enough to impact the overall performance.

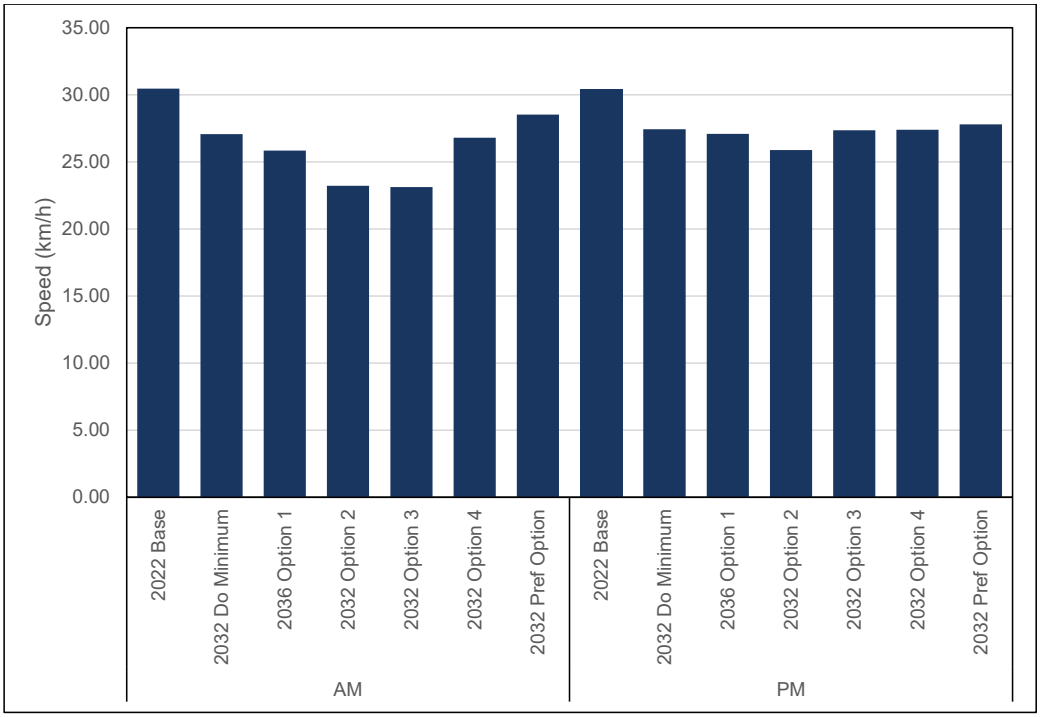


Figure 13-3 Average network speed comparison

13.1.5 Unreleased demand

Unreleased demand refers to the number of vehicles that were unable to enter the modelled network during the modelled period. Unreleased demand is caused by queueing that extends to the edge of the modelled network and is an indication of the network being unable to cater for the total traffic in the scenario.

In all future scenarios, no unreleased demand was modelled at any locations in the network.

13.2 General traffic travel time comparison

Figure 13-4 to **Figure 13-11** provide a comparison between average travel times for all vehicles using the key routes assessed during the Base Model validation process as shown previously in **Section 8.2.3**. The travel time results for the heavy vehicle routes included in each Option are presented later in this report in **Section 13.3.**

- Travel times are more impacted by the Options during the AM peak compared to the PM peak
- Tincogan Street travel times increase in Options 1-3 and the Preferred Option, as more vehicles are assigned to this route. Heavy vehicles required to turn right into Dalley Street or Stuart Street add to delays on Tincogan Street in Options 1 and 3.
- With the change in priority rules at Tincogan Street / Dalley Street and Tincogan Street / Stuart Street, vehicles must give way to traffic on Tincogan Street and wait for a gap before leaving either Dalley or Stuart Street. This increases the modelled travel time on Dalley Street northbound under Options 1-3 as more vehicles are added to Tincogan Street or to Dalley Street waiting to turn onto Tincogan Street. The increase in travel time under the Preferred Option is reduced, as heavy vehicles travelling between Jubilee Avenue and Murwillumbah Road use Brunswick Terrace instead of Tincogan Street.
- Burringbar Street travel times increase under Options 1, 3, 4 and the Preferred Option as heavy vehicles are added to this route. Option 3 affects the performance on Burringbar Street as heavy vehicles wait to turn into Stuart Street, which has a reduced speed limit of 30 km/hr in both directions.
- Burringbar Street westbound travel times are impacted by Option 2 as northbound vehicles clear Stuart Street and Dalley Street slower due to the increase traffic using Tincogan Street and create delays for vehicles turning off of Burringbar Street. The Preferred Option provides the quickest travel times during the most of the modelled hours.
- Northbound traffic on Station Street located south of Burringbar Street experiences additional travel time with the addition of heavy vehicles under Option 2 compared to the other Options. Travel times are also affected by the two pedestrian crossings located near Station Street / Burringbar Street and the number of vehicles using Burringbar Street depending on the Option.
- Travel times for southbound traffic on Station Street remains similar in most scenarios, with Option 2 showing the longest times due to the additional heavy vehicles added to this route.

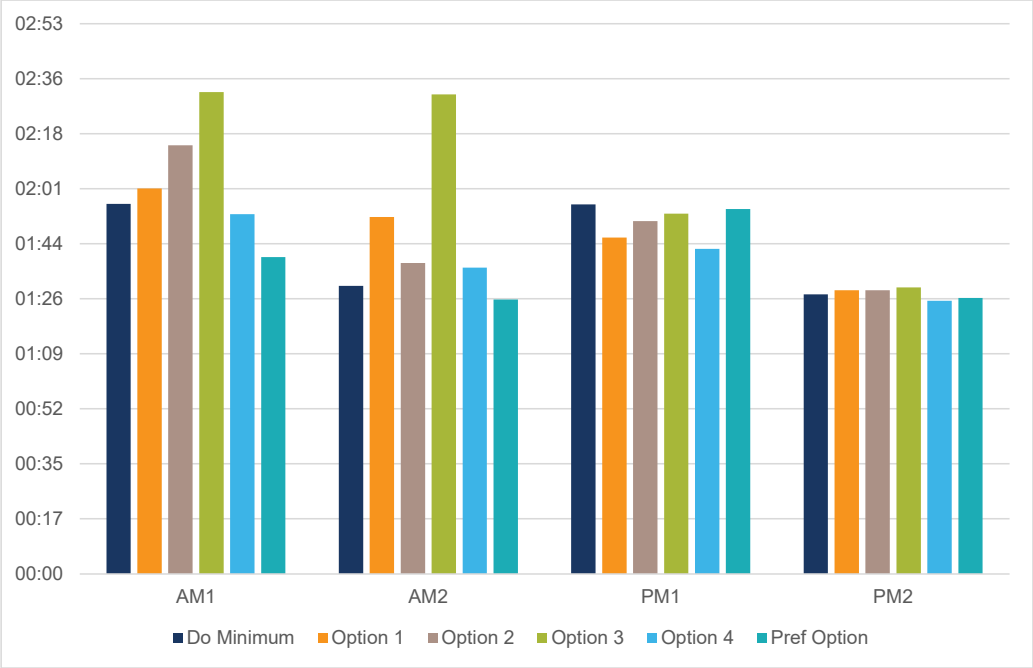


Figure 13-4 Travel time comparison – Tincogan Street eastbound

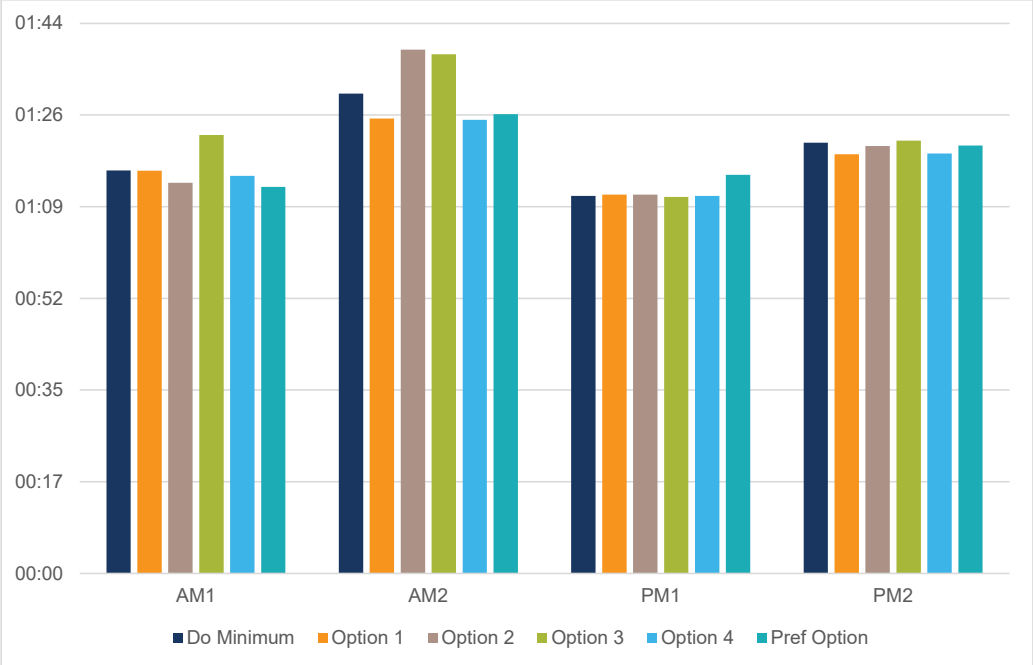


Figure 13-5 Travel time comparison – Tincogan Street westbound

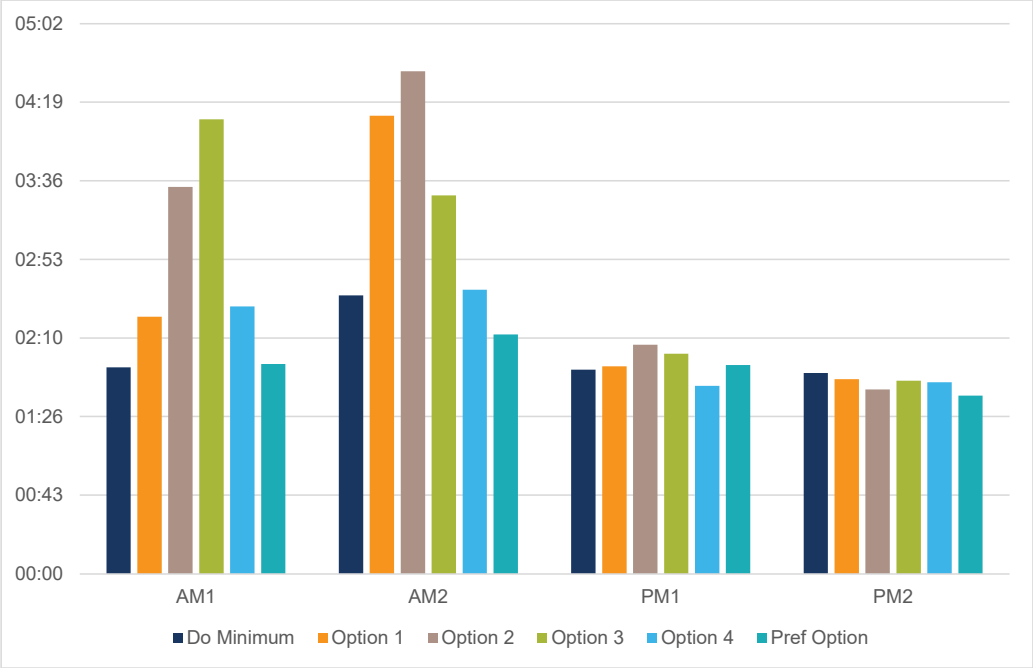


Figure 13-6 Travel time comparison – Dalley Street northbound

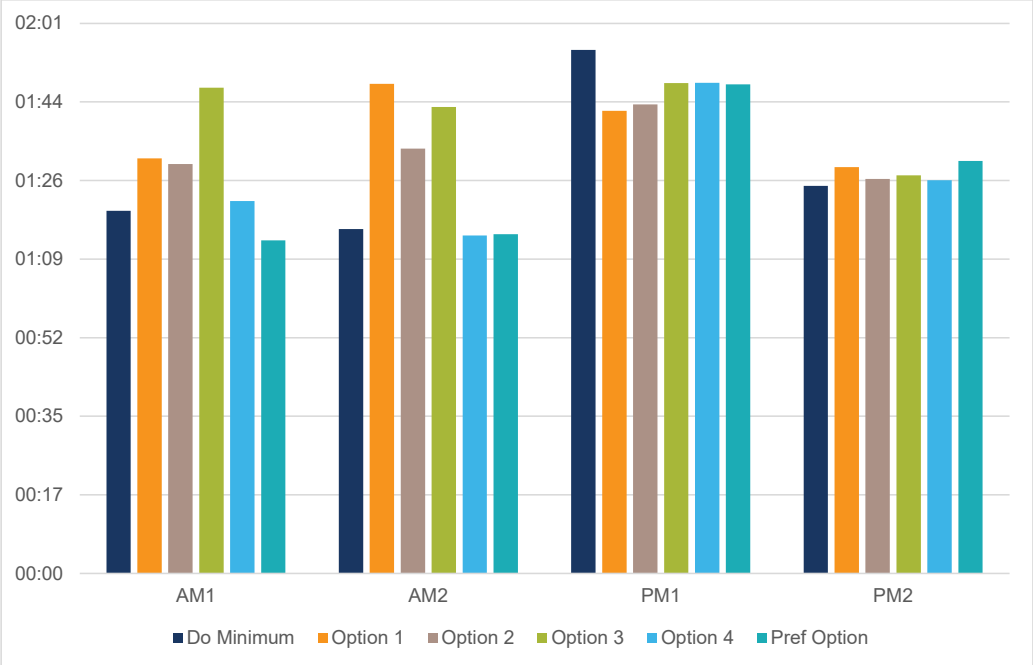


Figure 13-7 Travel time comparison – Dalley Street southbound

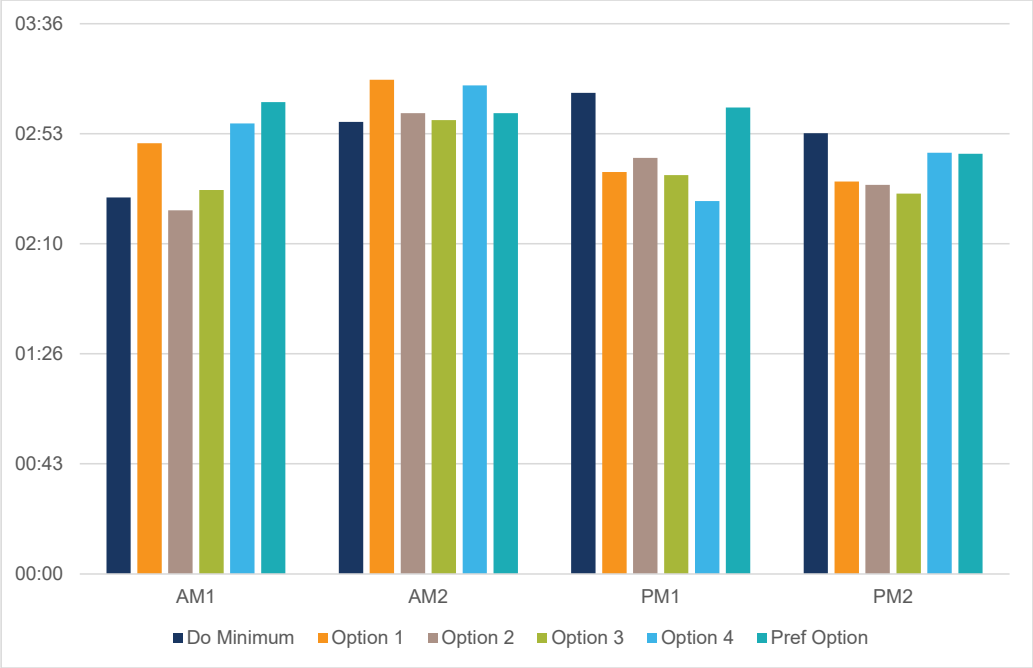


Figure 13-8 Travel time comparison – Burringbar Street eastbound

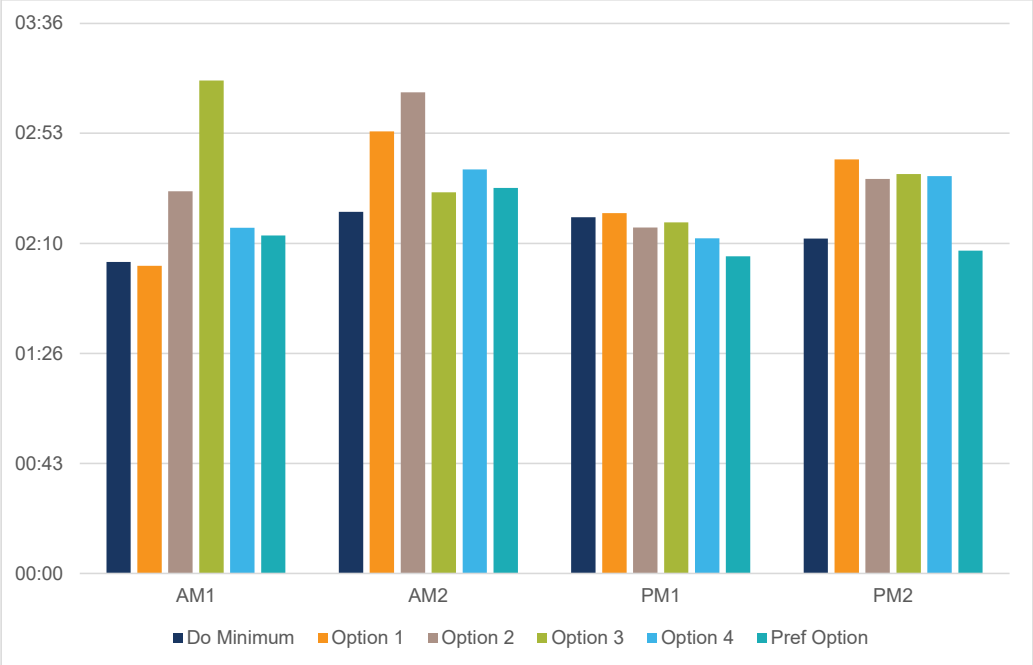


Figure 13-9 Travel time comparison – Burringbar Street westbound

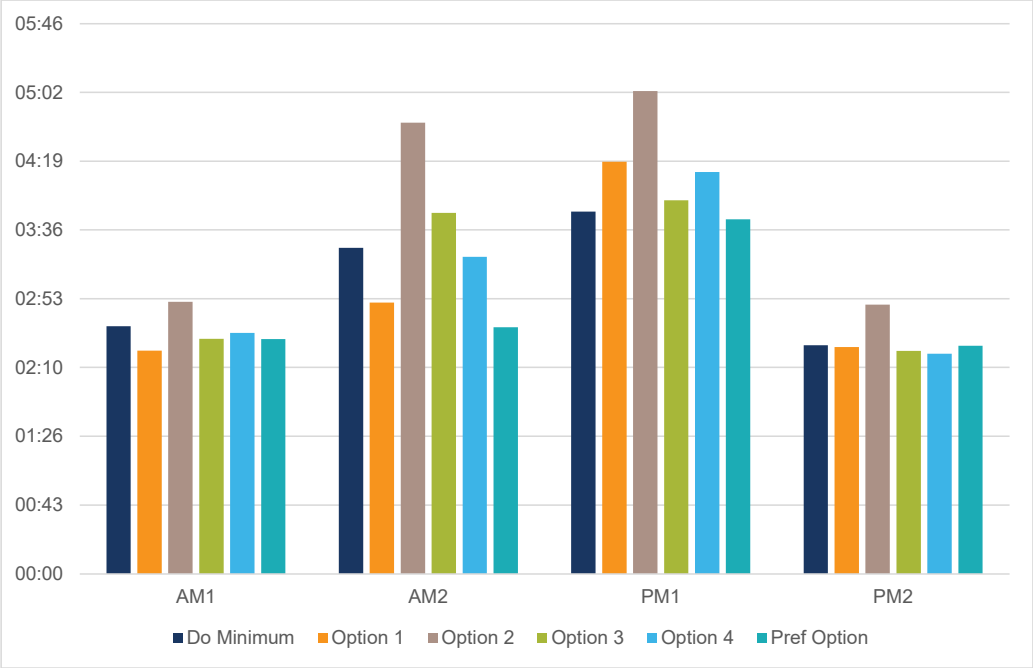


Figure 13-10 Travel time comparison – Station Street northbound

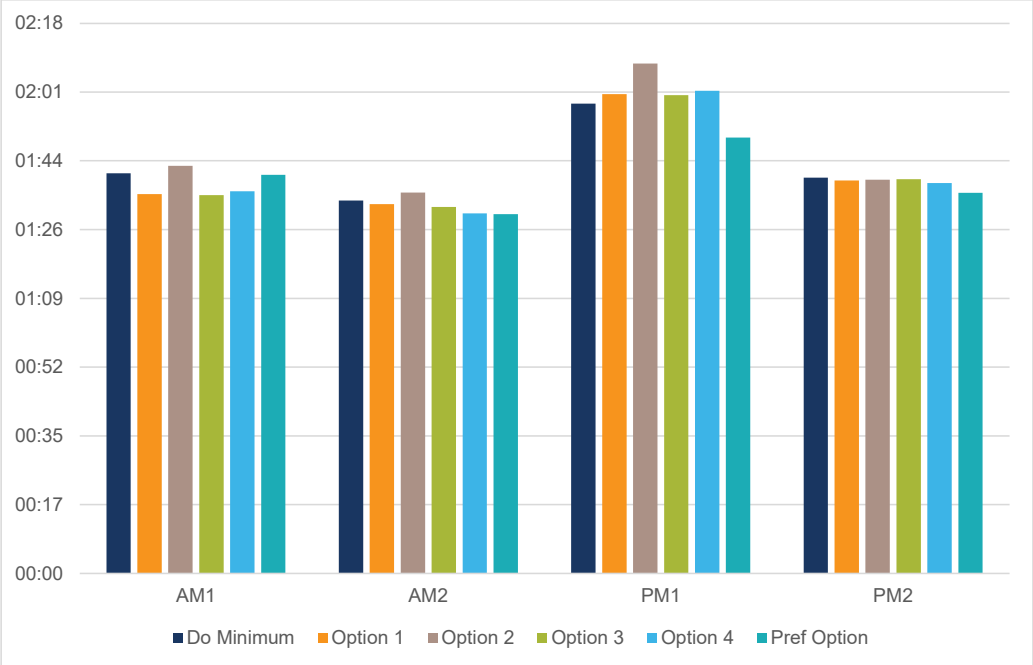


Figure 13-11 Travel time comparison – Station Street southbound

13.3 Heavy vehicle routes travel time comparison

Figure 13-12 to **Figure 13-17** provide a comparison between the average travel times for each heavy vehicle route Option as shown previously in **Section 5.2**.

- For heavy vehicles travelling between Murwillumbah Road and Argyle Street, Option 2 and the Preferred Option provide the quickest travel times in both peak periods. This is because these routes provide the shortest path with no requirement to give-way to general traffic.
- Heavy vehicles travelling between Murwillumbah Road and Jubilee Avenue experience the shortest travel times under Option 4 and the Preferred Option, as these routes avoid the 30 km/hr speed zones introduced to Burringbar Street and Stuart Street.
- Option 3 provides the quickest travel times for heavy vehicles travelling from Jubilee Avenue to Argyle Street, as it avoids congestion on Dalley Street and along Burringbar Street.
- Congestion on Station Street in the northbound direction south of Burringbar Street leads to the longest travel times under Option 2 and the Preferred Option for vehicles heading to Argyle Street from Jubilee Avenue.
- For heavy vehicles heading southbound from Argyle Street to Jubilee Avenue, Option 2 and the Preferred Option provide the fastest travel times as Station Street southbound remains 50 km/hr.

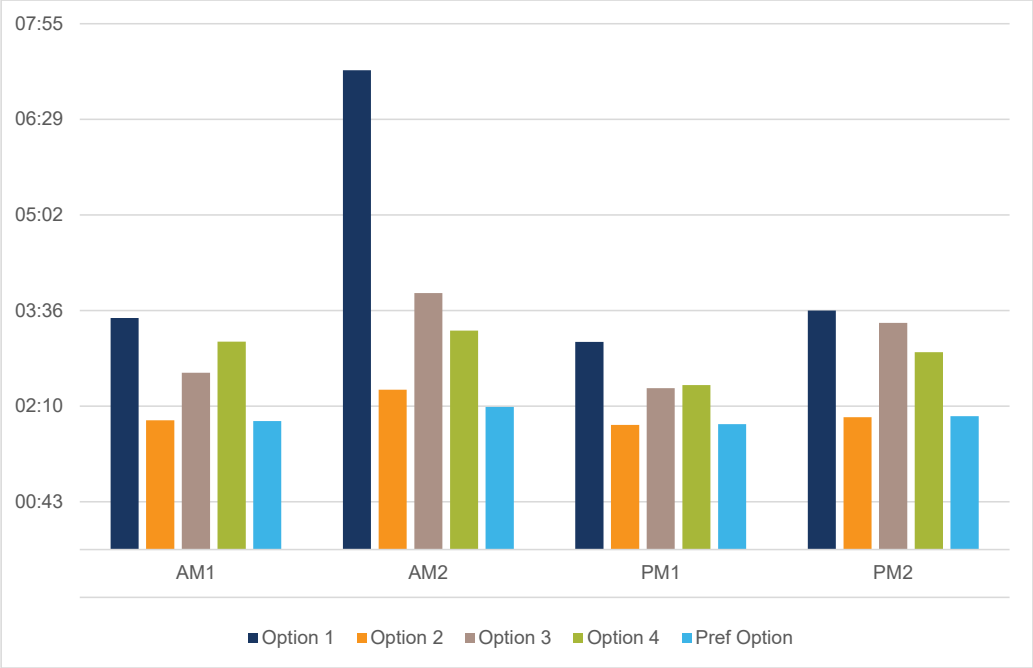


Figure 13-12 HV travel time comparison - Argyle Street to Murwillumbah Road westbound

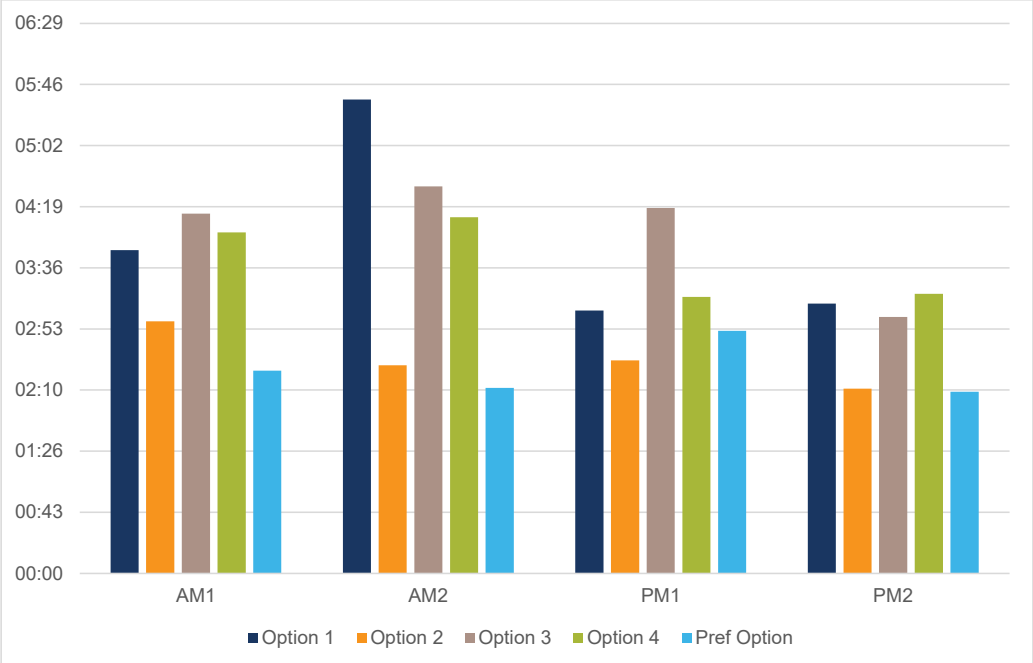


Figure 13-13 HV travel time comparison – Murwillumbah Road to Argyle Street eastbound

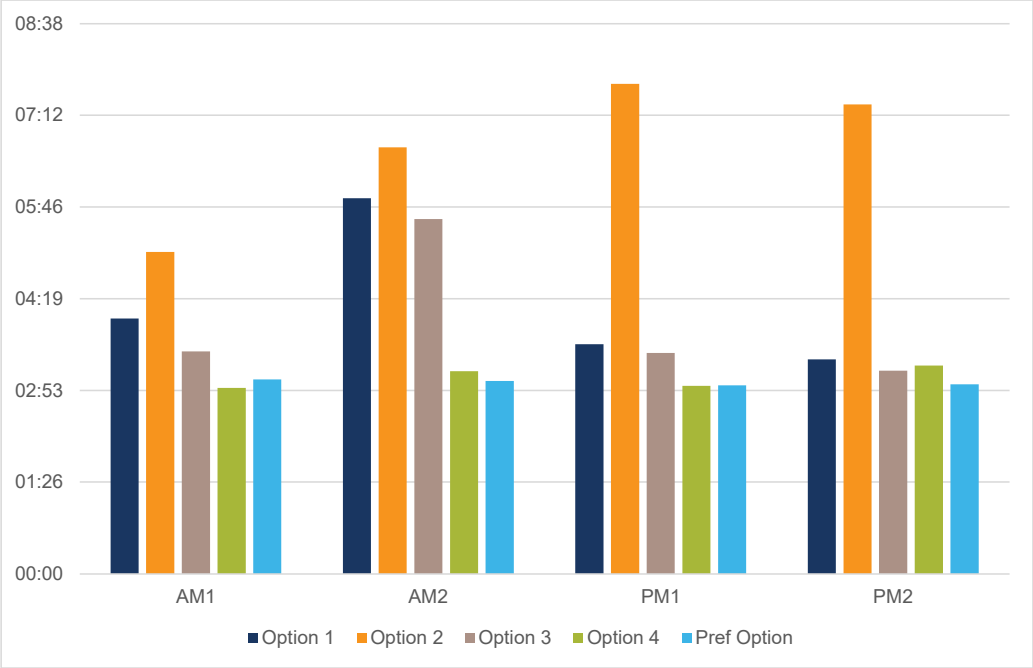


Figure 13-14 HV travel time comparison –Jubilee Avenue to Murwillumbah Road northbound

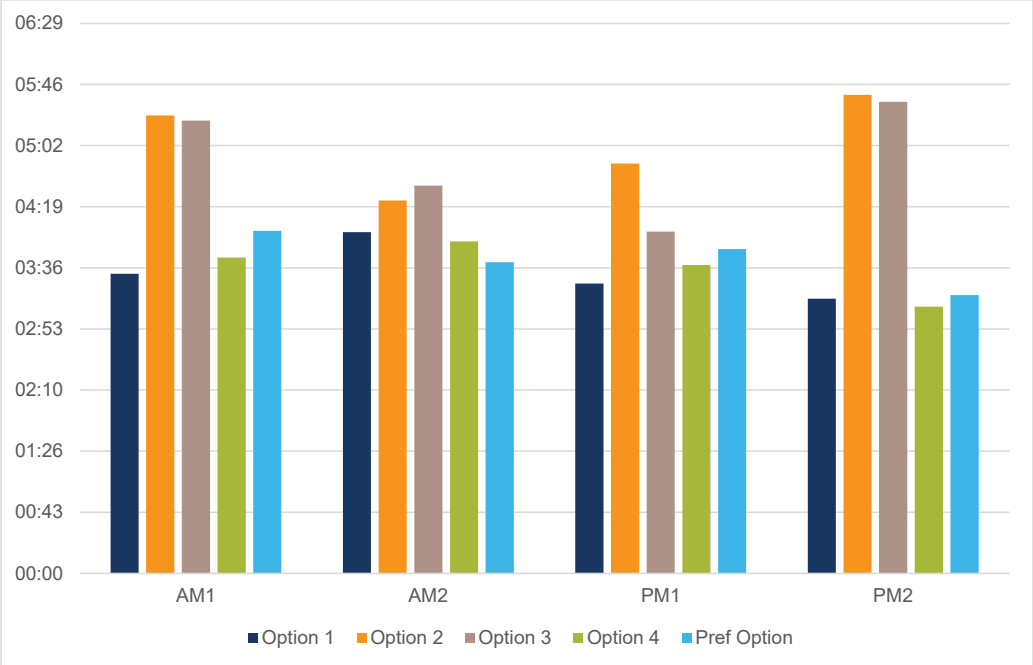


Figure 13-15 HV travel time comparison –Murwillumbah Road to Jubilee Avenue southbound

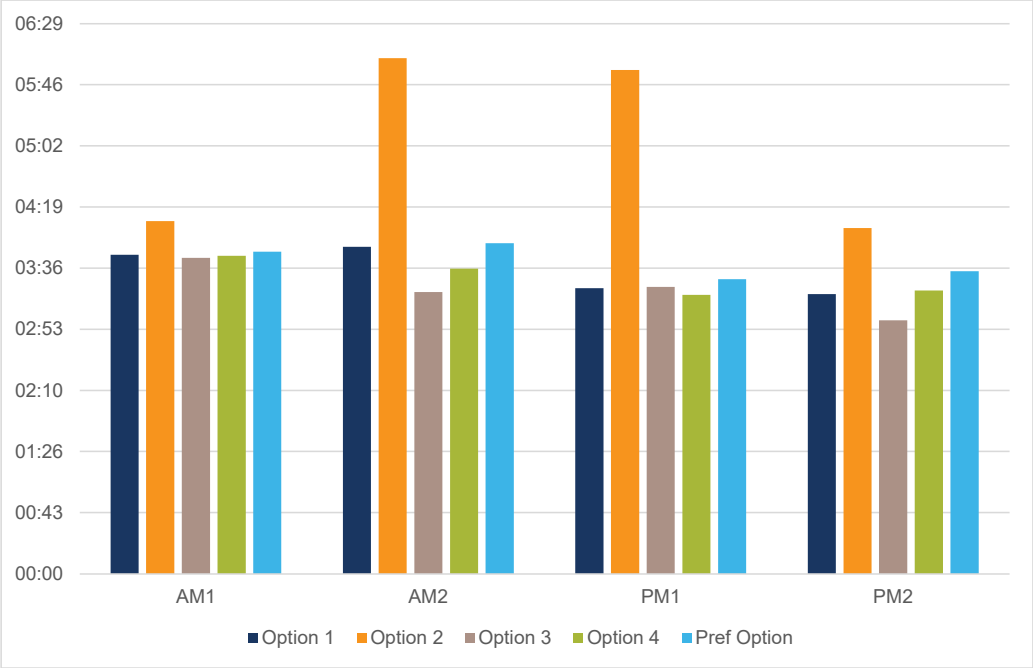


Figure 13-16 HV travel time comparison –Jubilee Avenue to Argyle Street northbound

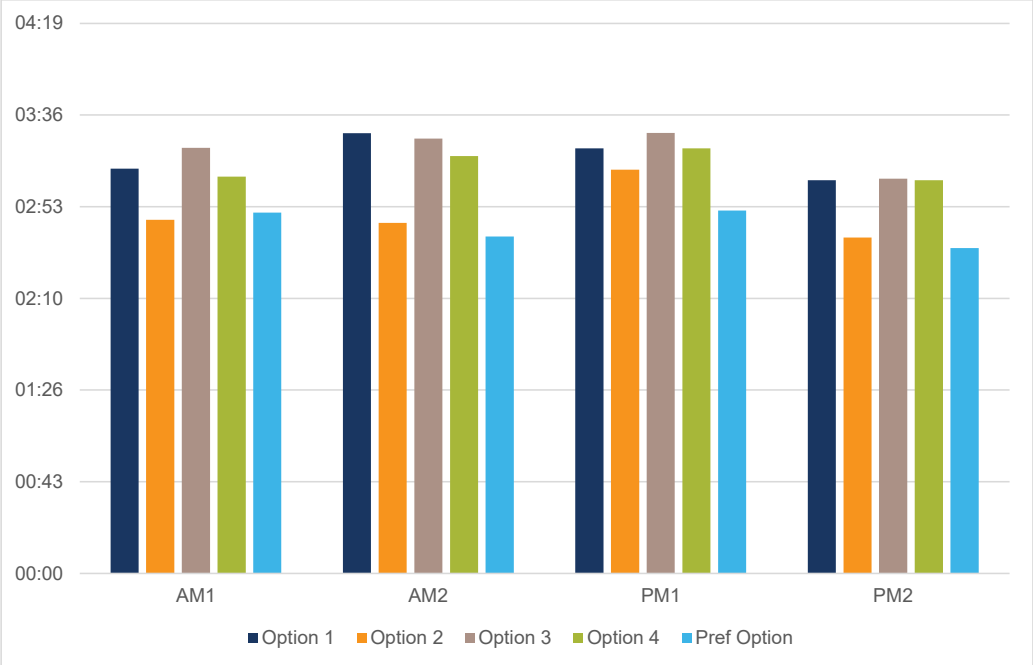


Figure 13-17 HV travel time comparison - Argyle Street to Jubilee Avenue southbound

13.4 Intersection performance comparison

Table 13-3 and **Table 13-4** provide a summary of the intersection performance across all options for the first and second hours of the AM and PM peak periods, respectively.

- Tincogan Street / Dalley Street will require an upgrade in future due to the increased traffic demands in 2032 and the change in priority rules to favour the east and west approaches. LOS E or F is modelled in all scenarios of the AM peak period, with delays increasing under the Options as heavy vehicles are assigned to either Tincogan Street or Dalley Street.
- Tincogan Street / Dalley Street also performs unsatisfactorily during the PM peak, with LOS D or worse modelled in all scenarios during the first hour.
- Tincogan Street / Stuart Street will require an upgrade due to the additional future traffic volumes and change in priority rules, similar to Tincogan Street / Dalley Street. The intersection performs at LOS D in all scenarios during the first hour of the PM peak period and performs at LOS F during the AM peak period under Option 3.
- Burringbar Street / Dalley Street performs unsatisfactorily during the PM peak period in the first hour of all scenarios due to the reduction in speed limit to 30 km/hr. Delays are increased during the AM peak under Options 1-3 due to downstream congestion on Dalley Street and Stuart Street with the additional heavy vehicles associated with these Options.
- Dalley Street / Whian Street shows unsatisfactory performance during the second hour of the AM peak under Options 1, 2 and 4. This is primarily due to a small number of vehicles turning right from the north approach of Dalley Street into River Terrace as they wait for a gap in traffic and is impacted by the arrival pattern of vehicles heading north.
- Murwillumbah Road / Brunswick Terrace / Tincogan Street shows an LOS D during the second hour of the AM peak under Option 3, as vehicles turning right from Tincogan Street west struggle to find a gap in traffic. The delay at this location is also impacted by the arrival patterns of vehicles at the eastern approach and shows satisfactory performance under all other Options and time periods.
- All other intersections operate satisfactorily at LOS C or better in all Options scenarios and during all modelled time periods.

Table 13-3 AM peak intersection performance comparison

Intersection	AM Peak - Intersection Delay (s)											
	08:00am - 09:00am						09:00am - 10:00am					
	Do Min.	Option 1	Option 2	Option 3	Option 4	Pref. Option	Do Min.	Option 1	Option 2	Option 3	Option 4	Pref. Option
Murwillumbah Rd / Brunswick Terrace / Tincogan St	14	16	15	25	15	19	17	24	22	43	21	17
Tincogan St / Gordon St	16	25	36	25	27	5	8	14	15	20	18	6
Tincogan St / Dalley St	79	104	156	171	113	69	111	205	266	225	117	65
Tincogan St / Stuart St	27	23	29	72	27	34	16	19	24	76	19	16
Tincogan St / Station St	4	4	3	4	4	3	4	3	4	4	4	4
Woolworths carpark / Station Street	3	2	3	3	4	4	4	6	5	6	4	5
Burringbar Street / River Terrace	15	14	14	12	18	27	23	19	23	18	26	36
Burringbar St / Dalley St	31	33	41	155	34	30	28	81	105	52	26	20
Burringbar St / Stuart St	19	16	20	17	20	15	20	19	22	25	19	19
Burringbar St / Station St	20	25	21	28	24	19	38	31	31	33	32	28
Argyle St / Station St	9	8	9	9	9	9	10	10	11	10	9	9
Dalley St / Whian St	21	23	24	23	18	18	35	72	47	25	44	18
Stuart St / Whian St	3	2	3	3	2	2	3	3	3	3	3	2
Jubilee Ave / Fern St	15	14	15	15	16	16	9	12	10	10	9	9
Stuart St / Fern St	14	14	13	29	8	13	11	13	16	18	11	11

Table 13-4 PM peak intersection performance comparison

Intersection	PM Peak - Intersection Delay (s)											
	03:00pm - 04:00pm						04:00pm - 05:00pm					
	Do Min.	Option 1	Option 2	Option 3	Option 4	Pref. Option	Do Min.	Option 1	Option 2	Option 3	Option 4	Pref. Option
Murwillumbah Rd / Brunswick Terrace / Tincogan St	12	12	12	12	12	11	8	8	9	9	8	11
Tincogan St / Gordon St	4	5	23	13	5	4	4	19	16	11	10	7
Tincogan St / Dalley St	58	59	77	68	48	130	43	42	39	42	39	54
Tincogan St / Stuart St	55	45	54	47	45	50	32	25	26	30	23	30
Tincogan St / Station St	3	3	3	3	3	4	4	4	5	4	3	3
Woolworths carpark / Station Street	5	4	4	5	4	4	4	4	4	4	4	4
Burringbar Street / River Terrace	9	8	7	8	9	28	18	18	18	19	20	17
Burringbar St / Dalley St	54	48	45	51	49	72	21	32	25	24	25	27
Burringbar St / Stuart St	23	24	23	23	25	28	25	25	23	25	25	24
Burringbar St / Station St	32	34	37	34	33	21	21	19	20	18	19	21
Argyle St / Station St	9	9	9	8	8	9	9	8	9	9	9	8
Dalley St / Whian St	21	18	19	18	20	22	25	27	26	28	26	31
Stuart St / Whian St	3	2	3	3	3	2	2	3	2	2	2	2
Jubilee Ave / Fern St	13	14	14	14	14	25	6	6	6	7	7	24
Stuart St / Fern St	12	9	13	17	9	7	5	7	7	7	6	5

14 Mitigation Scenario

14.1 Preferred Option deficiencies

The Preferred Option modelling results show improvements in traffic performance as shown in **Section 13** while also supporting the *Our Mullumbimby Masterplan* objectives and prioritising safety as summarised in **Section 12.6**. However, the intersection performance results indicate that the following three intersections will require mitigation in order to provide satisfactory performance for the Preferred Option in 2032:

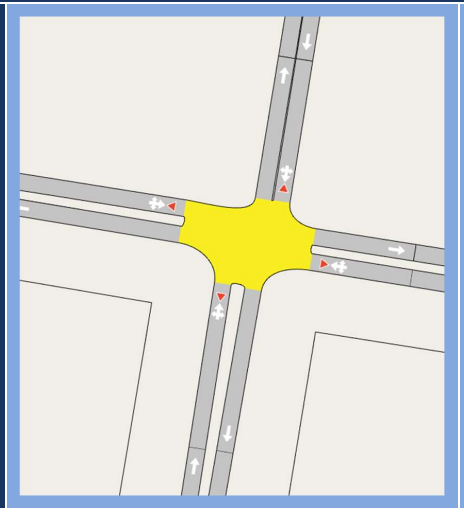
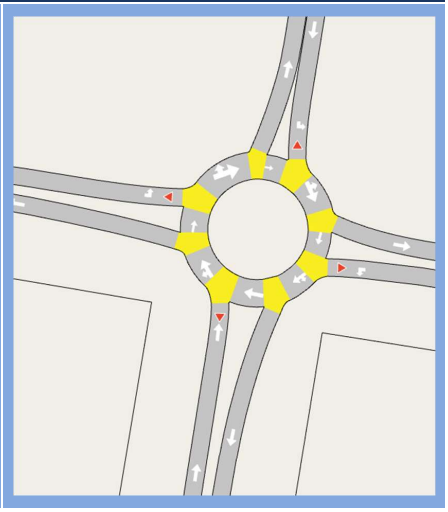
- Tincogan Street / Dalley Street
- Tincogan Street / Stuart Street
- Burringbar Street / Dalley Street.

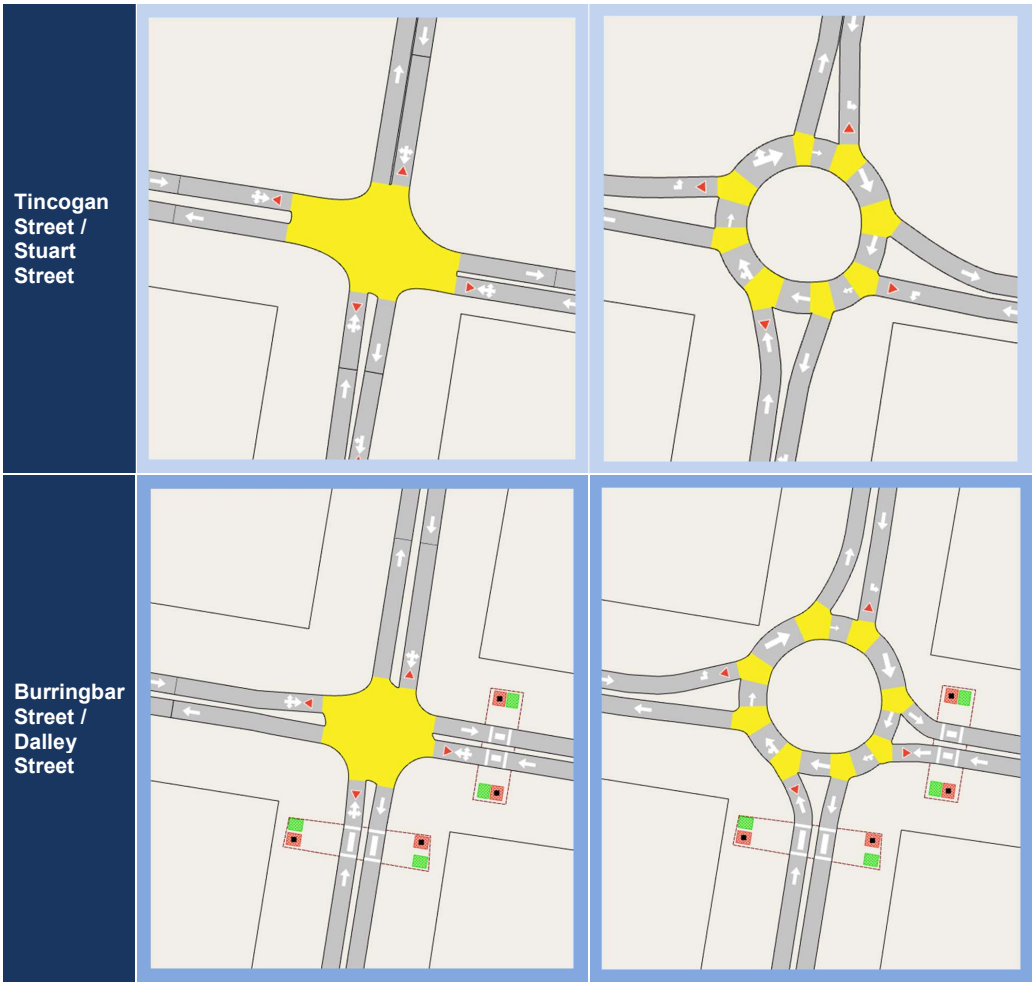
All three of the above intersections are currently four-way priority intersections, with one lane of travel in each direction. Upgrades to the above intersections have been modelled in Aimsun on top of the Preferred Option scenario to create the Mitigation Scenario. This section details the development, testing and results under the Mitigation Scenario.

14.2 Mitigation Scenario upgrades

Cardno now Stantec has developed and tested intersection upgrades for the three intersections identified above. The recommended intersection upgrades will introduce roundabouts in place of the existing priority intersections, and the Aimsun model layouts are shown in **Table 14-1** below.

Table 14-1 Summary of future infrastructure changes

Location	Existing layout	Upgrade layout
Tincogan Street / Dalley Street		



14.3 Mitigation Scenario future demands

The Mitigation Scenario traffic demands for 2032 were the same as the traffic demands used in the Do Minimum an Options models. The demand development process has been described in **Section 9.**

14.4 Mitigation Scenario heavy vehicle routes

The Mitigation Scenario includes the heavy vehicle routes identified for the Preferred Option as shown previously in **Section 12.6.2.** Heavy vehicles will use the following routes when travelling through the network:

- Option 4 to travel between Jubilee Avenue and Murwillumbah Road for both directions
- Option 2 to travel between Jubilee Avenue and Argyle Street for both directions
- Option 2 to travel between Argyle Street and Murwillumbah Road for both directions

14.5 Mitigation Scenario summary

14.5.1 Traffic demands and future infrastructure

Table 14-2 provides a summary of the traffic demand and infrastructure assumptions for the Mitigation Scenario.

Table 14-2 Summary of Mitigation Scenario infrastructure upgrades, traffic demands and heavy vehicle routes

Description	Mitigation Scenario
Infrastructure upgrades	
Tincogan Street priority change at Dalley and Stuart Streets	✓
Speed reductions associated with Stuart Street Green Spine	✓
Burringbar Street Talking Streets design	✓
Tincogan Street / Dalley Street roundabout upgrade	✓
Tincogan Street / Stuart Street roundabout upgrade	✓
Burringbar Street / Dalley Street roundabout upgrade	✓
Traffic demand	
Background growth	✓
Heavy vehicle route	
Between Jubilee Avenue and Murwillumbah Road	Option 4
Between Jubilee Avenue and Argyle Street	Option 2
Between Argyle Street and Murwillumbah Road	Option 2

14.5.2 Assessment years and time periods

Table 14-3 summarises the scenarios and years assessed. The Mitigation Scenario was assessed for the same two peak periods as the Existing Base, Do Minimum and Options models:

> AM peak: 8:00am to 10:00am

> PM peak: 3:00pm to 5:00pm

Table 14-3 Summary of assessment years and time periods

Model scenario	2022		2032	
	AM	PM	AM	PM
Mitigation	-	-	✓	✓

14.6 Mitigation Scenario operational results

This section summarises the modelling results for the Mitigation Scenario. To clarify the changes in performance under the Mitigation Scenario in comparison to the Do Minimum and Preferred Option, a results comparison between the three scenarios is presented below.

14.6.1 Mitigation Scenario network performance

Table 14-4 summarises the Mitigation Scenario network performance for all peak periods. Compared to the 2032 Preferred Option model, the results indicate that:

- The traffic demand is the same as the Preferred Option and Do Minimum scenarios
- The VKT remains almost unchanged between the three scenarios as the overall route choice for general traffic remains the same.
- The VHT is lowest in the Mitigation Scenario, which shows reductions of 5.8% and 2.9% in the AM and PM peaks respectively when compared to the Do Minimum. The Mitigation Scenario also shows reductions in VHT compared to the Preferred Option, with 0.4% and 1.5% in the AM and PM peaks.
- The reduction in VHT under the Mitigation Scenario reflects the improvement in general traffic performance with the roundabout upgrades. Vehicles on Stuart Street and Dalley Street will experience less delay when trying to find gaps in conflicting traffic on Tincogan Street and Burringbar Street.
- The total number of stops reduces in comparison to the Preferred Option and Do Minimum models, with the largest decrease of 13.8% modelled in the AM peak compared to the Do Minimum. This is reflective of the reduction in congestion after the roundabout upgrades in combination with assigning heavy vehicles to the boundary of the town centre.
- The average travel speed improves compared in the Mitigation Scenario, with increases of 6.4% in the AM peak and 3.3% in the PM peak compared to the Do Minimum. This is an improvement of 0.9% and 2% in each peak respectively when compared to the Preferred Option.
- There are no unreleased vehicles in both peaks of the Mitigation Scenario in any scenario.

Table 14-4 2032 Mitigation Scenario network performance

Network performance metric		2032 Mitigation Scenario		Compared to 2032 Preferred Option		Compared to 2032 Do Minimum	
		AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
All vehicles							
Total demand	veh	7155	6462	0 (+0%)	0 (+0%)	0 (+0%)	0 (+0%)
Vehicle kilometres travelled	km	7597	6321	35 (+0.5%)	22 (+0.3%)	17 (+0.2%)	18 (+0.3%)
Vehicle hours travelled	hr	264	223	-1 (-0.4%)	-4 (-1.6%)	-16 (-5.8%)	-7 (-2.9%)
Total number of stops	stop	12880	11555	-805 (-5.9%)	-318 (-2.7%)	-2059 (-13.8%)	-834 (-6.7%)
Averages per vehicle							
Average travel time in network	sec	132	125	-1 (-0.4%)	-2 (-1.7%)	-8 (-5.9%)	-4 (-3.1%)
Average number of stops	stop	1.8	1.8	-0.1 (-5.9%)	-0.1 (-2.8%)	-0.3 (-13.9%)	-0.1 (-6.8%)
Average speed	km/h	29	28	0.3 (+0.9%)	0.5 (+2%)	1.7 (+6.4%)	0.9 (+3.3%)
Unreleased demand							
Unreleased vehicles	veh	0	0	0	0	0	0

14.6.2 Mitigation Scenario intersection performance

Table 14-5 and **Table 14-6** show the Mitigation Scenario intersection performance results for the AM peak and PM peak, respectively. **Figure 14-1** shows the Mitigation Scenario intersection LoS results. Detailed intersection performance results showing information for each turning movement are provided in **Appendix B**. The intersection performance results indicate that:

- All intersections operate satisfactorily at LOS C or better in all modelled time periods.
- The intersection upgrade at Tincogan Street / Dalley Street results in an LOS B during the AM peak, improving from the LOS F and E in the Do Minimum and Preferred Option performance respectively.
- Tincogan Street / Stuart Street performs at LOS B after the roundabout upgrade, improving from the LOS D results in all prior scenarios.
- At Burringbar Street / Dalley Street, the intersection performance improves from LOS D and F in the Do Minimum and Preferred Options respectively to LOS C in the Mitigation Scenario.

Table 14-5 2032 Mitigation Scenario AM peak intersection performance

Intersection	2032 Mitigation Scenario AM peak							
	8:00am-9:00am				9:00am-10:00am			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1510	21	B	18	1407	16	B	17
Tincogan St / Gordon St	908	9	A	5	936	6	A	1
Tincogan St / Dalley St	965	26	B	5	992	21	B	6
Tincogan St / Stuart St	812	18	B	6	858	10	A	7
Tincogan St / Station St	817	2	A	4	943	4	A	4
Woolworths carpark / Station Street	951	3	A	3	1111	6	A	5
Burringbar Street / River Terrace	725	27	B	7	571	40	C	8
Burringbar St / Dalley St	826	10	A	2	578	32	C	2
Burringbar St / Stuart St	210	16	B	9	202	21	B	10
Burringbar St / Station St	1191	19	B	10	1156	30	C	10
Argyle St / Station St	2021	9	A	13	2025	9	A	11
Dalley St / Whian St	737	18	B	15	600	37	C	11
Stuart St / Whian St	109	3	A	1	132	2	A	1
Jubilee Ave / Fern St	1568	15	B	13	1356	9	A	9
Stuart St / Fern St	934	15	B	3	867	12	A	6

Table 14-6 2032 Mitigation Scenario PM peak intersection performance

Intersection	2032 Mitigation Scenario PM peak							
	3:00pm-4:00pm				4:00pm-5:00pm			
	Volume (veh)	Delay (s)	LoS	QL (veh)	Volume (veh)	Delay (s)	LoS	QL (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	844	11	A	11	805	11	A	11
Tincogan St / Gordon St	487	5	A	3	541	13	A	2
Tincogan St / Dalley St	565	26	B	3	567	37	C	6
Tincogan St / Stuart St	560	21	B	6	592	16	B	5
Tincogan St / Station St	652	4	A	3	707	4	A	3
Woolworths carpark / Station Street	1069	3	A	3	1088	3	A	4
Burringbar Street / River Terrace	496	35	C	7	430	17	B	6
Burringbar St / Dalley St	524	32	C	2	423	16	B	3
Burringbar St / Stuart St	231	23	B	14	193	21	B	10
Burringbar St / Station St	1259	29	C	10	1053	20	B	10
Argyle St / Station St	1983	9	A	6	1853	8	A	6
Dalley St / Whian St	567	18	B	12	479	26	B	13
Stuart St / Whian St	30	2	A	1	16	2	A	0
Jubilee Ave / Fern St	1492	24	B	10	1274	5	A	9
Stuart St / Fern St	974	11	A	6	781	5	A	4

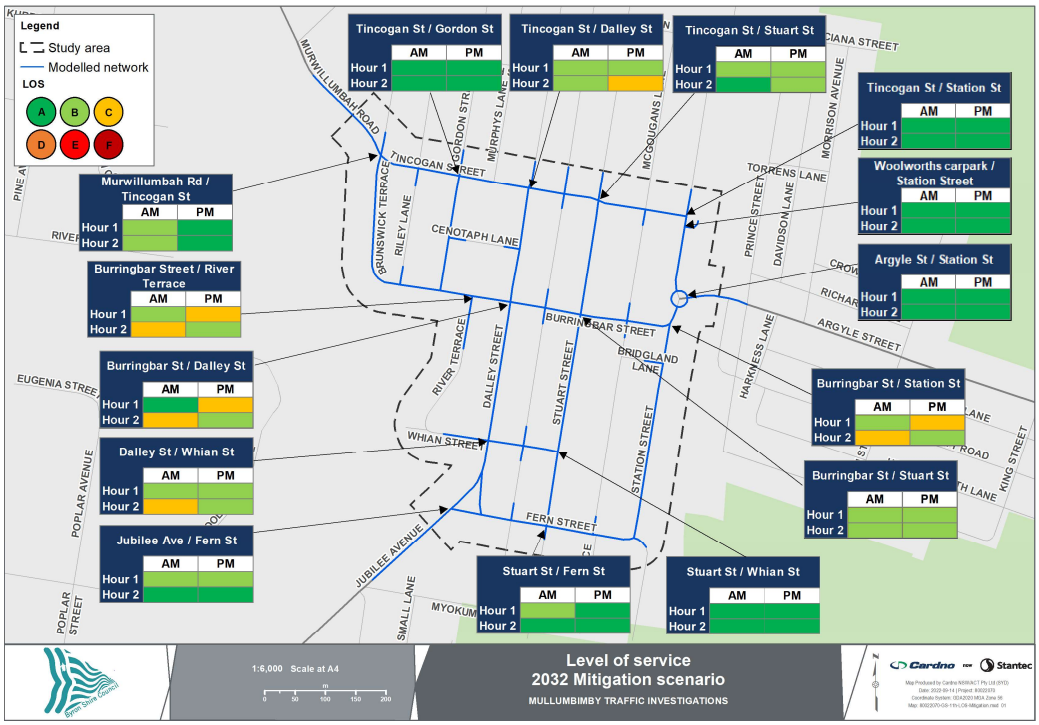


Figure 14-1 2032 Mitigation Scenario intersection level of service

14.6.3 Mitigation Scenario travel times

Table 14-7 to **Table 14-10** show the 2032 Mitigation Scenario travel times and average speeds for each two-hour peak on the travel time routes used for the Base Model validation and the main heavy vehicle routes. A comparison to the 2032 Preferred Option and Do Minimum model has also been provided. The results indicate:

- Travel times on Tincogan Street are reduced in the Mitigation Scenario when compared to the Preferred Option and Do Minimum scenarios. This is because the two upgraded roundabouts allow for vehicles to turn right from Tincogan Street without long delays while waiting for a gap in traffic.
- Travel times on Dalley Street are reduced by up to 45 seconds in both peak periods with the introduction of the Tincogan Street / Dalley Street and Burringbar Street / Dalley Street roundabouts.
- Travel times on Burringbar Street increase in the eastbound direction by up to 39 seconds in both peak periods with the Mitigation Scenario. This is because vehicles heading eastbound at the Burringbar Street / Dalley Street roundabout have to give way to northbound vehicles.
- Travel times on Station Street are similar in the southbound direction during the AM peak. Northbound travel times in the AM peak are improved, particularly in the second hour due to improved performance on Burringbar Street in the Mitigation Scenario.
- The heavy vehicle route performance is improved between Argyle Street and Murwillumbah Road under the Mitigation Scenario. This is because of the intersection upgrades provided along Tincogan Street in the Mitigation Scenario.
- Travel times for heavy vehicles are generally improved between Jubilee Avenue and Murwillumbah Road northbound under the Mitigation Scenario, with one exception of an increase by 3 seconds in the AM peak. The delay in the first hour is due to vehicles giving way at the upgraded Burringbar Street / Dalley Street roundabout. Southbound travel times are increased in the Mitigation Scenario due to heavy vehicles needing to give-way at the western approach of the Burringbar Street / Dalley Street roundabout.
- Heavy vehicles travelling northbound from Jubilee Avenue to Argyle Street experience additional delays in the Mitigation Scenario. This is due to additional vehicles travelling on Station Street to head northbound and avoid the new Burringbar Street roundabout, adding to the congestion on Station Street. Travel times in the southbound direction are slightly improved compared to the Preferred Option.

Table 14-7 2032 Mitigation Scenario AM peak travel times and average speeds

Route	Dir.	2032 Mitigation Scenario AM peak			
		Travel time (mm:ss)		Average speed (km/hr)	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	01:42	01:23	26	32
	WB	01:12	01:12	37	37
Dalley Street	NB	01:09	01:03	27	30
	SB	01:07	01:04	28	29
Burringbar Street	EB	03:00	03:14	16	15
	WB	02:09	02:17	23	21
Station Street	NB	02:31	02:55	19	17
	SB	01:44	01:31	29	33
HV Mitigation Scenario - Argyle St to Murwillumbah Rd	WB	01:54	01:55	40	39
HV Mitigation Scenario - Murwillumbah Rd to Argyle St	EB	02:22	02:04	32	37
HV Mitigation Scenario - Jubilee Ave to Murwillumbah Rd	NB	02:58	02:48	34	36
HV Mitigation Scenario - Jubilee Ave to Argyle St	NB	03:50	04:13	25	22
HV Mitigation Scenario - Argyle St to Jubilee Ave	SB	02:49	02:40	33	35
HV Mitigation Scenario - Murwillumbah Rd to Jubilee Ave	SB	04:10	03:54	24	26

Table 14-8 2032 Mitigation Scenario PM peak travel times and average speeds

Route	Dir.	2032 Mitigation Scenario PM peak			
		Travel time (mm:ss)		Average speed (km/hr)	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	01:32	01:22	29	33
	WB	01:11	01:09	38	39
Dalley Street	NB	01:10	00:42	26	44
	SB	01:12	01:22	26	23
Burringbar Street	EB	03:05	02:46	16	18
	WB	02:07	02:01	23	24
Station Street	NB	03:41	02:32	13	19
	SB	01:57	01:38	26	31
HV Mitigation Scenario - Argyle St to Murwillumbah Rd	WB	01:50	01:47	41	42
HV Mitigation Scenario - Murwillumbah Rd to Argyle St	EB	02:10	02:01	35	38
HV Mitigation Scenario - Jubilee Ave to Murwillumbah Rd	NB	02:49	02:43	35	37
HV Mitigation Scenario - Jubilee Ave to Argyle St	NB	04:42	03:36	20	26
HV Mitigation Scenario - Argyle St to Jubilee Ave	SB	03:00	02:38	31	35
HV Mitigation Scenario - Murwillumbah Rd to Jubilee Ave	SB	04:03	03:13	25	31

Table 14-9 2032 Mitigation Scenario AM peak travel time comparison

Route	Dir.	Travel time (mm:ss)			
		Compared to the 2032 Do Minimum		Compared to the 2032 Preferred Option	
		8:00am-9:00am	9:00am-10:00am	8:00am-9:00am	9:00am-10:00am
Tincogan St	EB	-00:14	-00:07	-00:10	-00:13
	WB	-00:04	-00:18	-00:03	-00:14
Dalley Street	NB	-00:45	-00:30	-00:18	-00:33
	SB	-00:13	-00:12	-00:15	-00:10
Burringbar Street	EB	+00:32	+00:16	+00:03	+00:02
	WB	+00:06	-00:05	-00:07	-00:22
Station Street	NB	-00:04	-00:30	+00:00	-00:24
	SB	+00:03	-00:02	+00:08	+00:01
HV Mitigation Scenario - Argyle St to Murwillumbah Rd	WB	-	-	-00:14	-00:23
HV Mitigation Scenario - Murwillumbah Rd to Argyle St	EB	-	-	-00:39	-00:08
HV Mitigation Scenario - Jubilee Ave to Murwillumbah Rd	NB	-	-	+00:03	-00:23
HV Mitigation Scenario - Jubilee Ave to Argyle St	NB	-	-	+00:05	+00:37
HV Mitigation Scenario - Argyle St to Jubilee Ave	SB	-	-	-00:18	-00:36
HV Mitigation Scenario - Murwillumbah Rd to Jubilee Ave	SB	-	-	+00:27	-00:01

Table 14-10 2032 Mitigation Scenario PM peak travel time comparison

Route	Dir.	Travel time (mm:ss)			
		Compared to the 2032 Do Minimum		Compared to the 2032 Preferred Option	
		3:00pm-4:00pm	4:00pm-5:00pm	3:00pm-4:00pm	4:00pm-5:00pm
Tincogan St	EB	-00:24	-00:06	-00:10	-00:04
	WB	-00:00	-00:12	-00:00	-00:10
Dalley Street	NB	-00:42	-00:08	-00:33	-00:03
	SB	-00:43	-00:03	-00:36	-00:04
Burringbar Street	EB	-00:04	-00:07	+00:39	+00:01
	WB	-00:13	-00:10	-00:04	-00:35
Station Street	NB	-00:06	+00:08	-00:31	+00:14
	SB	-00:01	-00:01	-00:05	+00:00
HV Mitigation Scenario - Argyle St to Murwillumbah Rd	WB	-	-	-00:38	-00:12
HV Mitigation Scenario - Murwillumbah Rd to Argyle St	EB	-	-	-00:05	-00:17
HV Mitigation Scenario - Jubilee Ave to Murwillumbah Rd	NB	-	-	-00:08	-00:33
HV Mitigation Scenario - Jubilee Ave to Argyle St	NB	-	-	+01:25	+00:16
HV Mitigation Scenario - Argyle St to Jubilee Ave	SB	-	-	-00:21	-00:27
HV Mitigation Scenario - Murwillumbah Rd to Jubilee Ave	SB	-	-	+00:25	+00:04

15 Concept plans

[To be provided in the Final Report.]

16 Conclusion

This report documents the development and results of the microsimulation model of the Mullumbimby town centre. The purpose of this study was to assess the impact of four proposed heavy vehicle routes on the operation of the network up in the forecast year of 2032. After the preliminary modelling and discussion with Council, a Preferred Option was selected by combining the strengths of two different options. For all scenarios, two peaks were modelled to capture typical weekday operation:

- AM Peak (8:00am – 10:00am)
- PM Peak (3:00pm – 5:00pm)

A summary of the main findings is presented below.

Existing Base Model

- In the Base Model, priority-controlled intersections of Tincogan Street / Dalley Street, Dalley Street / Whian Street and Burringbar Street / Dalley Street experienced high delays (LOS D or worse) from vehicles attempting to turn right as they wait to find a gap in traffic.

Future Models

- Intersection performance worsens between the 2022 Base Model and the 2032 Do Minimum model. Tincogan Street / Dalley Street and Tincogan Street / Stuart Street experience high delays due to the change in priority rules to favour the east and west movements.
- All scenarios produced zero unreleased vehicles, indicating that the network is able to cater for the projected demand in 2032.
- From a safety perspective, the inclusion of a pedestrian crossing on Tincogan Street should be placed at the mid-block instead of at the intersection of Tincogan Street / Dalley Street. From a traffic performance perspective, both options are acceptable but mid-block will impact general traffic the least.

Options Models

- The network statistics between each Option showed that while VKT remained similar, VHT increased with Options 2 and 3 due to the longer travel routes for heavy vehicles along with more travel time in reduced speed areas.
- General vehicle travel times showed that Tincogan Street and Dalley Street performed best under Option 4. Options 2 and 4 generally provided the quickest travel times on Burringbar Street. Northbound travel times for general traffic on Station Street are highest with Option 2. Southbound travel times remain similar across Options.
- Heavy vehicle travel times were quickest under Option 2 for most routes, with the exception of northbound from Jubilee Avenue to Argyle Street under Option 3.
- Option 2 provided the safest results in terms of the Safe System Assessment. Option 3 showed similar results to Option 2, and Option 4 identified a safe route for heavy vehicles travelling from Murwillumbah Road to Jubilee Avenue.
- The three most relevant Masterplan action items from the *Our Mullumbimby Masterplan* were found to be impacted by Options 2 and 4.

Preferred Option and Mitigation Scenario

- A Preferred Option was developed by combining the best performing sections of Option 2 and Option 4, resulting in the least safety impacts and impacts to the Masterplan initiatives while providing desirable traffic performance. The Preferred Option showed improved network, intersection and travel time performance compared to the other options.
- All options including the Preferred Option showed that at least three intersections would fail by 2032. The Mitigation Scenario was developed to include roundabout upgrades at Tincogan Street / Dalley Street, Tincogan Street / Stuart Street and Burringbar Street / Dalley Street.
- The traffic performance under the Mitigation Scenario was satisfactory to cater for the 2032 traffic demands, and showed general improvements compared to the Do Minimum and Preferred Option scenarios.

Considering traffic performance, safety considerations and Council's vision for the Mullumbimby town centre, the Preferred Option will maximise the benefits of defining heavy vehicle routes while minimising the impact to other road users. Roundabout upgrades to three intersections as tested in the Mitigation Scenario will be required in order to ensure that intersections will perform satisfactorily in 2032.

APPENDIX A

BASE MODEL DEVELOPMENT REPORT

Cardno now Stantec

Base Model Development Report

Mullumbimby Traffic Investigations

80022070

Prepared for
Byron Shire Council

25 August 2022

Cardno
now
Stantec

Contact Information

Stantec Australia Pty Ltd
Cardno

Level 9 – The Forum
203 Pacific Highway
St Leonards NSW 2065
PO Box 19

www.cardno.com
www.stantec.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

Author(s):

Karan Khanna
Transport Modeller

Approved By:

Siavash Shahsavaripour
Transport Modelling Team Leader

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Appendices

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Figures

1 Introduction

1.1 Background

Mullumbimby is located within the Byron Shire local government area, on the Northern Rivers region of New South Wales. Situated 120 kilometres south of Brisbane and 630 kilometres from Sydney, Mullumbimby has a strong rural town identity. The M1 Motorway is located approximately four kilometres east of the town, and provides connectivity to surrounding regions on the north coast of New South Wales and Queensland. The regional context of Mullumbimby is shown in **Figure 1-1**.

The Our Mullumbimby Masterplan is a high-level road map which sets out the aspirations of Byron Shire Council and the community for Mullumbimby over the next ten years. Adopted by Council in December 2019, the Masterplan provides a direction for the long-term future of the township and its surrounds with a focus on preserving the town's unique character and enhancing environmental, economic and social sustainability.

Several projects outlined in the Masterplan are now underway or are in the design and planning process across Mullumbimby, including the Stuart Street Green Spine project, the Talking Street trial and Tincogan Street traffic calming and intersection priority changes. However, the Masterplan does not specify any heavy vehicle routes through the town centre. Treatments for the road network in Mullumbimby that are outlined in the Masterplan will ultimately be dependent on the heavy vehicle route selected. Additionally, the community has highlighted preferences for additional transport outcomes in Mullumbimby, such as bus stop locations, satellite parking areas and pedestrian crossings on Tincogan Street. Therefore, Council has identified the need for additional investigation to successfully implement the aspirations of the Masterplan to Council's and the community's expectations.

Council has commissioned Cardno to undertake a traffic and transport study of the Mullumbimby town centre. The study aims to develop a preferred route for heavy vehicles through the town and understand the impacts on the transport network on a broader scale, while promoting Mullumbimby's unique local character and improving safety and accessibility for all road users, including pedestrians and cyclists. The traffic and transport study will employ transport modelling to identify existing transport network issues, model and quantify the impacts of alternative heavy vehicle routes through the town centre, model the interactions between all users of the transport network, and determine preferred intersection arrangements.

1.2 Project objectives

The objectives of the Mullumbimby town centre traffic and transport study can be summarised as follows:

- Develop a local area traffic model of the Mullumbimby town centre to replicate existing traffic conditions across the network and identify current issues, performance deficiencies and congestion hotspots
- Model alternative heavy vehicle traffic routes through the town centre to link traffic from the Pacific Motorway to Main Arm and Coolamon Scenic Drive (south)
- Assess the layout of the Tincogan Street / Dalley Street and Tincogan Street / Stuart Street intersections
- Assess the implications of a zebra crossing on Tincogan Street
- Analyse each heavy vehicle route, compare their advantages and disadvantages and select a preferred route from the perspectives of safety, traffic performance, infrastructure, land-use suitability and implications on the Mullumbimby Masterplan
- Develop concept plans and layout maps for the Tincogan Street intersections and the preferred heavy vehicle route
- Prepare the Traffic and Transport Assessment Report, summarising the outcomes of the study.

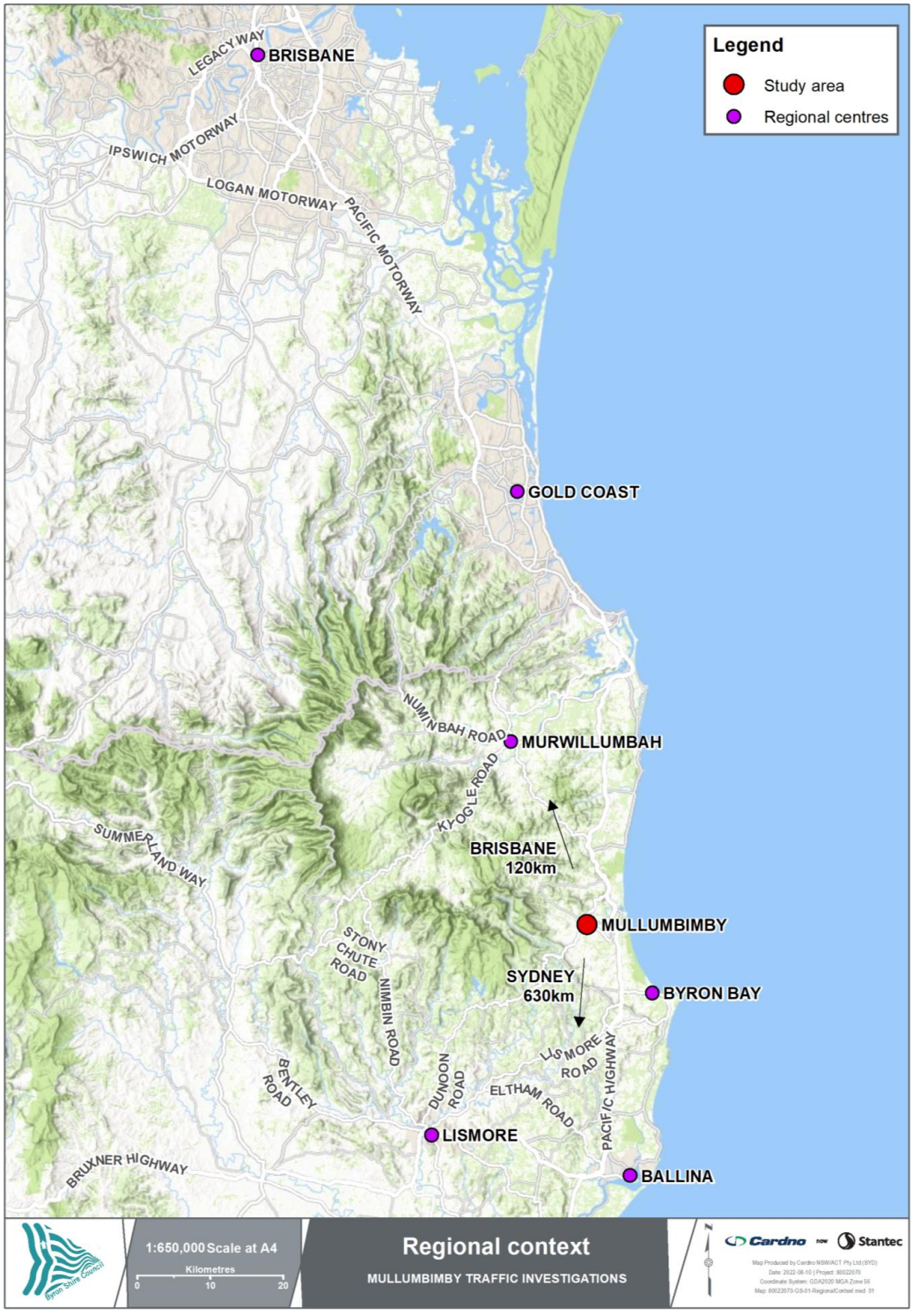


Figure 1-1 Regional context

1.3 Scope of works

Cardno's scope of works for the transport modelling services include:

- Review and analyse survey data and background documentation
- Develop a 2022 Base Model to capture existing conditions on a typical weekday in the AM peak and PM peak, and calibrate and validate the Base Model in accordance with the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013)
- Prepare the Base Model Development Report (this report) in accordance with *Technical Direction 2017/001: Operational Modelling and Reporting Structure* (Roads and Maritime Services, 2017)
- Assess and estimate the future year traffic demands to form the basis of the future-year assessment based on:
  - Historical growth data provided by Council
  - Nominal growth rates agreed with Council
  - First principles traffic generation or data from previous studies for the new developments of 1660 Coolamon Scenic Drive and 156 Stuart Street (Lot 22).
- Prepare the Demand Estimation Technical Memorandum to summarise the future demand estimation procedure and results
- Develop the following future year scenarios and extract the modelling results:
  - Do Nothing: Existing road network with projected traffic growth
  - Options 1-4: Network including different heavy vehicle routes, intersection upgrades and other town centre improvements
  - Preferred Option: Refinement of the preferred option from Options 1-4 with small modifications/minor tweaks to identify simple improvements.
- Develop and assess the Preferred Option scenario for the opening year
- Develop and assess two design options for Tincogan Street / Dalley Street and Tincogan Street / Stuart Street intersections
- Prepare the Traffic and Transport Assessment Report.

1.4 Study area

The study area is centred on the Mullumbimby town centre. The town centre consists of low-density residential developments, local centre commercial and retail facilities, and mixed-use land uses.

The primary access links to the study area are via Argyle Street to the east, Jubilee Avenue to the south, and Murwillumbah Road to the west. Tincogan Street, Station Street, Stuart Street, Dalley Street, Fern Street and Burringbar Street are the major links within the study area. Large amounts of on-street angle parking and several pedestrian crossings exist on Dalley Street, Stuart Street and Burringbar Street, adjacent to the commercial and retail developments.

Figure 1-2 shows the study area and modelled road network.

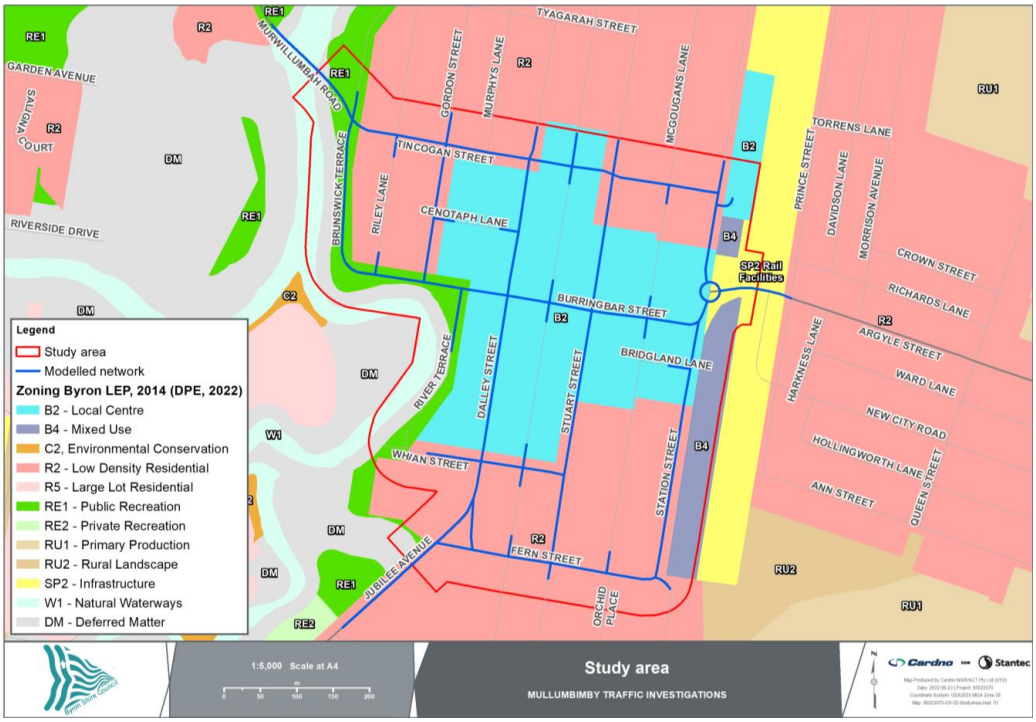


Figure 1-2 Study area

1.5 Stakeholders

Stakeholders for the project include:

> Byron Shire Council

1.6 Report outline

The structure of this report is outlined below:

> **Section 1 – Introduction**: Outline of the background, project objectives, scope of works and study area

> **Section 2 – Existing conditions**: Discussion of the existing network operations, traffic survey scope for intersection counts, queue lengths and travel time

> **Section 3 – Model assumptions**: Discussion of the assumptions underlying the development of the Base Model and explanation of the modelling methodology

> **Section 4 – Model stability**: Statistical analysis of the stability of the model

> **Section 5 – Model calibration and validation**: Summary of the Base Model calibration and validation

> **Section 6 – Model limitations**: Discussion of the limitations of the model that may affect the future-year modelling, and suggestions for accounting for these limitations in the future-year model outputs

> **Section 7 – Conclusion**: Summary of the main outcomes of the Base Model development.

2 Existing conditions

This section provides an overview of the existing conditions in and around the study area. It includes a description of the traffic survey data collected for the project, congestion locations, site visit findings and existing conditions analysis.

2.1 Traffic data sources

The traffic data used to develop the models was compiled from several sources, including:

- Classified intersection counts
- Automatic tube counts
- Travel time data
- Origin-destination surveys

2.1.1 Classified intersection counts

Classified intersection counts (CICs) record vehicle volumes for all movements at an intersection. These are compared to the modelled turn volumes to ensure that the Base Model accurately replicates existing traffic movements.

Trans Traffic Survey conducted classified intersection counts in June 2022 for the following dates and times:

- Friday 17 June 2022
  - AM peak: 6:00am – 10:00am
  - PM peak: 3:00pm – 7:00pm

Data was recorded in 15-minute intervals. The data was classified into the following vehicle types:

- Light vehicles
- Heavy vehicles
- Cyclists
- Pedestrians.

Table 2-1 lists the intersections for which CICs were collected. **Figure 2-1** shows the CIC locations.

Table 2-1 Intersections for classified intersection count surveys

#	Intersection	Type
1	Tincogan St / Murwillumbah Rd	Priority
2	Tincogan St / Gordon St	Priority
3	Tincogan St / Dalley St	Priority
4	Tincogan St / Stuart St	Priority
5	Tincogan St / Station St	Priority
6	Station St / Woolworths carpark	Priority
7	Burringbar St / River Terrace	Priority
8	Burringbar St / Dalley St	Priority
9	Burringbar St / Stuart St	Priority
10	Burringbar St / Station St	Priority
11	Station St / Argyle St	Roundabout
12	Dalley St / Whian St	Priority
13	Whian St / Stuart St	Priority
14	Jubilee Ave / Fern St	Priority
15	Fern St / Stuart St	Priority

Figure 2-1 Locations of classified intersection count and automatic tube count surveys

2.1.2 Automatic tube counts

Automatic tube counts (ATC) use pneumatic tubes across the road that register vehicle movement. They are capable of measuring traffic volumes, vehicle types and speeds. ATCs are typically used to record data over an extended period of time, such as a week or month.

ATCs were collected at four locations in the study area. The data was collected for a one-week period from Wednesday 15 June 2022 to Tuesday 21 June 2022. **Table 2-2** lists the locations where ATC surveys were collected, and **Figure 2-1** shows the ATC locations.

Table 2-2 Locations for automatic tube count surveys

ID	Location	Survey dates	Survey time
1	Jubilee Avenue south of Fern Street	Wednesday 15 June 2022 – Tuesday 21 June 2022	24 hours
2	Dalley Street between Tincogan Street and Burringbar Street		
3	Stuart Street between Tincogan Street and Burringbar Street		
4	Station Street between Tincogan Street and Argyle Street		
5	Burringbar Street between Stuart Street and Station Street		
6	Argyle Street east of Station Street		
7	Stuart Street between Whian Street and Burringbar Street		
8	River Terrace between Whian Street and Burringbar Street		
9	Station Street between Fern Street and Burringbar Street		
10	Murwillumbah Road west of Brunswick Terrace		
11	Tincogan Street between Dalley Street and Stuart Street		
12	Brunswick Terrace between Riley Lane and Tincogan Street		

2.1.3 Origin-destination surveys

Origin-destination (OD) surveys record the volumes of vehicles travelling between each pair of origin and destination zones in a network. OD survey data is used to develop trip demands between different locations in the study area.

An OD survey was conducted at the same date and times as the CIC survey. The survey recorded the movements of vehicles between four external entry and exit points and four internal waypoints. **Table 2-3** lists and **Figure 2-2** shows the surveyed OD points.

Table 2-3 OD survey points

ID	Point	Location
1	Murwillumbah Road External	External
2	Station Street External	
3	Argyle Street External	
4	Jubilee Avenue External	
5	Stuart Street between Tincogan Street and Burringbar Street	Internal waypoint
6	Burringbar Street between Dalley Street and Stuart Street	
7	Dalley Street between Burringbar Street and Fern Street	
8	Station Street between Bridgland Lane and Fern Street	

Figure 2-2 OD survey points

Cardno also extracted OD data from the TomTom database. The data was extracted for the same date and times as when the classified intersection counts were performed.

The study area was divided into 14 internal zones and 8 external entry and exit points to capture a detailed view of vehicle origins and destinations in the study area. **Table 2-4** lists and **Figure 2-3** shows the TomTom OD zones.

Table 2-4 TomTom OD zones

ID	Zone	Location
1	Fern Street	Internal
2	Dalley Street (south of Burringbar)	
3	Lane between Stuart and Dalley	
4	Stuart Street (south of Burringbar)	
5	McGougans Lane (south of Burringbar)	
6	Station Street (south of Burringbar)	
7	Dalley Street (north of Burringbar)	
8	Tincogan Street (north of Burringbar)	
9	Stuart Street (north of Burringbar)	
10	McGougans Lane (north of Burringbar)	
11	Station Street (north of Burringbar)	
12	Brunswick Terrace	
13	Tincogan Street and Gordon Street	
14	River Terrace	
15	Tyagarah Street External	External
16	Dalley Street External	
17	McGougans Lane External	
18	Station Street External	
19	Argyle Street External	
20	Murwillumbah Road External	
21	Stuart Street External	
22	Jubilee Avenue External	

Figure 2-3 TomTom OD zones

Cardno performed a comparison of the trip distributions from the OD survey and the TomTom OD data. **Table 2-5** and **Table 2-6** show the external zone trip distributions for the AM peak and PM peak, respectively.

The TomTom OD data was found to sufficiently match the OD survey. As the TomTom data provided more detailed vehicle movement information, Cardno adopted the TomTom OD data for trip demand development.

Table 2-5 OD survey and TomTom OD data external zone trip distribution comparison – AM peak

AM peak - 8:00am-10:00am									
	OD survey					TomTom OD data			
	Murwillumbah Road	Station Street	Argyle Street	Jubilee Avenue		Murwillumbah Road	Station Street	Argyle Street	Jubilee Avenue
Murwillumbah Road	-	1%	72%	26%	Murwillumbah Road	-	0%	73%	27%
Station Street	23%	-	68%	9%	Station Street	0%	-	100%	0%
Argyle Street	64%	3%	-	33%	Argyle Street	35%	0%	-	65%
Jubilee Avenue	44%	2%	53%	-	Jubilee Avenue	24%	0%	76%	-

Table 2-6 OD survey and TomTom OD data external zone trip distribution comparison – PM peak

PM peak - 3:00pm-5:00pm									
	OD survey					TomTom OD data			
	Murwillumbah Road	Station Street	Argyle Street	Jubilee Avenue		Murwillumbah Road	Station Street	Argyle Street	Jubilee Avenue
Murwillumbah Road	-	4%	56%	40%	Murwillumbah Road	-	1%	65%	34%
Station Street	31%	-	48%	22%	Station Street	0%	-	63%	38%
Argyle Street	43%	7%	-	50%	Argyle Street	39%	3%	-	58%
Jubilee Avenue	39%	3%	58%	-	Jubilee Avenue	19%	0%	81%	-

2.1.4 Travel time data

Travel time data records the travel time for vehicles along particular routes and/or sections of the model. The purpose of travel time data is to ensure that the model is realistically replicating delays and driver behaviour that impact travel times along a road.

TomTom captures 3.5 million kilometres of floating car data (FCD) every day in Australia. The data is collected from a combination of TomTom devices (fleet and consumer), third-party auto original-equipment manufacturers (OEMs) and mobile devices. FCD provides a new method for measuring speeds, travel times and road performance. Probe devices in vehicles, which may be cellular phones or Global Positioning System (GPS) devices, provide average travel time data in large sample sizes per route segment. This method of data collection is advantageous to the traditional floating car method and less susceptible to being skewed by anomalous data points.

Travel time routes were selected to cover the most common and realistic journeys within the study area, including journeys on Tincogan Street, Station Street, Burringbar Street and Dalley Street. The travel time routes were divided into segments to better identify localised congestion points and driver behaviours along each route. **Table 2-7** summarises the travel time routes and segments and **Figure 2-4** shows the travel time routes.

Cardno extracted travel time data for these routes and segments from the TomTom database. The data was extracted for the same date and times as when the classified intersection counts were performed.

Table 2-7 Travel time routes and segments

Route	Direction	Segments
Tincogan Street	Eastbound	▪ Murwillumbah Road from Federation Bridge to Dalley Street ▪ Tincogan Street from Dalley Street to Station Street
	Westbound	▪ Tincogan Street from Station Street to Dalley Street ▪ Murwillumbah Road from Dalley Street to Federation Bridge
Dalley Street	Northbound	▪ Dalley Street from Fern Street to Burringbar Street ▪ Dalley Street from Burringbar Street to Tincogan Street
	Southbound	▪ Dalley Street from Tincogan Street to Burringbar Street ▪ Dalley Street from Burringbar Street to Fern Street
Station Street	Northbound	▪ Fern Street from Dalley Street to Station Street ▪ Station Street from Fern Street to Tincogan Street
	Southbound	▪ Station Street from Tincogan Street to Fern Street ▪ Fern Street from Station Street to Dalley Street
Burringbar Street	Eastbound	▪ Brunswick Terrace from Tincogan Street to River Terrace ▪ Burringbar Street from River Terrace to Stuart Street ▪ Burringbar Street from Stuart Street to Argyle Street, then Argyle Street from Station Street to Princes Street
	Westbound	▪ Argyle Street from Princes Street to Station Street, then Burringbar Street from Argyle Street to Stuart Street ▪ Burringbar Street from Stuart Street to River Terrace ▪ Brunswick Terrace from River Terrace to Tincogan Street

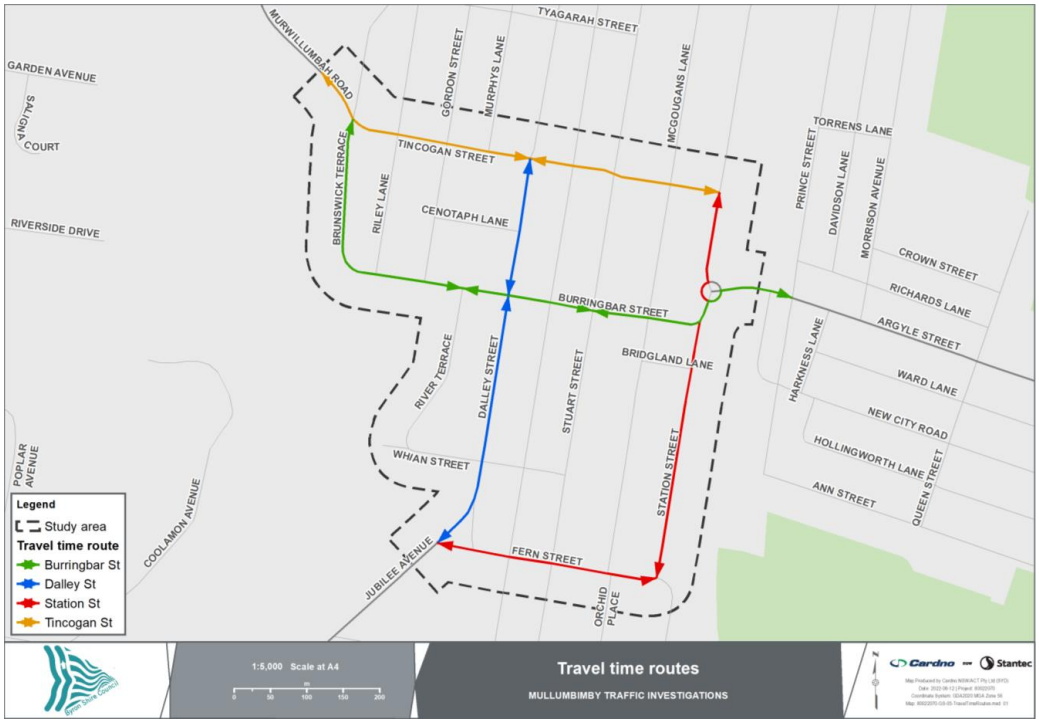


Figure 2-4 Travel time routes

2.2 Site visit and existing conditions analysis

Cardno undertook a site visit of the study area on Thursday 26 May 2022 and Friday 27 May 2022.

2.2.1 Land uses

The study area mainly consists of residential land uses around the Mullumbimby town centre along the boundary of the study area. Retail and commercial land uses can be found in the centre of the study area along Stuart Street, Burringbar Street and Dalley Street. On Station Street, a Woolworths supermarket is located north of Argyle Street and the Mullumbimby train station is to the south of Argyle Street.

2.2.2 Parking manoeuvres

Parking manoeuvres can cause delays to traffic, particularly on main roads and around popular destinations such as the shops on Stuart Street, Dalley Street, Station Street and Burringbar Street. Double-parked cars were also observed on Burringbar Street during the site visit on either side of Stuart Street. Parking turnover in these locations is also typically high which can result in more frequent delays.

It was noted during both peak periods of the site visit that the only queues observed on Burringbar Street were due to parking manoeuvres. Traffic on Burringbar Street and Stuart Street was primarily near the retail areas, with the residential ends quiet. Traffic near the shops on these streets was slow moving to search for parking spaces.

Delays associated with parking were considered where on-street parking is available within the network. These delays caused by parking manoeuvres were captured in the model by including periodic section incidents in the lane adjacent to the parking. The periodic section incident closes a portion of the lane for a length of time. The duration of all incidents was assumed to be 20 seconds with a standard deviation of 20 seconds. This accounts for the delay incurred by a vehicle performing a parallel park. The frequency of incidents was varied across the model depending on the estimated turnover rate (influenced by the parking location, permitted parking time, etc.) and the length of the parking section (number of spaces).

2.2.3 Pedestrian network

Footpaths are provided along most local roads in the study area, with the exception of on Fern Street and Whian Street. Footpaths are limited to one side of the road only in some locations such as on Stuart Street near Fern Street, Station Street south of the Mullumbimby Library and on Tincogan Street.

The majority of pedestrians were observed on Burringbar Street, Dalley Street and Stuart Street. Pedestrians were noted to cross Burringbar Street where convenient rather than at the pedestrian crossings.

2.2.4 Bicycle network

Cycleways are provided within the town centre along Stuart Street, Dalley Street and Burringbar Street. The cycleways are alongside general traffic and linemarked, which results in cyclists riding between parked cars and moving vehicles.

A limited number of cyclists were observed during the site visit, with two recorded in the AM peak and one in the PM peak. Of the AM peak cyclists, one chose to use the footpath instead of the on-road cycleway.

2.3 Congestion locations

Cardno extracted speed data from TomTom for June 2022 to assist with identifying congestion hotspots across the study area. **Figure 2-5**, **Figure 2-6**, **Figure 2-7** and **Figure 2-8** show the outputs from TomTom.

Note the following limitations of the outputs:

> The average speed on local roads is the average of both directions

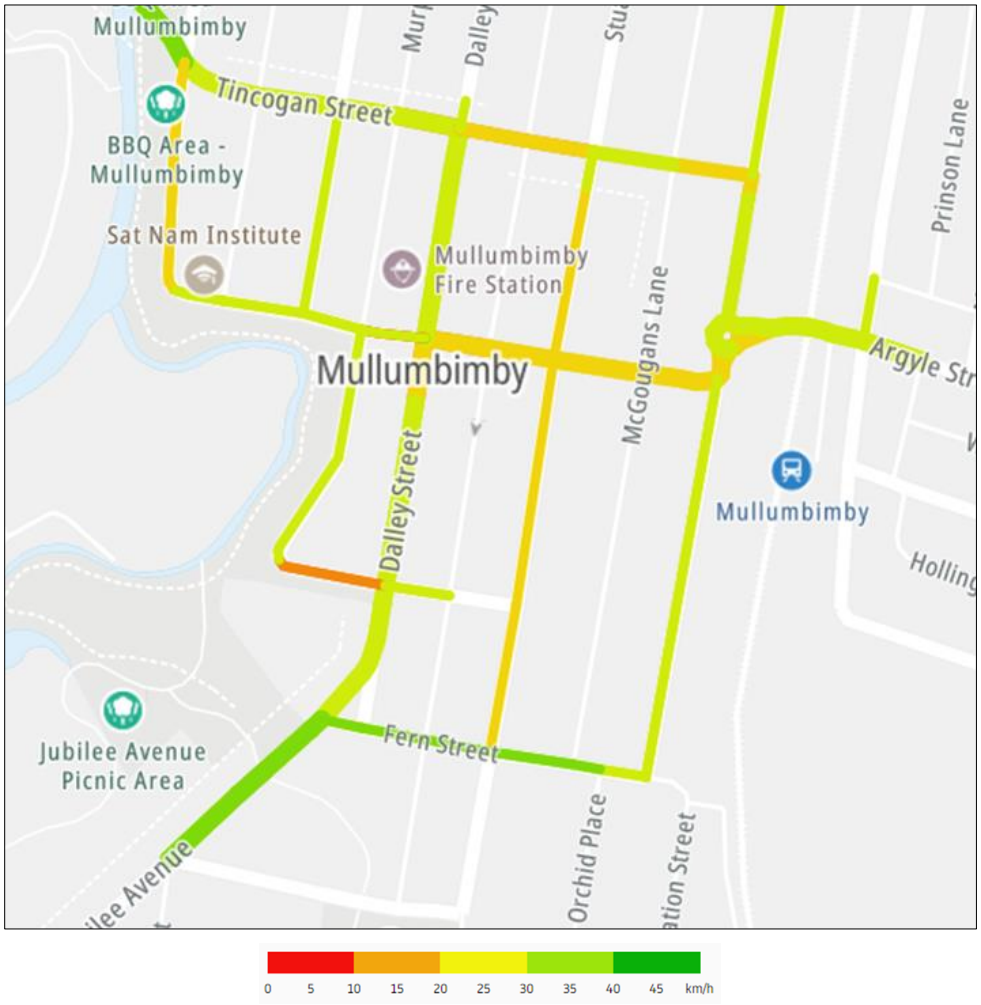


Figure 2-5 Average speeds (8:00am-9:00am)

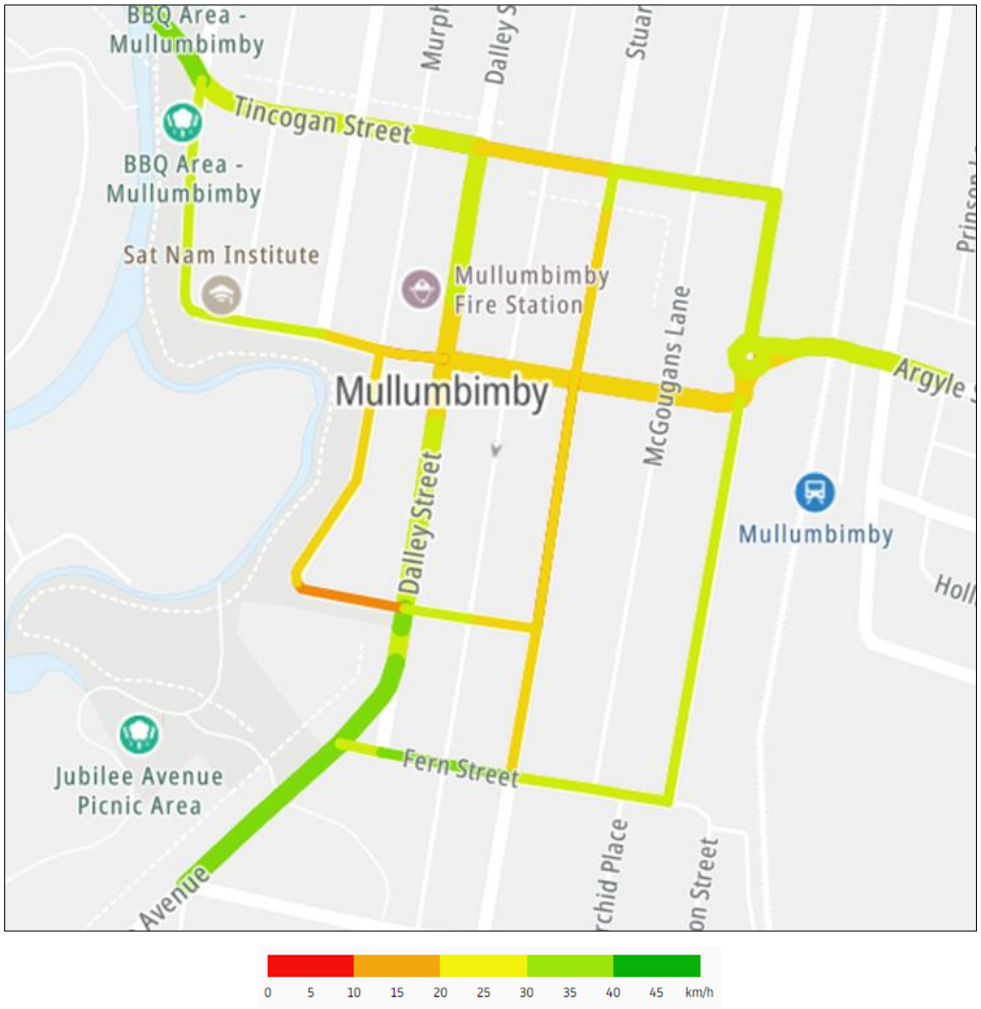


Figure 2-6 Average speeds (9:00am-10:00am)

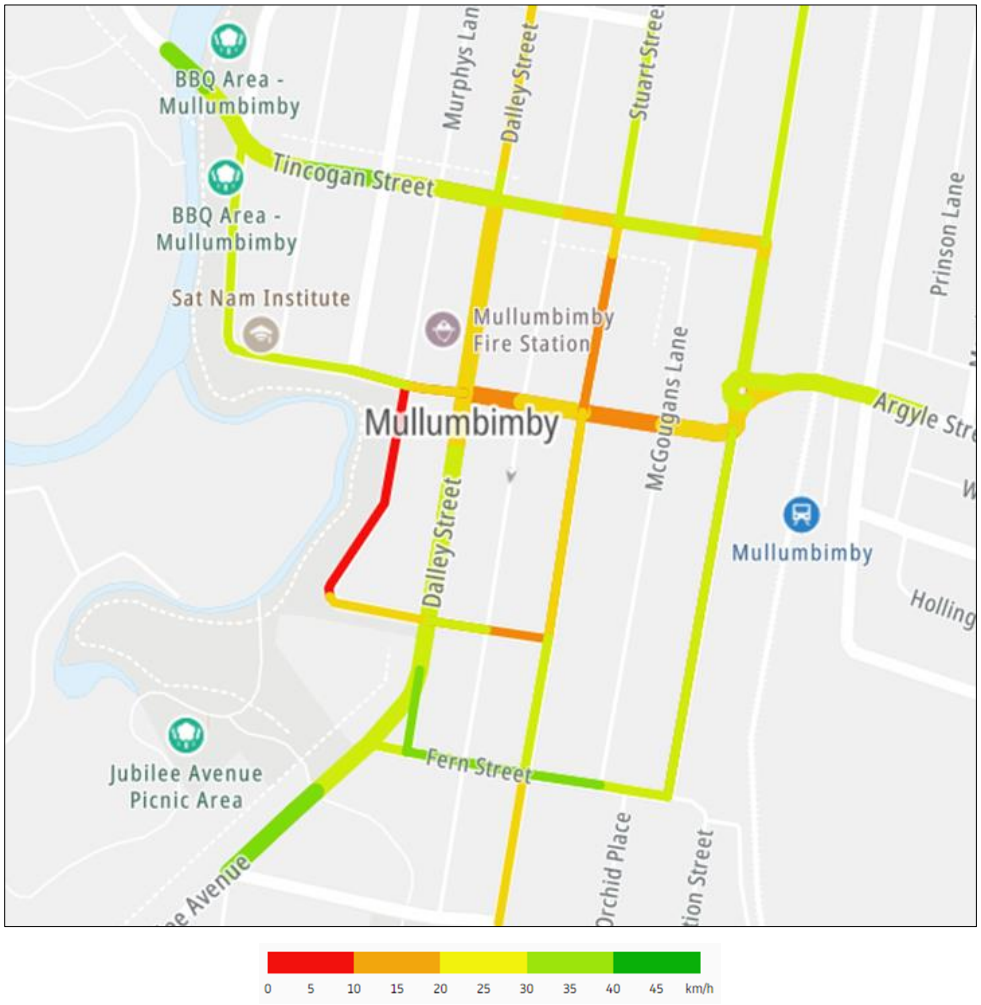


Figure 2-7 Average speeds (3:00pm-4:00pm)

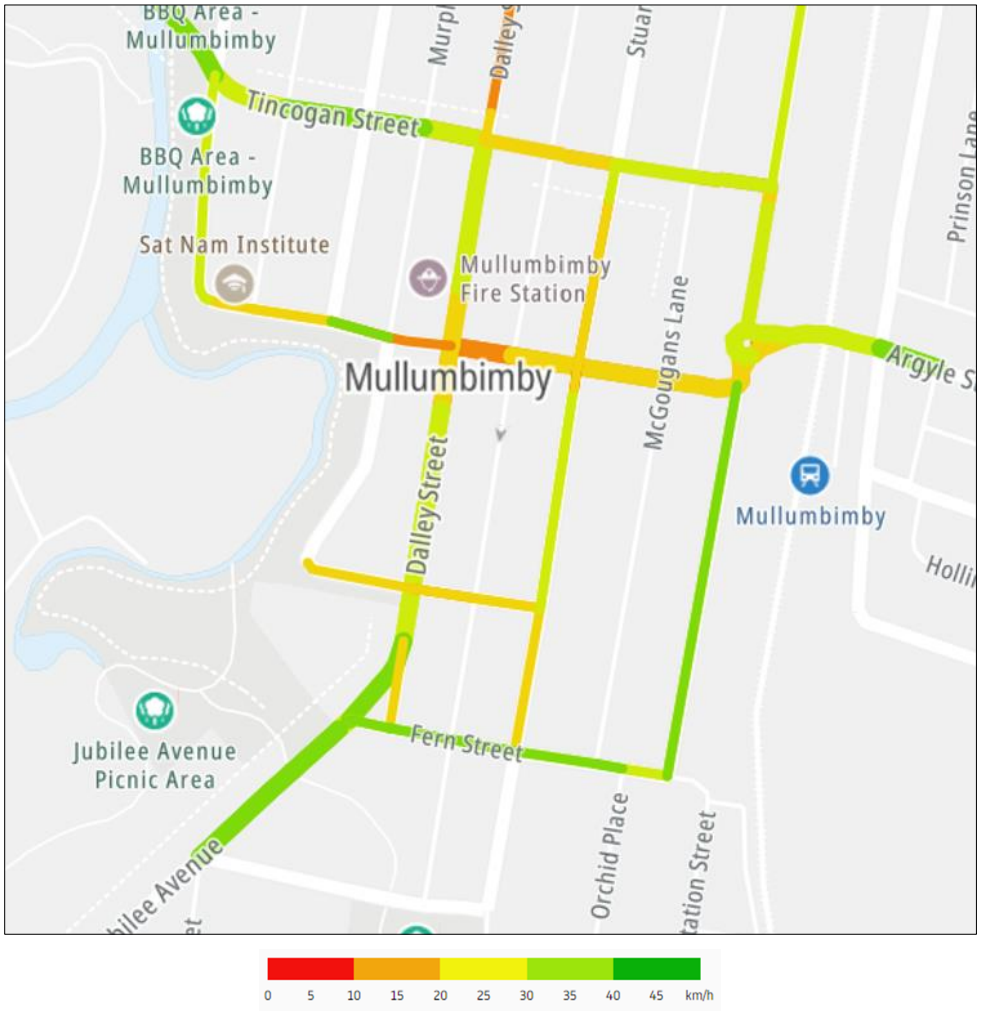


Figure 2-8 Average speeds (4:00pm-5:00pm)

3 Model assumptions

This section outlines the assumptions used in the development of the Base Model.

3.1 Modelling platform

The microsimulation network model was developed using Aimsun Next 22[1]. A microsimulation model was considered the most appropriate tool for modelling the baseline conditions as well as future infrastructure changes involving general traffic, pedestrians and public transport. Microsimulation models are capable of explicitly modelling each of these elements and quantifying the network impacts of infrastructure changes.

3.2 Network coding

The Base Model was coded based on aerial imagery from MetroMap, supplemented by site visit observations. **Figure 3-1** shows the extent of the microsimulation modelled network.

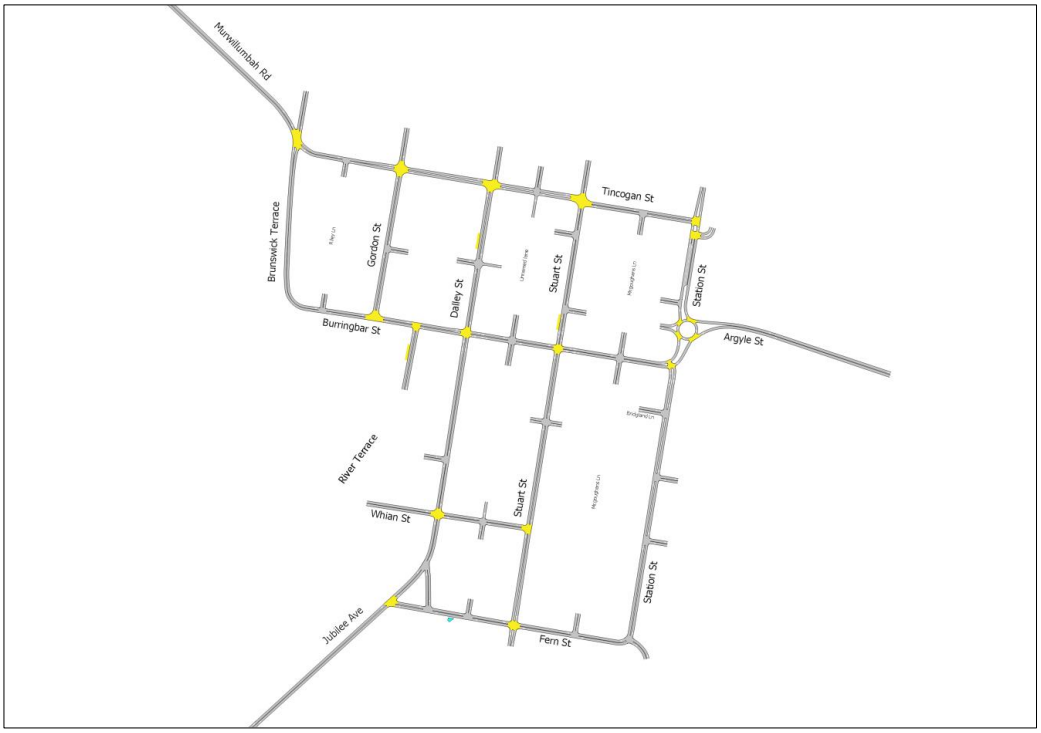


Figure 3-1 Modelled road network

3.3 Time period

The traffic peak day was determined from the automatic tube counts. It was assumed the peak day was the day with the highest traffic volume recorded across all ATC survey locations in the study area. The model provides an indication of the performance of the network during the peak day. **Figure 3-2** shows the traffic profile of the surveyed week, with the peak day highlighted. The peak day (Friday 17 June 2022) aligns with the CIC survey date.

[1] 2022-02-07 (ad1b1b9cdb x64 Python 3)

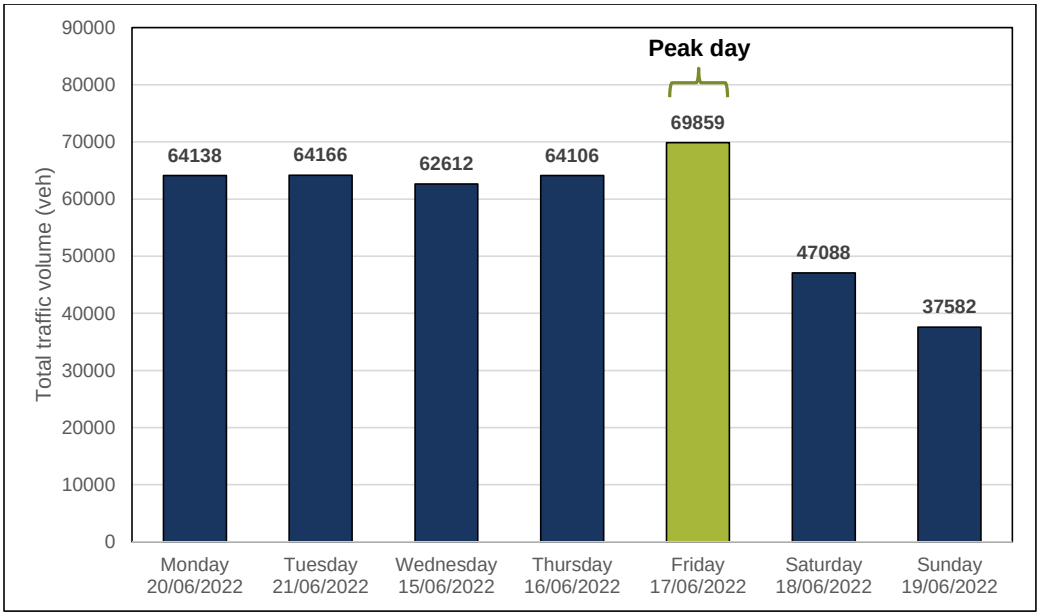


Figure 3-2 Surveyed week traffic profile

The traffic peak period was determined from the classified intersection counts. It was assumed that the peak period was the two-hour period with the highest traffic volume recorded across all intersections in the network. The model provides an indication of the performance of the network during this period in each peak.

Figure 3-3 and **Figure 3-4** show the traffic profiles for the AM peak and PM peak, respectively. The profile is recorded in 15-minute intervals with the two-hour peak period highlighted in each case.

Two hours were modelled for each peak in the microsimulation model. A half-hour warm-up was included in each peak to build up the traffic density in the model to accurately reflect the starting traffic conditions. **Table 3-1** shows the warm-up and modelled period for each peak for the microsimulation model.

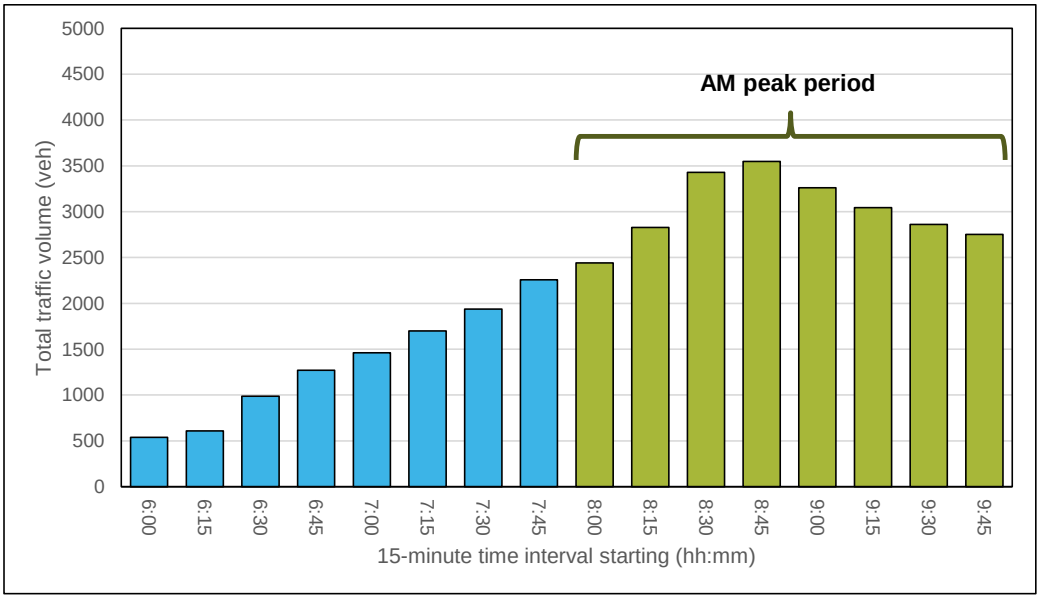


Figure 3-3 AM peak traffic profile

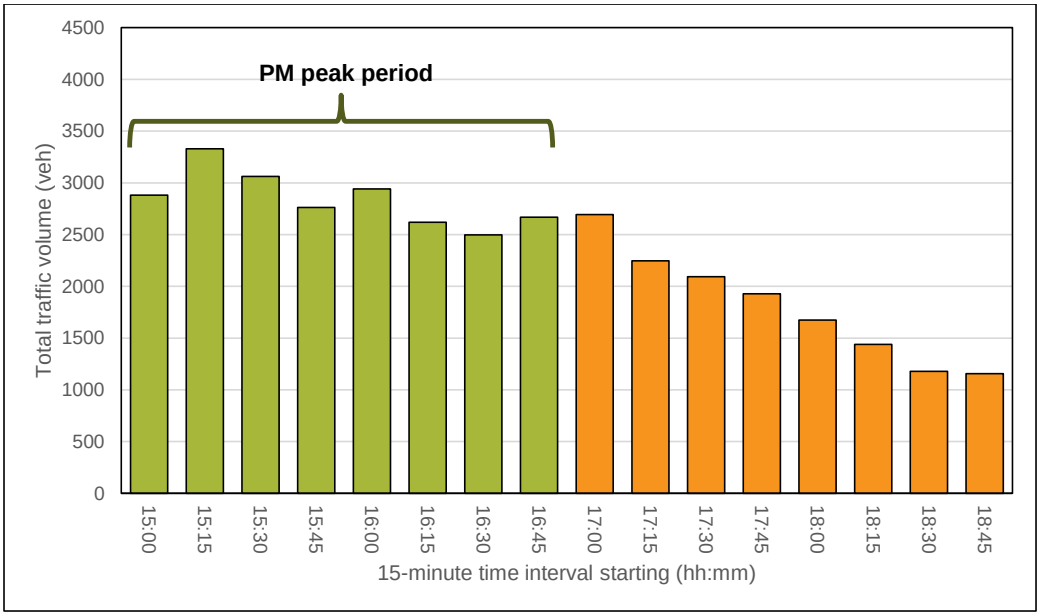


Figure 3-4 PM peak traffic profile

Table 3-1 Modelled time periods

Peak	Aimsun model time period	
	Warm-up	Peak period
AM peak	7:30am-8:00am	8:00am-10:00am
PM peak	2:30pm-3:00pm	3:00pm-5:00pm

3.4 Trip assignment

This section outlines the trip assignment types used in the microsimulation model.

Three assignment methods were used in the microsimulation modelling:

> Static assignment
> Dynamic user equilibrium
> Stochastic route choice.

These assignment methods are outlined in the following sections. Each assignment was used as the starting point for subsequent assignments.

3.4.1 Static assignment

Static assignment uses deterministic algorithms to assign traffic volumes to links in the network. Individual vehicles are not modelled, and the performance of each section is determined by the link performance function. Typically link performance functions are based on the number of vehicles assigned to a section and the section capacity, although other attributes may also be considered.

3.4.2 Dynamic user equilibrium

To assess options that impact vehicle route choice, dynamic user equilibrium (DUE) assignment was used. DUE is based on an iterative simulation process where drivers choose their routes through the network based on the travel cost, they experienced in the previous iteration. The simulation continues until a stable model environment is reached where travel times and volumes do not change significantly between iterations.

The principle of this assignment is that users will try to minimise their individual travel times by travelling on a route which they perceive to be the shortest path given the traffic conditions. To achieve a dynamic equilibrium state, the travel times of each OD pair for vehicles departing at the same time must be equal across all used routes, and less than that of a single user on any of the unused routes.

3.4.3 Stochastic route choice

The stochastic route choice (SRC) assignment is based on discrete route choice models or on a user-defined assignment. Discrete route choice models are based on discrete choice theory and emulate the decisions of users selecting paths from those that are available. This model uses the probability of choosing alternative paths from the available paths as a function of their disutility, typically influenced by travel time and/or travel cost.

The results from the SRCs were used for model calibration, validation and reporting. The SRC introduces randomness into the simulation to represent fluctuations in traffic patterns and driver behaviour. A statistical analysis of the stability of the SRC runs has been undertaken.

3.5 Vehicle types

The model includes four vehicle types:

- Light vehicles
- Rigid heavy vehicles (RHVs)
- Articulated heavy vehicles (AHVs)
- Buses.

3.5.1 Vehicle classification

Table 3-2 shows the surveyed vehicle composition from the classified intersection counts. Note that bus volumes have been coded separately in accordance with published timetables and are not included. Pedestrians are also present in the model at pedestrian crossings only.

Table 3-2 CIC surveyed vehicle composition

Peak	Hour	Light vehicles		Heavy vehicles		All vehicles
		Demand (veh)	% of total demand	Demand (veh)	% of total demand	Total demand (veh)
AM peak	8:00am-9:00am	2197	94.6%	126	5.4%	2323
	9:00am-10:00am	1961	95.5%	93	4.5%	2054
PM peak	3:00pm-4:00pm	2168	95.5%	102	4.5%	2270
	4:00pm-5:00pm	2006	97.4%	53	2.6%	2059

As rigid heavy vehicles and articulated heavy vehicles were not counted separately in the CICs, ATC data was used to classify the rigid heavy vehicle and articulated heavy vehicle demands. ATC data was collected based on the Austroads (1994) vehicle classification scheme shown in **Figure 3-5**.

It was noted that articulated heavy vehicles travelled between the major links in the study area, being Argyle Street, Jubilee Avenue, and Murwillumbah Road. The Mullumbimby town centre was only used as a thoroughfare. The proportions of heavy vehicles observed along these major links at the boundary of the study area are shown in **Table 3-3** and **Table 3-4**.

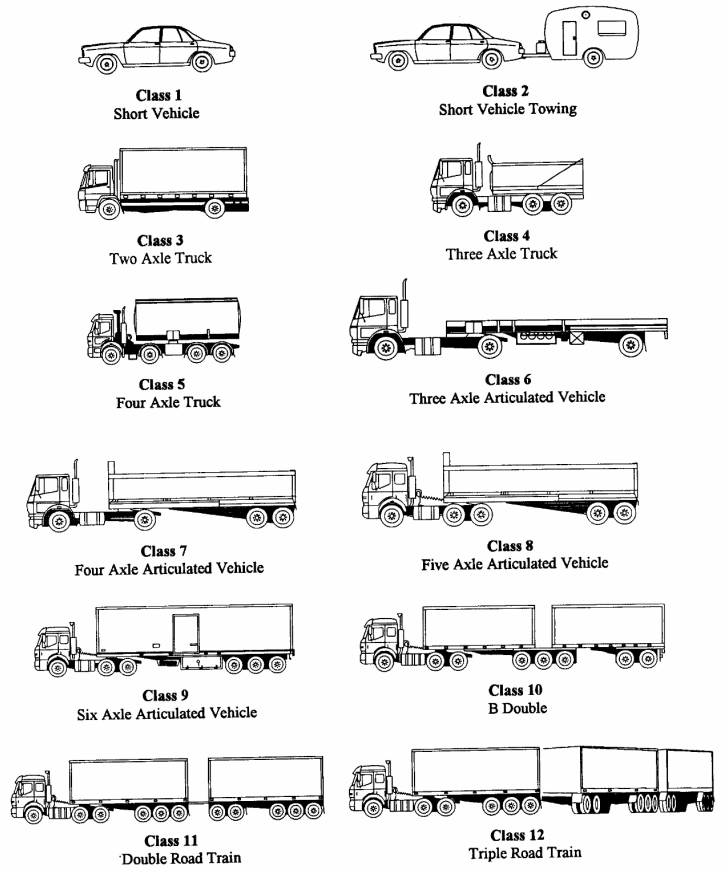


Figure 3-5 Austroads vehicle classification

Source: Austroads (1994)

Table 3-3 Heavy vehicle proportions – AM peak

	8:00am-9:00am		9:00am-10:00am	
	RHV proportion	AHV proportion	RHV proportion	AHV proportion
Argyle Street	63%	37%	74%	26%
Murwillumbah Road	76%	24%	73%	27%
Jubilee Avenue	83%	17%	78%	23%

Table 3-4 Heavy vehicle proportions – PM peak

	3:00pm-4:00pm		4:00pm-5:00pm	
	RHV proportion	AHV proportion	RHV proportion	AHV proportion
Argyle Street	61%	39%	81%	19%
Murwillumbah Road	79%	21%	85%	15%
Jubilee Avenue	70%	30%	73%	27%

3.6 Traffic zones

The model comprises a total of 38 zones within the study area. The zones represent areas where demand to and from the study area enters or exits the network. **Figure 3-6** shows the microsimulation zoning structure, while **Table 3-5** lists the zones and provides a description for each.

Table 3-5 Aimsun traffic zones

ID	Description
1100	Cenotaph Ln (E)
1153	Bridgland Ln
1154	McGoughans Ln (S)
1180	Station St carpark adjacent to Mullumbimby Library
1218	Station St (S)
1221	Argyle St
1224	Murwillumbah Rd
1227	Jubilee Ave
1230	Woolworths carpark
1233	Mcgoughans Ln south of Tincogan St
1234	Station St carpark adjacent to Milk and Honey
1237	Riley Ln (N)
1278	Riley Ln (S)
1298	Dalley St carpark adjacent to RSL (W)
1361	Dalley St carpark adjacent to Mullumbimby Tyrepower
1364	Gordon St
1365	Dalley St
1366	Stuart St (N)
1367	Station St (N)
1377	Cenotaph Ln (W)

ID	Description
1382	Stuart St carpark adjacent to RSL
1385	Unnamed lane north of Burringbar St
1390	Stuart St carpark adjacent to Middle Pub
1394	Mcgoughans Ln north of Burringbar St
1398	Station Street carpark between Argyle St and Tincogan St
1401	Mcgoughans Ln south of Burringbar St
1404	Unnamed lane from Whian St to Burringbar St
1407	Unnamed lane south of Whian Street
1408	Unnamed lane north of Fern Street
1414	Stuart St (S)
1539	Brunswick Terrace
1620	Whian St
1629	Stuart St angle parking between Whian St and Burringbar St (E)
1630	Stuart St angle parking between Whian St and Burringbar St (W)
1647	Burringbar St angle parking between Dalley St and Stuart St (N)
1649	Burringbar St angle parking between Dalley St and Stuart St (S)
1654	Unnamed lane north of Tincogan St
1703	River Terrace

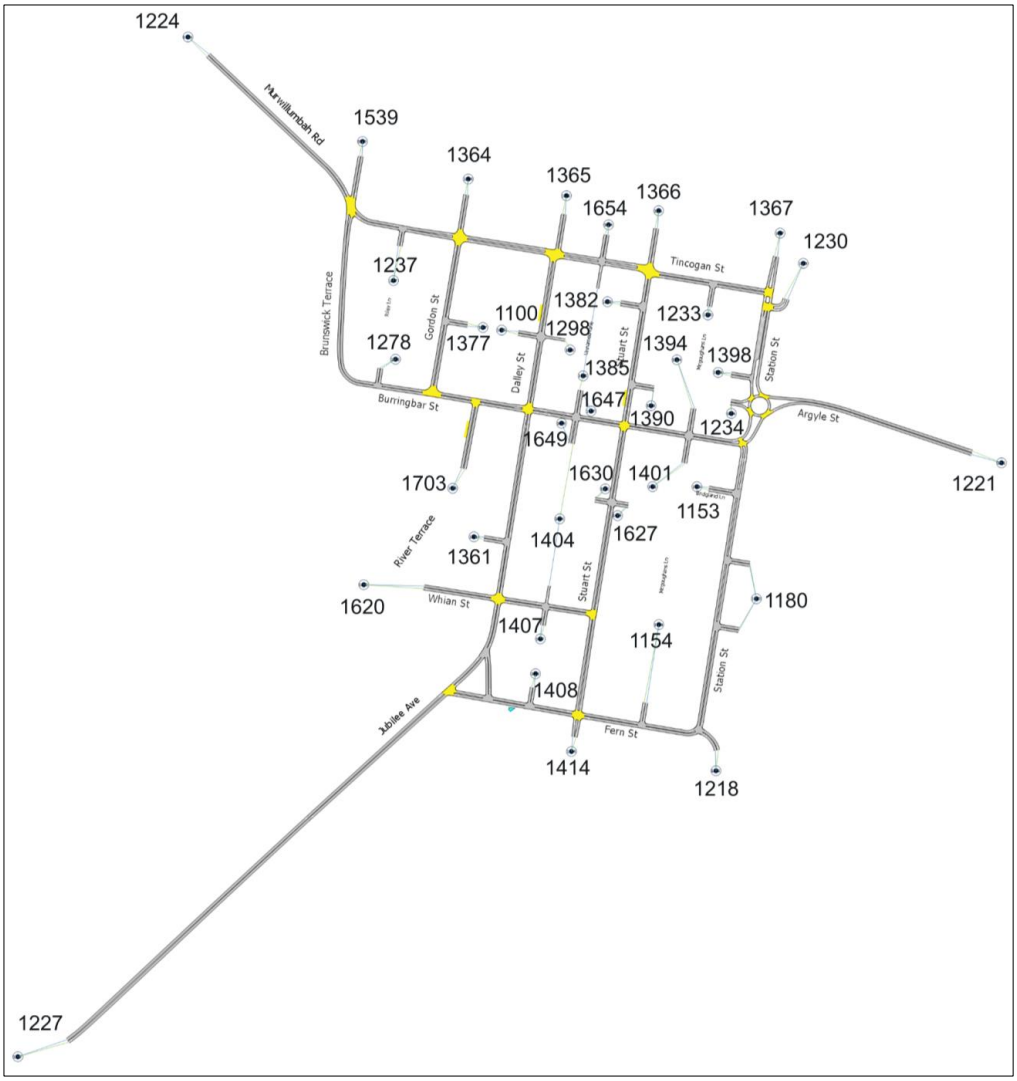


Figure 3-6 Traffic zones

3.7 Road types

Table 3-6 shows the road types that were adopted in the model. Parameters were adjusted during the calibration and validation process to replicate observed conditions in the study area.

Table 3-6 Modelled road types

Road type	Capacity (PCU/ln/hr)
01. Local	400
02. Collector	600
03. Main Road	800
04. Subarterial	900

3.8 Speed profiles

Posted speed limits in the study area were determined from aerial and street-level photography. The following speed limits were adopted in the model:

> A speed limit of 50 kilometres per hour applies to all roads in the study area.

> A speed limit of 40 kilometres per hour was applied within the circulating lane of the Argyle Street / Station Street roundabout.

> As Aimsun turn speeds at intersections are typically overestimated by Aimsun, turn speeds were manually adjusted at all intersections to more accurately reflect vehicle behaviour.

Figure 3-7 shows the modelled speed limits across the study area.

Figure 3-7 Modelled speed limits

3.9 School zones

No schools are present in the study area. Saint John's Primary School is located to the north-west of the study area, and Mullumbimby High School is located to the south-west of the study area.

The roads surrounding these schools have a speed limit of 40 kilometres per hour between 8:00am – 9:30am and 2:30pm – 4:00pm. The school zones are located at the Murwillumbah Road and Jubilee Avenue entrances to the study area. The modelled AM peak is 8:00am-10:00am, so this speed limit reduction was

applied to the last hour and 30 minutes of the AM peak model. Likewise, the modelled PM peak is 3:00pm-5:00pm, so the speed limit reduction was applied to the first hour of the PM peak model.

Figure 3-8 shows the location of the modelled school zones.

Figure 3-8 Modelled school zone locations

3.10 Traffic signals

There are no traffic signals in the study area.

3.11 Public transport

This section outlines the public transport connections that are within the study area.

3.11.1 Trains

There are no train services within the study area.

3.11.2 Buses

Two regular bus routes operate through the study area. Additionally, two temporary flood recovery shuttle services operate through the study area during the modelled date. **Table 3-7** lists the bus routes in the study area. **Figure 3-9** shows the bus routes in the study area.

Table 3-7 Bus routes

Route	Description
640	Ballina to Mullumbimby
642	Billinudgel to Mullumbimby (Flood Recovery Shuttle)
645	Byron Bay to Ocean Shores
698	Mullumbimby to Upper Wilsons Creek

All bus routes with at least one bus that operates during the modelled time periods were included in the models. The latest timetables from Transport for NSW were used to code the bus routes and timetables. The stop time at all stops was assumed to be 20 seconds.

Figure 3-9 Bus routes

3.12 Demand development

This section outlines the demand development procedure.

3.12.1 Demand estimation procedure overview

The methodology to develop the Base Model demand is outlined below.

1. The prior matrix for the AM peak and PM peak scenarios were extracted from the TomTom OD data
2. An initial OD matrix was calculated by disaggregating the TomTom OD matrix to match the zoning system in the Aimsun microsimulation model
    a. As no heavy vehicle matrices were available, the initial heavy vehicle matrices were determined from observed traffic survey data
3. An estimate of the total traffic volume (in and out) of each centroid was determined from traffic survey data
4. The initial OD matrix was refined by furnessing based on the estimated total traffic volume for each centroid
5. The matrices were profiled based on the observed traffic profile for each peak. Volumes in each 15-minute interval were rounded to the nearest vehicle for each OD
6. Minor manual adjustments were made to the matrices to attain the calibration and validation targets.

The demand estimation procedure is iterative and involves continual refinement of the model parameters and demand matrix.

3.12.2 Total traffic demand

Figure 3-10 summarises the traffic demand in each two-hour peak period.

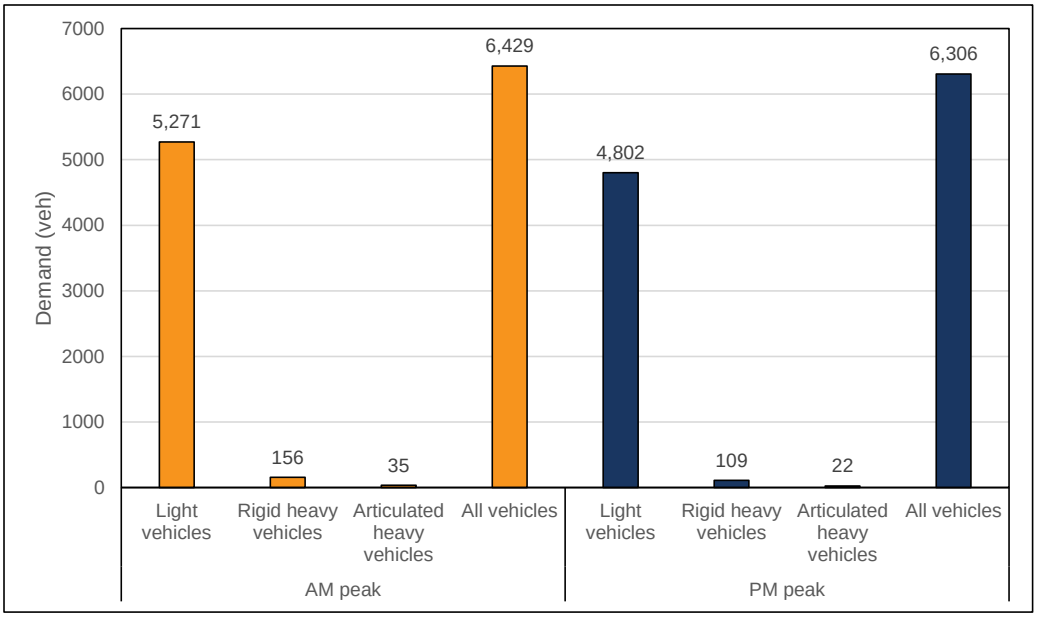


Figure 3-10 Total traffic demand

3.12.3 Traffic demand composition

The traffic demand differentiated between light vehicles, rigid heavy vehicles and articulated heavy vehicles (refer to **Section 3.5**). **Table 3-8** summarises the traffic demand composition for each peak. Note that buses are not included in the demand as they follow fixed routes and run to a fixed timetable.

Table 3-8 Traffic demand composition

Peak	Light vehicles		Rigid heavy vehicles		Articulated heavy vehicles		All vehicles
	Demand (veh)	% of total demand	Demand (veh)	% of total demand	Demand (veh)	% of total demand	Total demand (veh)
AM peak	5271	82.0%	156	2.4%	35	0.5%	6429
PM peak	4802	76.2%	109	1.7%	22	0.3%	6306

3.12.4 Demand profile

Figure 3-11 and **Figure 3-12** show a comparison between the surveyed traffic profile and the modelled traffic profile for each peak. The modelled traffic profile was based on the observed traffic profile from the intersection count data. The graphs indicate there is no significant change between the observed and modelled profile across the two peaks.

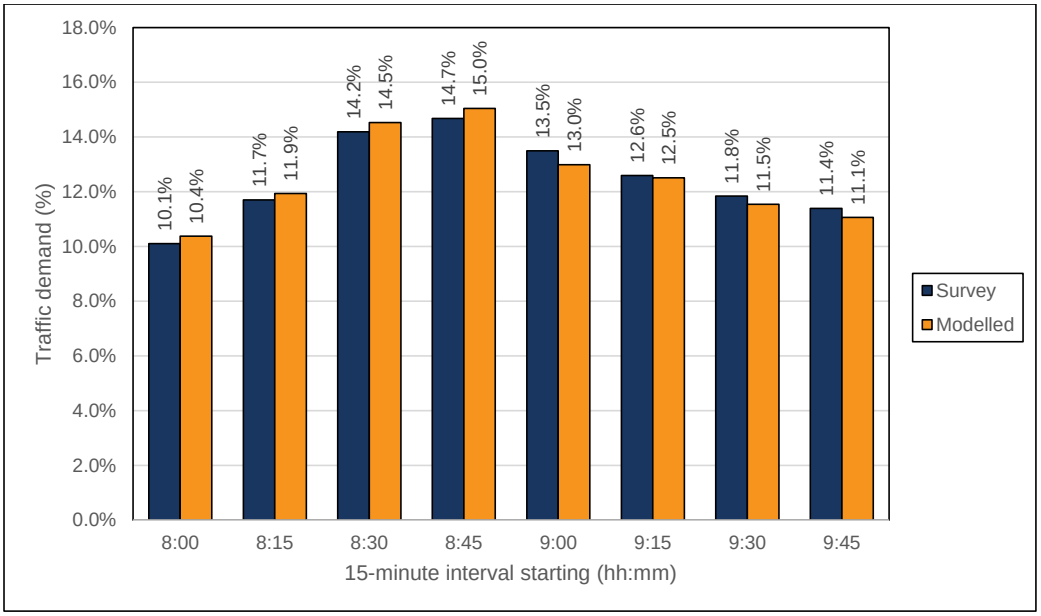


Figure 3-11 Demand profile (AM peak)

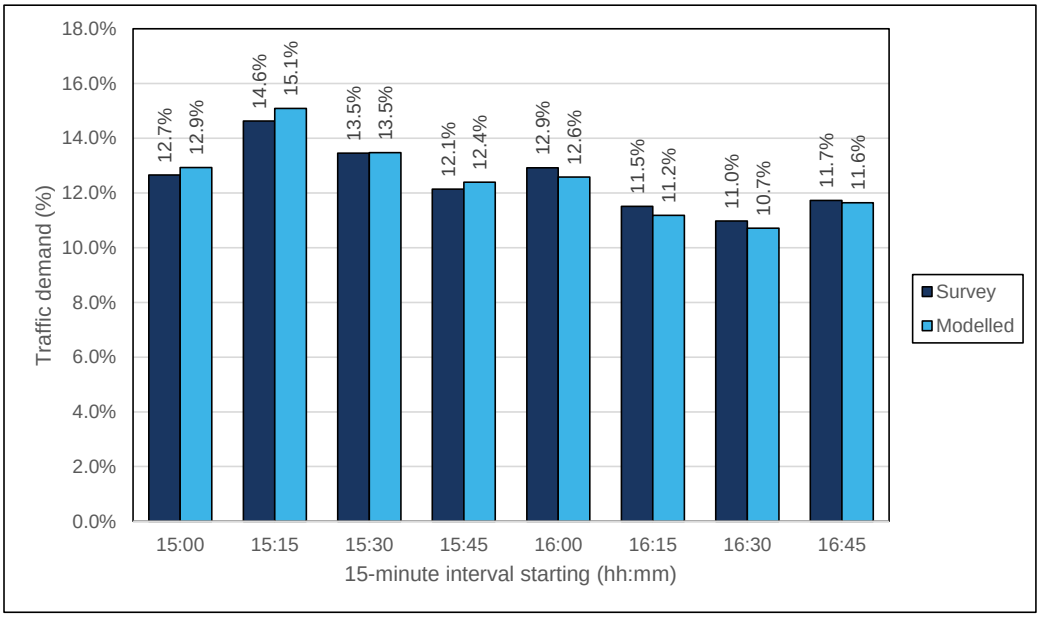


Figure 3-12 Demand profile (PM peak)

3.13 Elevation and slope profile

Slopes have an impact on traffic behaviour, queue dispersion and travel times. A slope model was developed to factor the acceleration of each vehicle type within the microsimulation model proportionally to the slope of the road at any given point.

Slope data was obtained from a one-metre resolution digital terrain model available from NSW Spatial Services. The digital terrain model was imported into Aimsun to set the slope of each section. The altitude at the start, intermediate and end section points were reviewed and manual adjustments made if needed.

3.14 Pedestrians and cyclists

Unsignalised pedestrian zebra crossings located along Burringbar Street, Dalley Street, Stuart Street and Station Street were included in the model. Pedestrian volumes at the zebra crossings were determined from the classified intersection counts. **Figure 3-13** shows the locations of the zebra crossings in the model.

Figure 3-13 Pedestrian crossings

Figure 3-14 and **Figure 3-15** show the pedestrian zebra crossing profiles for the AM peak and PM peak, respectively. The profile is recorded in 15-minute intervals with the two-hour peak period highlighted in each case. The data indicates that pedestrian activity is highest in the PM peak. In both the AM peak and the PM peak, the two-hour pedestrian activity peak coincides with the two-hour traffic volume peak.

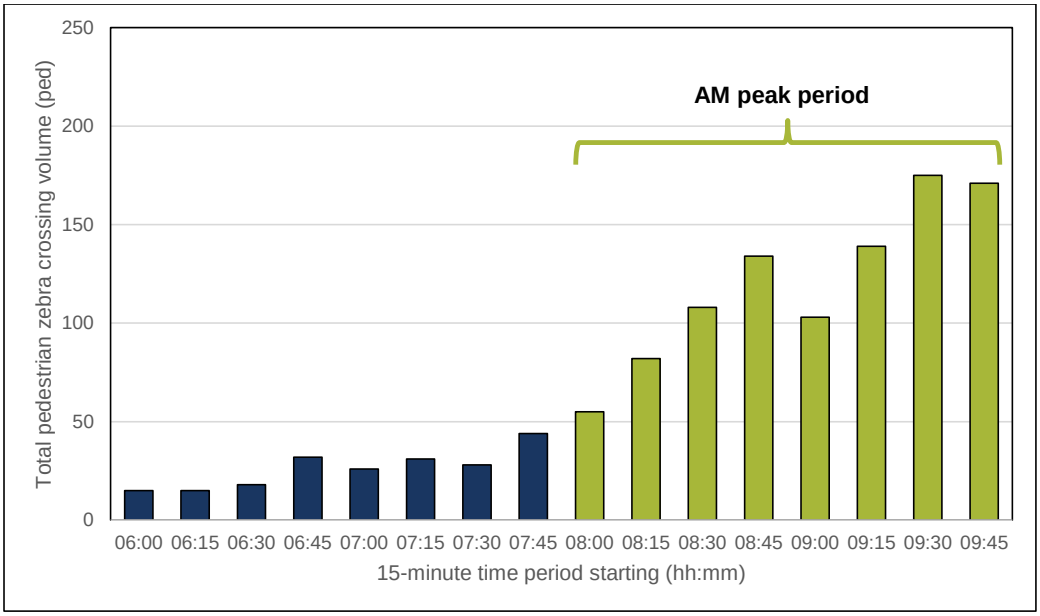


Figure 3-14 Pedestrian zebra crossing AM peak profile

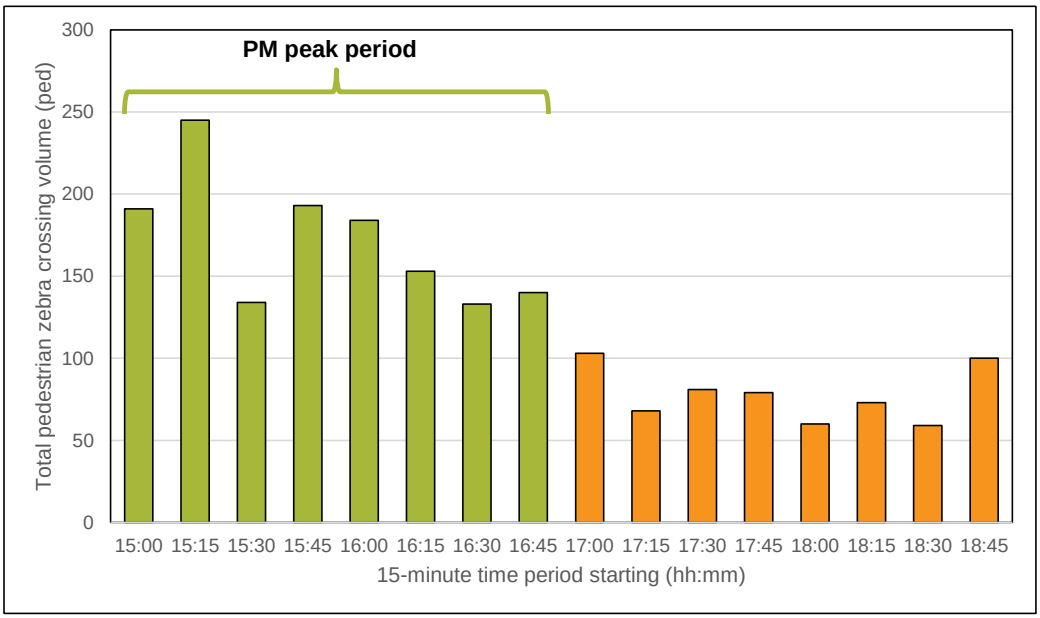


Figure 3-15 Pedestrian zebra crossing PM peak profile

3.15 Calibration and validation criteria

The Base Model was calibrated and validated according to the criteria outlined in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). These criteria ensure that the existing traffic conditions are replicated to a statistically high degree of accuracy.

3.15.1 Network calibration

The recommended method of calibration is the modified Chi-Square empirical formula developed by Geoffrey E. Havers in the 1970s, known as the GEH-statistic. The GEH-statistic measures the degree of divergence of the modelled value form the observed value while accounting for the relative scale of each movement, that is, movements with higher volumes are more important to match than those with lower volumes.

The GEH-statistic is given by **Equation 1**:

$$GEH = \sqrt{\frac{(V_o - V_m)^2}{0.5(V_o + V_m)}}$$ Equation 1

where:

V_o = the observed traffic flow
V_m = the modelled traffic flow.

The GEH-statistic is used for individual flows and the R-squared (R^2) statistical measure is used for correlation of the entire data set.

A GEH less than five is considered a good match between the modelled and observed traffic flows while a GEH value of greater than 10 requires further explanation. **Table 3-9** provides the criteria recommended in *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013) criteria for model calibration.

Table 3-9 Network-wide calibration criteria.

Criteria	Requirement
Turn and link flow comparisons with GEH ≤ 5	At least 85% of all surveyed turns and links
Turn and link flow comparisons with GEH ≤ 10	100% of all surveyed turns and links
Turn and link flow comparisons with GEH > 10	Require explanation in the Base Model Development Report
Coefficient of determination (R^2)	Greater than 0.9 for a plot of observed versus modelled flows

3.15.2 Network validation

Validation ensures that factors that influence traffic (other than traffic volumes) such as road capacity, driver behaviour and responsiveness are adequately captured in the model. Two validation criteria were used for the Base Model:

> Travel time validation

> Congestion hotspot validation.

These are each outlined below.

3.15.2.1 Travel time validation

The validation of travel times on key routes confirms that the model is accurately replicating observed congestion and driver behaviour. **Table 3-10** shows the travel time validation criteria recommended in *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013).

Table 3-10 Travel time validation criteria

Criteria	Requirement
Journey time average	Average modelled journey time to be within 15 per cent or one minute of average observed journey time for the full length of the route
Section time average	Average modelled journey time to be within 15 per cent of the observed journey time for individual sections

The travel time routes are shown in **Section 2.1.4**.

3.15.2.2 Congestion hotspot validation

Modelled average speed by section was plotted for each peak and compared to the average speed data extracted from TomTom (refer to **Section 2.3**). This provided an additional layer of verification that the average speeds in the model were reflective of those in reality.

4 Model stability

The stochasticity of a microsimulation model can cause instability. This can undermine the reliability of the model to forecast future traffic conditions. It is important that the Base Model is stable and has an appropriate degree of accuracy for future options assessment. To determine the stability of a model, a total of five seed values and the default time-step value in Aimsun are initially used to iteratively determine the number of runs, as recommended by *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013).

Vehicle hours travelled (VHT) was the statistic chosen to determine the model stability. The VHT results are a single-figure summary that provide an indication of whole-network performance by identifying whether the model has unrealistic gridlocks and/or excessive delays. VHT is calculated by summing the individual travel time for each vehicle across the whole network. In Aimsun, VHT is only calculated using vehicles which complete a trip from their origin to their destination; any vehicles remaining in the network at the conclusion of the simulation period are excluded from the VHT.

4.1 Seeds run

To analyse the model stability, each peak period model was assessed using the five seed values recommended in *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). The different seeds introduce slight variations to the number of vehicles in the network for regular intervals throughout the simulation. The seed values used were:

- 560
- 28
- 7771
- 86524
- 2849.

4.2 Stability assessment

Figure 4-1 and **Figure 4-2** show the variation in VHT per 15-minute interval for the AM peak and PM peak respectively. The results show that the model results are consistently similar across the seeds run.

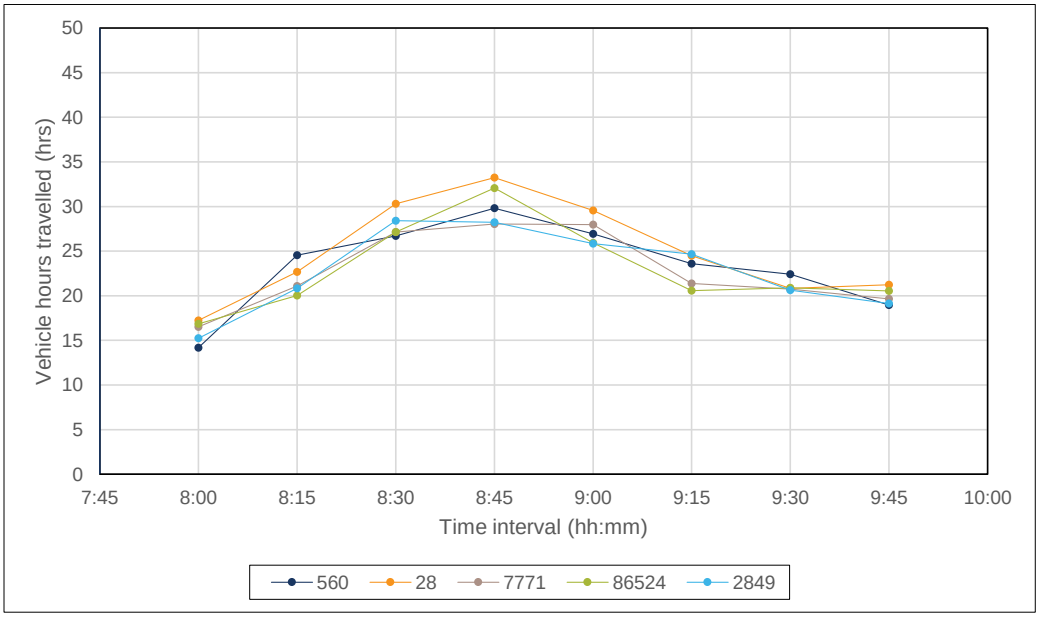


Figure 4-1 Vehicle hours travelled (VHT) across all seeds (AM peak)

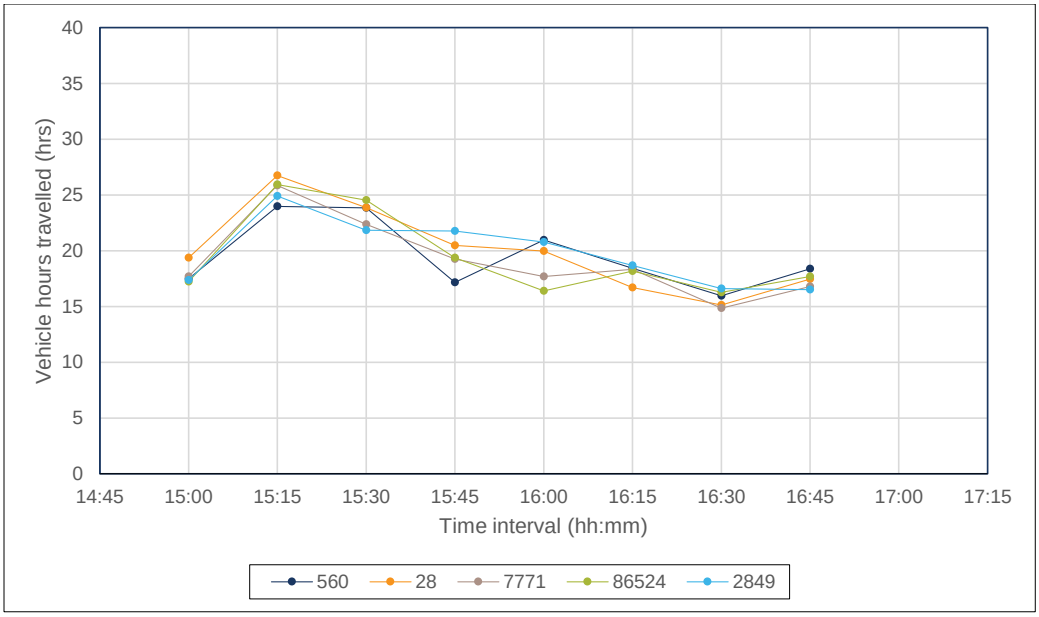


Figure 4-2 Vehicle hours travelled (VHT) across all seeds (PM peak)

The number of seed runs required to determine the stability of the model is calculated iteratively using **Equation 2**:

$$N = \left(\frac{t\sigma}{\Delta}\right)^2 \qquad \text{Equation 2}$$

where:

N = number of runs required
t = two-tailed inverse of Student's t-distribution
σ = standard deviation
Δ = acceptable error (produce of precision and sample mean).

The t-value required for a confidence interval of 95 per cent given five initial seeds is 2.776. The number of runs required for each peak period are shown in **Table 4-1**.

Table 4-1 Number of simulation runs required

Parameter	AM Peak	PM Peak
t	2.776	2.776
σ	7.1	2.7
$\bar{x}$	187	157
Δ	9.36	7.83
N	4.47	0.90

The number of simulation runs required (N) is less than the initial number of seeds used in all peaks, and therefore it is sufficient to retain the five seeds for a confidence interval of 95 per cent. **Table 4-2** shows the VHT bounds and the median seed for each peak.

Table 4-2 Median seed values

Peak	All seeds			Median seed	
	VHT lower bound	Mean VHT	VHT upper bound	VHT	Seed value
AM peak	183	187	199	184	86524
PM peak	153	157	160	156	560

The results reported in the remainder of this report for calibration and validation are based on the median seed values for each peak shown in **Table 4-2**.

5 Model calibration and validation

5.1 Convergence

As outlined in **Section 3.4.2**, DUE is an iterative procedure that involves shifting users to the shortest path given the travel times on each path in the previous iteration. The relative gap (RGap) is a measure of the difference between the modelled travel times and the travel times if all vehicles were using the shortest path. It provides an indication of whether the DUE assignment has converged to the optimal solution.

Figure 5-1 and **Figure 5-2** show the DUE convergence for the AM peak and PM peak respectively. All peaks converge within three iterations.

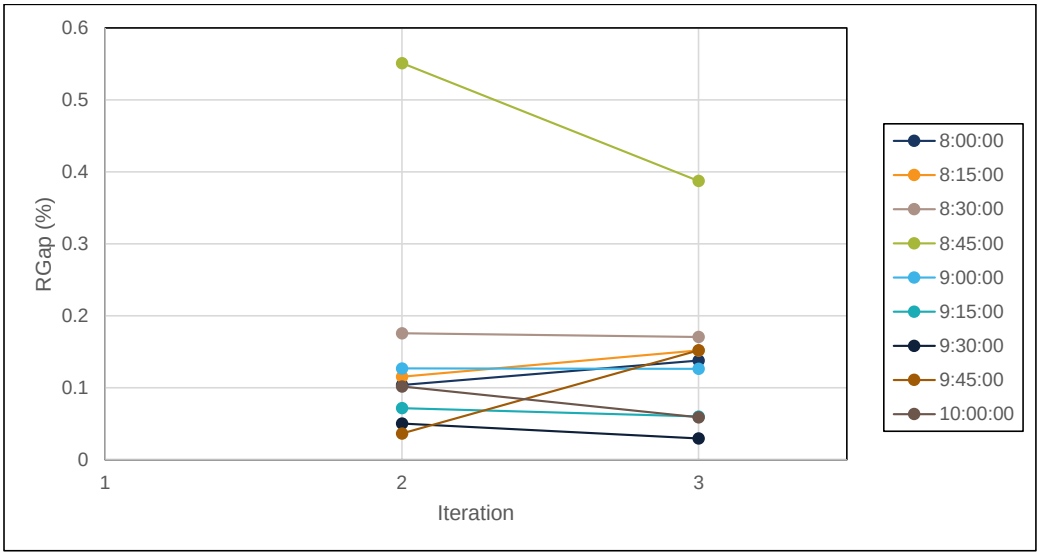


Figure 5-1 AM peak DUE convergence

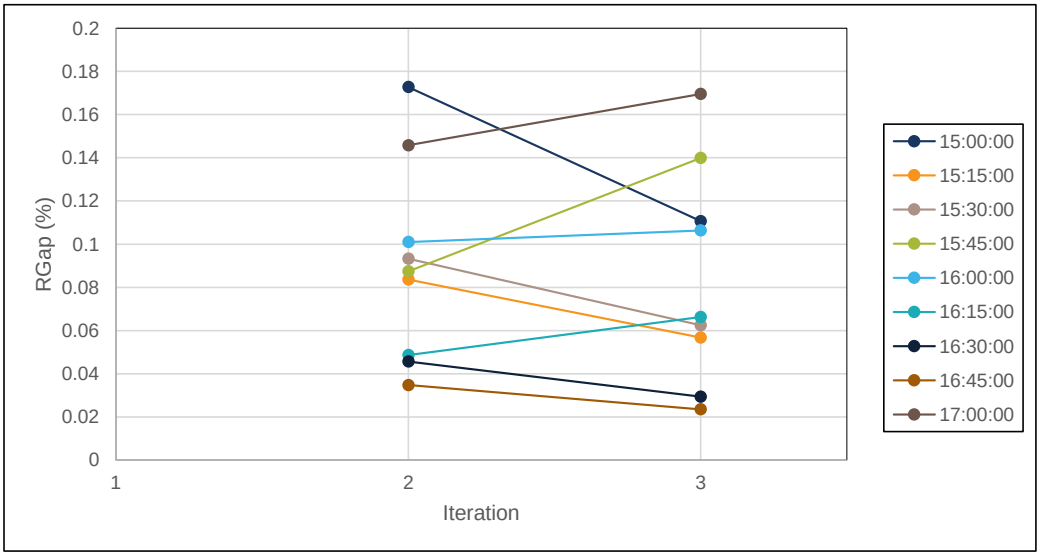


Figure 5-2 AM peak DUE convergence

5.2 Calibration

This section outlines the calibration results. **Table 5-1** provides a summary of the GEH criteria for turning counts and the number of compliant counts within each peak. The results indicate that:

- There is a good correlation between the observed and modelled turn volumes, with at least 85 percent of locations having a GEH exceeding five across all modelled hours and peaks.
- GEH was less than five for heavy vehicles for all turns.
- No turns had a GEH exceeding 10.

A list of all intersection movement results is presented in **Appendix A**.

Table 5-1 Summary of network-wide calibration statistics

Criteria	AM peak		PM peak	
	8:00am-9:00am	9:00am-10:00am	3:00pm-4:00pm	4:00pm-5:00pm
Light vehicles				
Turns with GEH ≤ 5.0	135 / 156 (86.5%)	135 / 156 (86.5%)	134 / 156 (85.9%)	138 / 156 (88.9%)
Turns with GEH ≤ 10.0	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)
Calibration target achieved?	✓	✓	✓	✓
Heavy vehicles				
Turns with GEH ≤ 5.0	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)
Turns with GEH ≤ 10.0	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)	156 / 156 (100.0%)
Calibration target achieved?	✓	✓	✓	✓

Figure 5-3, **Figure 5-4**, **Figure 5-5** and **Figure 5-6** show the regression analyses for all vehicles for each modelled hour. The coefficient of determination (R^2) value for the linear trendline in each instance is shown on the chart. The boundaries for GEH = 5.0 are also shown.

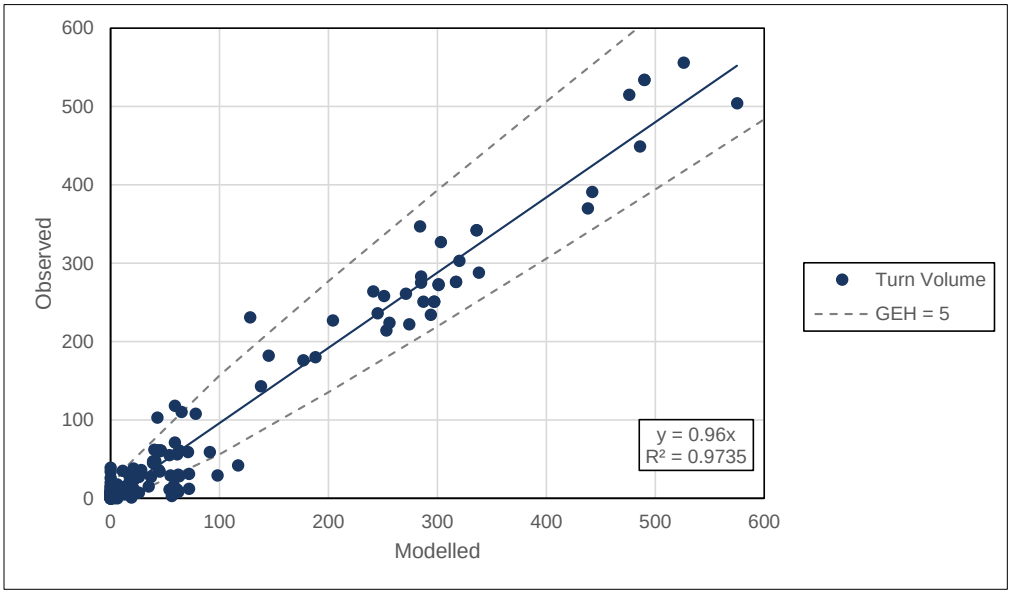


Figure 5-3 Turn regression analysis (8:00am-9:00am)

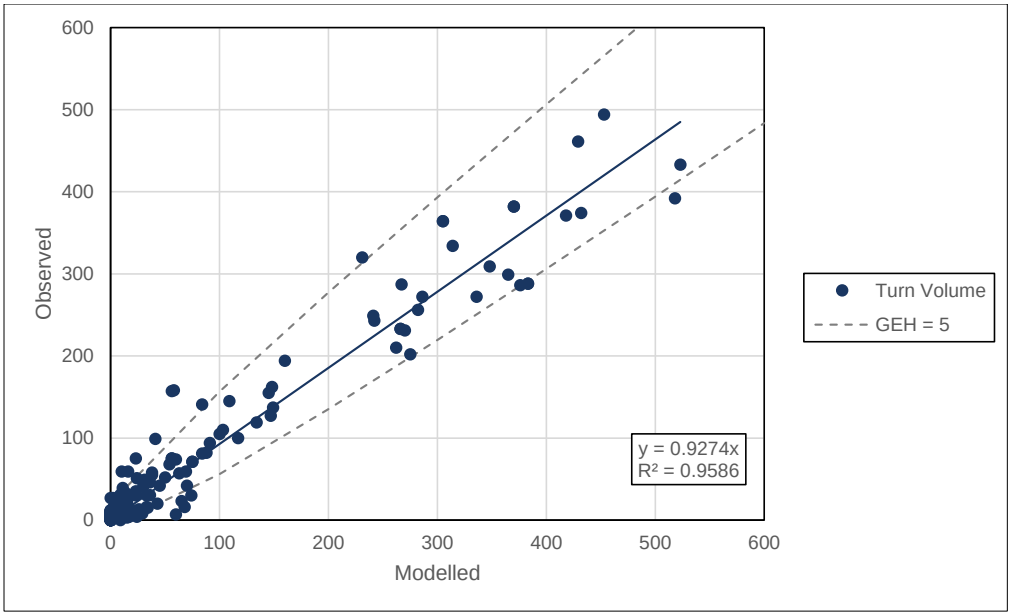


Figure 5-4 Turn regression analysis (9:00am-10:00am)

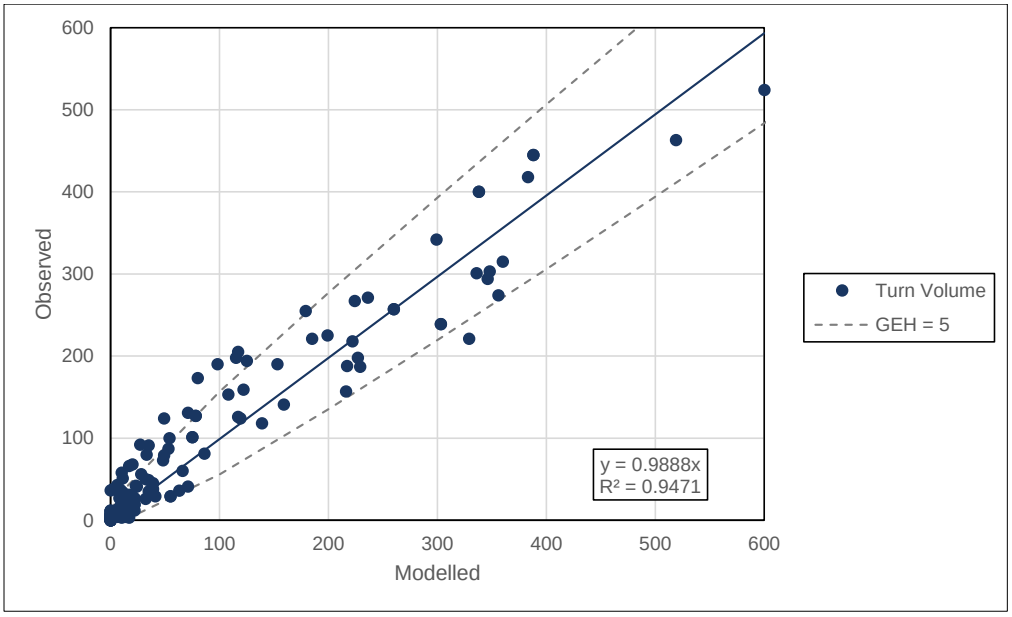


Figure 5-5 Turn regression analysis (3:00pm-4:00pm)

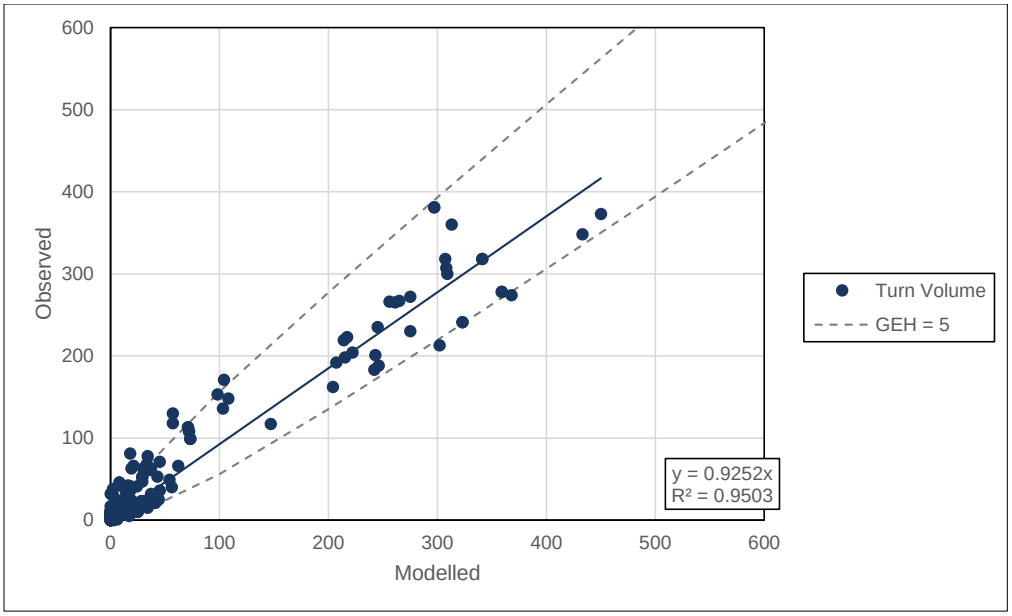


Figure 5-6 Turn regression analysis (4:00pm-5:00pm)

5.3 Validation

This section outlines the microsimulation validation results. The microsimulation model was validated using travel times along major routes, and congestion hotspot validation.

5.3.1 Travel time validation results

Table 5-3 and **Table 5-4** show the detailed travel times for each hour of each peak on each travel time route. The modelled travel time on all routes was within 15 per cent of the observed travel time. **Appendix B** contains detailed graphs showing the cumulative travel time along each route. **Table 5-2** summarises the results.

In all peak periods and hours, the modelled travel time on all segments was within 15 per cent of the observed travel time. The modelled total travel time on each route was within five per cent of the observed travel time along the full route, which meets the journey time average criteria of within 15 per cent.

Table 5-2 Travel time validation results summary

Criteria		AM peak		PM peak	
		8:00am-9:00am	9:00am-10:00am	3:00pm-4:00pm	4:00pm-5:00pm
Section time average	Modelled time within 15 per cent of observed time	18 / 18 (100%)	18 / 18 (100%)	18 / 18 (100%)	18 / 18 (100%)
Journey time average	Modelled time within 15 per cent or one minute of observed time	8 / 8 (100%)	8 / 8 (100%)	8 / 8 (100%)	8 / 8 (100%)

Table 5-3 Travel time validation results – AM peak

Segment	8:00am-9:00am					9:00am-10:00am				
	Modelled (s)	Observed (s)	Observed +/-15% (s)	Difference (s)		Modelled (s)	Observed (s)	Observed +/-15% (s)	Difference (s)	
Tincogan Street (eastbound)										
1	56	56	48-64	0	✓	46	45	38-52	1	✓
2	99	101	86-116	-2		81	89	76-102	-8	
Tincogan Street (westbound)										
1	45	44	37-51	1	✓	48	54	46-62	-6	✓
2	87	78	66-90	9		88	94	80-108	-6	
Dalley Street (northbound)										
1	46	44	37-51	2	✓	54	51	43-59	3	✓
2	95	87	74-100	8		108	118	100-136	-10	
Dalley Street (southbound)										
1	24	26	22-30	-2	✓	30	33	28-38	-3	✓
2	68	76	65-87	-8		74	82	70-94	-8	
Station Street (northbound)										
1	33	31	26-36	2	✓	32	30	26-35	2	✓
2	105	104	88-120	1		115	108	92-124	7	
Station Street (southbound)										
1	66	64	54-74	2	✓	61	59	50-68	2	✓
2	92	94	80-108	-2		86	89	76-102	-3	
Burringbar Street (eastbound)										
1	51	47	40-54	4	✓	54	55	47-63	-1	✓
2	90	92	78-106	-2		115	105	89-121	10	
3	143	143	122-164	0		169	165	140-190	4	
Burringbar Street (westbound)										
1	45	43	37-49	2	✓	46	48	41-55	-2	✓
2	82	83	71-95	-1		89	97	82-112	-8	
3	124	127	108-146	-3		136	134	114-154	2	

Table 5-4 Travel time validation results – PM peak

Segment	3:00pm-4:00pm					4:00pm-5:00pm				
	Modelled (s)	Observed (s)	Observed +/-15% (s)	Difference (s)		Modelled (s)	Observed (s)	Observed +/-15% (s)	Difference (s)	
Tincogan Street (eastbound)										
1	44	48	41-55	-4	✓	38	42	36-48	-4	✓
2	90	96	82-110	-6		85	86	73-99	-1	
Tincogan Street (westbound)										
1	36	37	31-43	-1	✓	41	41	35-47	0	✓
2	77	74	63-85	3		78	73	62-84	5	
Dalley Street (northbound)										
1	53	56	48-64	-3	✓	52	54	46-62	-2	✓
2	97	97	82-112	0		95	97	82-112	-2	
Dalley Street (southbound)										
1	44	44	37-51	0	✓	31	35	30-40	-4	✓
2	90	92	78-106	-2		84	86	73-99	-2	
Station Street (northbound)										
1	25	28	24-32	-3	✓	26	28	24-32	-2	✓
2	121	121	103-139	0		107	112	95-129	-5	
Station Street (southbound)										
1	77	78	66-90	-1	✓	63	65	55-75	-2	✓
2	103	111	94-128	-8		88	99	84-114	-11	
Burringbar Street (eastbound)										
1	34	38	32-44	-4	✓	46	48	41-55	-2	✓
2	101	108	92-124	-7		91	100	85-115	-9	
3	156	170	145-196	-14		147	156	133-179	-9	
Burringbar Street (westbound)										
1	44	49	42-56	-5	✓	51	55	47-63	-4	✓
2	81	89	76-102	-8		93	95	81-109	-2	
3	122	133	113-153	-11		136	139	118-160	-3	

5.3.2 Congestion hotspot validation results

Congestion hotspot validation was used to ensure that the models adequately reproduce congestion patterns within the study area. **Table 5-5**, **Table 5-6**, **Table 5-7** and **Table 5-8** show a comparison between the observed average speed and modelled average speed for all key routes in the study area. The plots indicate that the average speed is closely matched by the model on all key routes. In particular:

Table 5-5 Surveyed and modelled speed data comparison – AM peak, 8:00am-9:00am

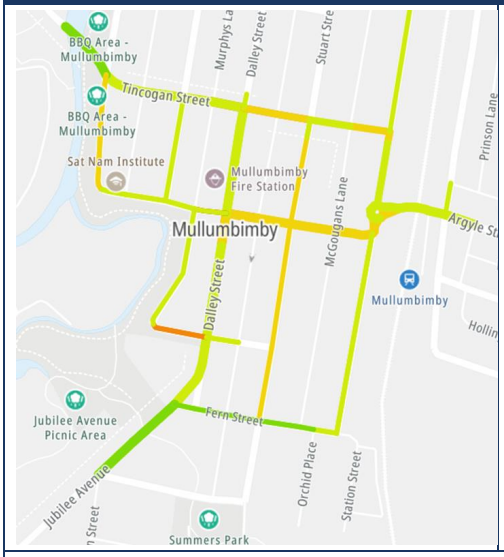
Observed average speed	Modelled average speed
	

Table 5-6 Surveyed and modelled speed data comparison – AM peak, 9:00am-10:00am

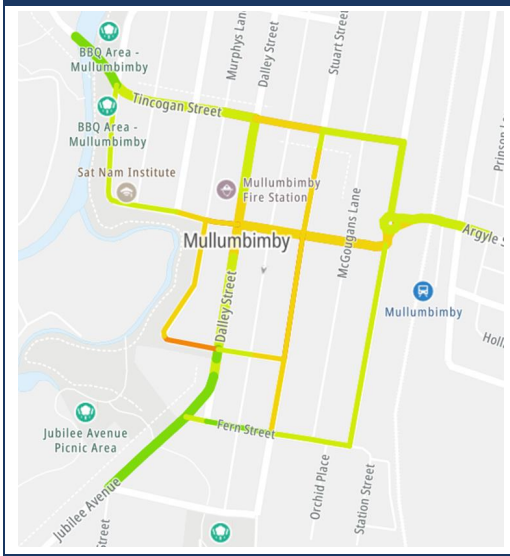
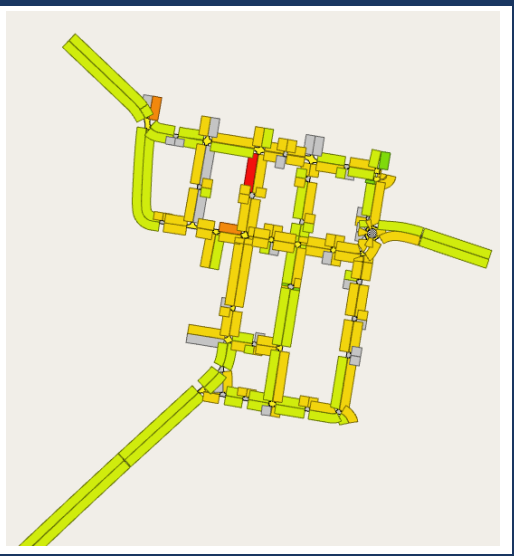
Observed average speed	Modelled average speed
	

Table 5-7 Surveyed and modelled speed data comparison – PM peak, 3:00pm-4:00pm

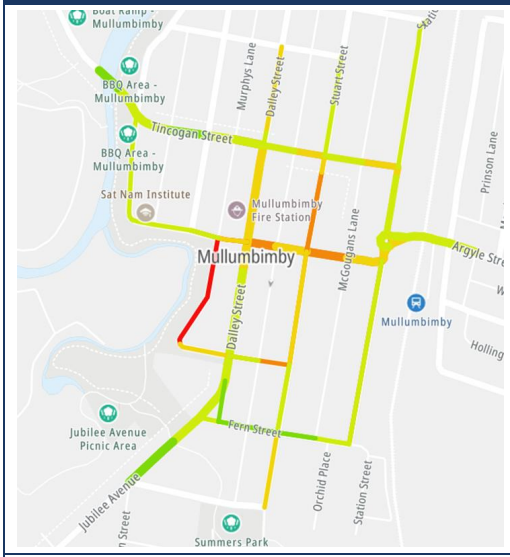
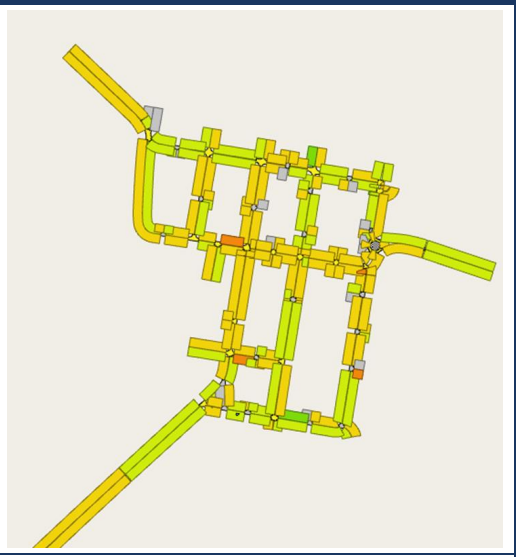
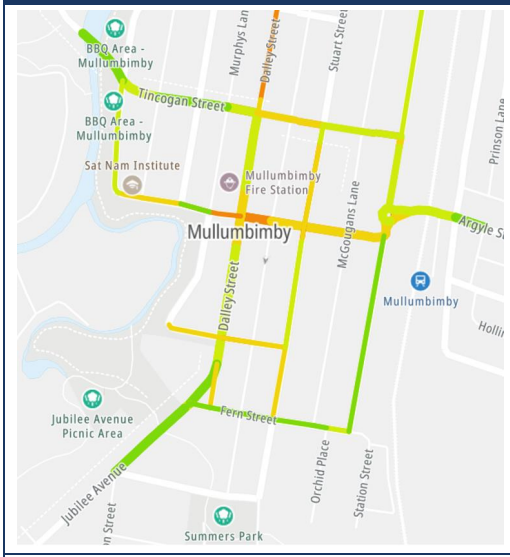
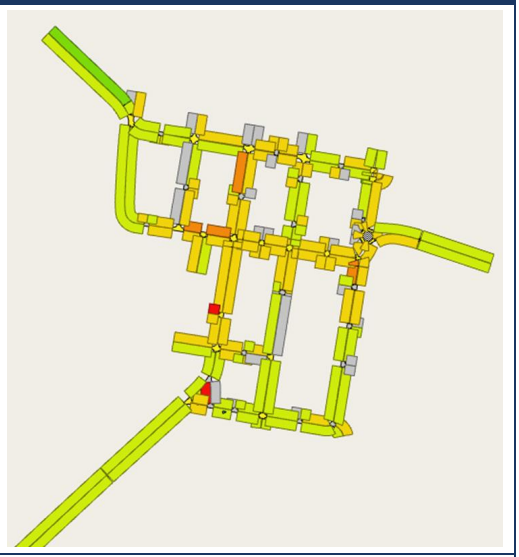
Observed average speed	Modelled average speed
	

Table 5-8 Surveyed and modelled speed data comparison – PM peak, 4:00pm-5:00pm

Observed average speed	Modelled average speed
	

6 Model limitations

The Base Model has been developed in accordance with *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). Future model scenarios should consider the limitations of the Base Model outlined below.

- U-turn movements were not calibrated at any intersections, including roundabouts.
- It is not recommended to use the model to assess intersections that were not calibrated using survey data
- Consideration should be given before assessing travel time on routes that were not validated using travel time data
- Cyclist volumes and infrastructure were not considered in the models.

7 Conclusion

This report has documented the development of a microsimulation Base Model of the Mullumbimby town centre. The existing traffic conditions in the study area were analysed from various data sources including classified intersection counts, travel time data and origin-destination surveys.

The Base Model was calibrated to represent conditions during two peaks:

- Friday 17 June 2022
  - AM peak: 8:00am – 10:00am
  - PM peak: 3:00pm – 5:00pm

The Base Models were developed in accordance with the relevant guidelines for NSW. A statistical analysis of stability indicated that the models are stable with less than five seeds required to ensure a confident statistical result. The calibration and validation results indicate that the Base Models have:

- High network-wide calibration with over 85 per cent of turning movements having a GEH of less than five, and no turning movements having a GEH greater than 10 across all peaks
- High statistical correlation between modelled and observed turning volumes with $R^2 > 0.947$ across all modelled peaks
- Modelled travel times that fit well with observed data
- Sufficient representation of observed congestion across the study area.

The microsimulation Base Model meets the calibration and validation targets set out in the Traffic Modelling Guidelines (Roads and Maritime Services, 2013) and are therefore considered fit-for-purpose for assessing existing and future network performance. They are considered to provide a realistic replication of existing traffic conditions within the Mullumbimby town centre and provide a robust foundation on which to base the future-year assessment.

APPENDIX A

CALIBRATION RESULTS

Turn	AM Peak																							
	08:00 - 09:00												09:00 - 10:00											
	Light vehicles				Heavy vehicles				All vehicles				Light vehicles				Heavy vehicles				All vehicles			
	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH
1EL	1	0	1	1.41	0	0	0	0.00	1	0	1	1.41	1	5	-4	2.31	0	0	0	0.00	1	5	-4	2.31
1ER	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	0	3	-3	2.45	0	1	-1	1.41	0	4	-4	2.83
1ET	427	355	72	3.64	11	15	-4	1.11	438	370	68	3.38	421	361	60	3.03	11	13	-2	0.58	432	374	58	2.89
1NL	1	5	-4	2.31	0	0	0	0.00	1	5	-4	2.31	0	2	-2	2.00	0	0	0	0.00	0	2	-2	2.00
1NR	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83
1NT	6	0	6	3.46	0	0	0	0.00	6	0	6	3.46	9	0	9	4.24	0	0	0	0.00	9	0	9	4.24
1SL	59	53	6	0.80	2	4	-2	1.15	61	57	4	0.52	85	81	4	0.44	3	1	2	1.41	88	82	6	0.65
1SR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
1ST	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
1WL	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74	0	2	-2	2.00	0	0	0	0.00	0	2	-2	2.00
1WR	95	29	66	8.38	3	0	3	2.45	98	29	69	8.66	67	14	53	8.33	1	2	-1	0.82	68	16	52	8.02
1WT	513	531	-18	0.79	13	25	-12	2.75	526	556	-30	1.29	444	482	-38	1.77	9	12	-3	0.93	453	494	-41	1.88
2EL	17	11	6	1.60	0	1	-1	1.41	17	12	5	1.31	1	12	-11	4.31	2	0	2	2.00	3	12	-9	3.29
2ER	0	8	-8	4.00	0	1	-1	1.41	0	9	-9	4.24	0	9	-9	4.24	0	0	0	0.00	0	9	-9	4.24
2ET	433	376	57	2.83	9	15	-6	1.73	442	391	51	2.50	407	357	50	2.56	11	14	-3	0.85	418	371	47	2.37
2NL	2	6	-4	2.00	0	0	0	0.00	2	6	-4	2.00	5	7	-2	0.82	4	2	2	1.15	9	9	0	0.00
2NR	0	2	-2	2.00	0	0	0	0.00	0	2	-2	2.00	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
2NT	4	1	3	1.90	0	0	0	0.00	4	1	3	1.90	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
2SL	1	0	1	1.41	2	0	2	2.00	3	0	3	2.45	4	9	-5	1.96	0	0	0	0.00	4	9	-5	1.96
2SR	1	3	-2	1.41	0	0	0	0.00	1	3	-2	1.41	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00
2ST	0	3	-3	2.45	0	1	-1	1.41	0	4	-4	2.83	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41
2WL	13	13	0	0.00	0	1	-1	1.41	13	14	-1	0.27	14	6	8	2.53	0	0	0	0.00	14	6	8	2.53
2WR	42	36	6	0.96	2	0	2	2.00	44	36	8	1.26	10	38	-28	5.72	1	1	0	0.00	11	39	-28	5.60
2WT	465	491	-26	1.19	11	24	-13	3.11	476	515	-39	1.75	421	448	-27	1.30	8	13	-5	1.54	429	461	-32	1.52
3EL	39	41	-2	0.32	0	4	-4	2.83	39	45	-6	0.93	38	50	-12	1.81	0	5	-5	3.16	38	55	-17	2.49
3ER	3	6	-3	1.41	0	0	0	0.00	3	6	-3	1.41	0	9	-9	4.24	0	0	0	0.00	0	9	-9	4.24
3ET	269	216	53	3.40	5	6	-1	0.43	274	222	52	3.30	260	226	34	2.18	10	5	5	1.83	270	231	39	2.46
3NL	5	6	-1	0.43	0	0	0	0.00	5	6	-1	0.43	5	8	-3	1.18	0	0	0	0.00	5	8	-3	1.18
3NR	10	14	-4	1.15	0	0	0	0.00	10	14	-4	1.15	4	10	-6	2.27	0	0	0	0.00	4	10	-6	2.27
3NT	19	13	6	1.50	0	0	0	0.00	19	13	6	1.50	16	9	7	1.98	0	1	-1	1.41	16	10	6	1.66
3SL	173	165	8	0.62	4	11	-7	2.56	177	176	1	0.08	142	146	-4	0.33	3	9	-6	2.45	145	155	-10	0.82
3SR	40	61	-21	2.96	0	1	-1	1.41	40	62	-22	3.08	23	73	-50	7.22	0	2	-2	2.00	23	75	-52	7.43
3ST	5	8	-3	1.18	0	0	0	0.00	5	8	-3	1.18	0	12	-12	4.90	0	0	0	0.00	0	12	-12	4.90
3WL	13	5	8	2.67	0	0	0	0.00	13	5	8	2.67	15	3	12	4.00	0	0	0	0.00	15	3	12	4.00
3WR	126	217	-91	6.95	2	14	-12	4.24	128	231	-103	7.69	56	152	-96	9.41	2	6	-4	2.00	58	158	-100	9.62
3WT	329	278	51	2.93	9	10	-1	0.32	338	288	50	2.83	355	290	65	3.62	10	9	1	0.32	365	299	66	3.62
4EL	0	9	-9	4.24	4	2	2	1.15	4	11	-7	2.56	5	18	-13	3.83	2	2	0	0.00	7	20	-13	3.54
4ER	13	7	6	1.90	0	1	-1	1.41	13	8	5	1.54	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46
4ET	295	267	28	1.67	6	6	0	0.00	301	273	28	1.65	253	206	47	3.10	9	4	5	1.96	262	210	52	3.38
4NL	0	6	-6	3.46	0	2	-2	2.00	0	8	-8	4.00	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74
4NR	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45
4NT	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46
4SL	54	51	3	0.41	0	4	-4	2.83	54	55	-1	0.14	41	96	-55	6.65	0	3	-3	2.45	41	99	-58	6.93
4SR	16	22	-6	1.38	4	1	3	1.90	21	23	-2	0.43	30	30	0	0.00	3	0	3	2.45	33	30	3	0.53
4ST	3	4	-1	0.53	1	0	1	1.41	4	4	0	0.00	1	2	-1	0.82	1	0	1	1.41	2	2	0	0.00
4WL	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
4WR	45	59	-14	1.94	0	1	-1	1.41	45	60	-15	2.07	47	50	-3	0.43	3	2	1	0.63	50	52	-2	0.28
4WT	262	250	12	0.75	9	11	-2	0.63	271	261	10	0.61	329	263	66	3.84	7	9	-2	0.71	336	272	64	3.67
5NR	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45
5NT	37	26	11	1.96	0	1	-1	1.41	37	27	10	1.77	65	23	42	6.33	0	0	0	0.00	65	23	42	6.33
5SL	286	226	60	3.75	8	8	0	0.00	294	234	60	3.69	231	237	-6	0.39	11	6	5	1.71	242	243	-1	0.06
5ST	19	24	-5	1.08	0	0	0	0.00	19	24	-5	1.08	33	16	17	3.43	0	0	0	0.00	33	16	17	3.43
5WL	5	9	-4	1.51	0	0	0	0.00	5	9	-4	1.51	24	4	20	5.35	0	0	0	0.00	24	4	20	5.35
5WR	268	266	2	0.12	16	17	-1	0.25	285	283	2	0.12	338	297	41	2.30	10	12	-2	0.60	348	309	39	2.15
6EL	59	71	-12	1.49	0	0	0	0.00	59	71	-12	1.49	91	94	-3	0.31	0	0	0	0.00	91	94	-3	0.31
6ER	26	7	19	4.68	0	0	0	0.00	26	7	19	4.68	34	15	19	3.84	0	0	0	0.00	34	15	19	3.84
6NL	21	38	-17	3.13	0	0	0	0.00	21	38	-17	3.13	36	46	-10	1.56	0	0	0	0.00	36	46	-10	1.56
6NT	284	254	30	1.83	16	18	-2	0.49	301	272	29	1.71	366	274	92	5.14	10	12	-2	0.60	376	286	90	4.95
6SR	63	61	2	0.25	0	0	0	0.00	63	61	2	0.25	69	59	10	1.25	0	0	0	0.00	69	59	10	1.25
6ST	279	243	36	2.23	8	8	0	0.00	287	251	36	2.19	230	243	-13	0.85	11	6	5	1.71	241	249	-8	0.51
7EL	14	13	1	0.27	0	1	-1	1.41	14	14	0	0.00	26	12	14	3.21	0	1	-1	1.41	26	13	13	2.94
7ET	87	58	29	3.41	4	1	3	1.90	91	59	32	3.70	81	80	1	0.11	3	1	2	1.41	84	81	3	0.33
7SL	26	22	4	0.82	0	5	-5	3.16	26	27	-1	0.19	23	29	-6	1.18	0	1	-1	1.41	23	30	-7	1.36
7SR	0	11	-11	4.69	0	6	-6	3.46	1	17	-16	5.33	0	5	-5	3.16	0	1	-1	1.41	0	6	-6	3.46
7WR	41	47	-6	0.90	0	0	0	0.00	41	47	-6	0.90	22	31	-9	1.75	0	1	-1	1.41	22	32	-10	1.92
7WT	68	12	56	8.85	4	0	4	2.83	72	12	60	9.26	73	30	43	5.99	1	0	1	1.41	74	30	44	6.10
8EL	126	132	-6	0.53	10	11	-1	0.31	138	143	-5	0.42	142	123	19	1.65	4	4	0	0.00	147	127	20	1.71
8ER	61	52	9	1.20	0	4	-4	2.83	61	56	5	0.65	53	64	-11	1.44	0	4	-4	2.83	54	68	-14	1.79
8ET	45	33	12	1.92	0	1	-1	1.41	45	34	11	1.75	28	40	-12	2.06	2	1	1	0.82	30	41	-11	1.85
8NL	59	112	-53	5.73	0	6	-6	3.46	59	118	-59	6.27	54	151	-97	9.58	2	6	-4	2.00	56	157	-101	9.79
8NR	5	10	-5	1.83	0	0	0	0.00	5	10	-5	1.83	11	11	0	0.00	0	0	0	0.00	11	11	0	0.00
8NT	141	169	-28	2.25	4	13	-9	3.09	145	182	-37	2.89	82	135	-53	5.09	2	6	-4	2.00	84	141	-57	5.37
8SL	51	28	23	3.66	4	1	3	1.90	55	29	26	4.01	69	41	28	3.78	1	1	0	0.00	70	42	28	3.74
8SR	230	216	14	0.94	15	20	-5	1.20	245	236	9	0.58	270	245	25	1.56	12	11	1	0.29	282	256	26	1.59
8ST	184	176	8	0.60	4	4	0	0.00	188	180	8	0.59	144	159	-15	1.22	4	3	1	0.53	148	162	-14	1.12
8WL	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74
8WR	59	4	55	9.80	3	4	-1	0.53	62	8	54	9.13	59	7	52	9.05	1	0	1	1.41	60	7	53	9.16
8WT	9	8	1	0.34	0	2	-2	2.00	10	10	0	0.00	14	21	-7	1.67	1	1	0	0.00	15	22	-7	1.63
9EL	70	54	16	2.03	1	5	-4	2.31	71	59	12	1.49	56	73	-17	2.12	4	1	3	1.90	60	74	-14	1.71
9ER	38	45	-7	1.09	0	2	-2	2.00	39	47	-8	1.22	14	54	-40	6.86	2	5	-3	1.60	16	59	-43	7.02
9ET	192	211	-19	1.34	10	16	-6	1.66	204	227	-23	1.57	154	184	-30	2.31	4	10	-6	2.27	160	194	-34	2.56
9NL	0	26	-26	7.21	0	0	0	0.00	0	26	-26	7.21	10	57	-47	8.12	0	2	-2	2.00	10	59	-49	8.34
9NR	0	15	-15	5.48	0	0	0	0.00	0	15	-15	5.48	1	12	-11	4.31	2	5	-3	1.60	3	17	-14	4.43
9NT	8	10	-2	0.67	4	1	3	1.90	12	11	1	0.29	5	13	-8	2.67	7	2	5	2.36	12	15	-3	0.82
9SL	17	10	7	1.91	0	1	-1	1.41	17	11	6	1.60	11	22	-11	2.71	0	0	0	0.00	11	22	-11	2.71
9SR	70	26	44	6.35	2	5	-3	1.60	72	31	41	5.71	23	50	-27	4.47	1	1	0	0.00	24	51	-27	4.41
9ST	56	10	46	8.01	5	1	4	2.31	61	11	50	8.33	41	20	21	3.80	2	0	2	2.00	43	20	23	4.10
9WL	11	33	-22	4.69	0	2	-2	2.00	11	35	-24	5.00	28	45	-17	2.81	2	1	1	0.82	30	46	-16	2.60
9WR	0	38	-38	8.72	0	1	-1	1.41	0	39	-39	8.83	62	56	6	0.78	1	1	0	0.00	63	57	6	0.77
9WT	225	239	-14	0.92	15	25	-10	2.24	241	264	-23	1.45	276	258	18	1.10	10	14	-4	1.15	286	272	14	0.84
10NR	269	323	-54	3.14	12	24	-12	2.83	284	347	-63	3.55	219	302	-83	5.14	10	18	-8	2.14	231	320	-89	5.36
10NT	244	247	-3	0.19	7	11	-4	1.33	251	258	-7	0.44	143	127	16	1.38	6	10	-4	1.41	149	137	12	1.00
10SL	0	19	-19	6.16	0	1	-1	1.41	0	20	-20	6.32	9	29	-20	4.59	0	0	0	0.00	9	29	-20	4.59
10ST	61	106	-45	4.92	4	4	0	0.00	65	110	-45	4.81	108	138	-30	2.71	1	7	-6	3.00	109	145	-36	3.19

10WL	303	275	28	1.65	16	28	-12	2.56	320	303	17	0.96	302	317	-15	0.85	12	17	-5	1.31	314	334	-20	1.11
10WR	0	14	-14	5.29	0	1	-1	1.41	0	15	-15	5.48	0	26	-26	7.21	0	1	-1	1.41	0	27	-27	7.35
12EL	34	15	19	3.84	1	0	1	1.41	35	15	20	4.00	4	24	-20	5.35	2	3	-1	0.63	6	27	-21	5.17
12ER	10	6	4	1.41	0	1	-1	1.41	10	7	3	1.03	2	26	-24	6.41	0	1	-1	1.41	2	27	-25	6.57
12ET	4	2	2	1.15	0	3	-3	2.45	4	5	-1	0.47	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00
12NL	18	19	-1	0.23	0	2	-2	2.00	18	21	-3	0.68	15	30	-15	3.16	0	0	0	0.00	15	30	-15	3.16
12NR	19	12	7	1.78	0	0	0	0.00	21	12	9	2.22	1	9	-8	3.58	1	2	-1	0.82	3	11	-8	3.02
12NT	268	248	20	1.25	17	27	-10	2.13	285	275	10	0.60	269	194	75	4.93	6	8	-2	0.76	275	202	73	4.73
12SL	10	21	-11	2.79	7	8	-1	0.37	17	29	-12	2.50	0	10	-10	4.47	0	0	0	0.00	0	10	-10	4.47
12SR	57	28	29	4.45	5	2	3	1.60	62	30	32	4.72	14	33	-19	3.92	0	0	0	0.00	14	33	-19	3.92
12ST	464	427	37	1.75	22	22	0	0.00	486	449	37	1.71	501	379	122	5.82	17	13	4	1.03	518	392	126	5.91
12WL	18	13	5	1.27	0	0	0	0.00	18	13	5	1.27	0	10	-10	4.47	0	1	-1	1.41	0	11	-11	4.69
12WR	0	34	-34	8.25	0	0	0	0.00	0	34	-34	8.25	9	30	-21	4.76	0	1	-1	1.41	9	31	-22	4.92
12WT	56	3	53	9.76	0	0	0	0.00	56	3	53	9.76	29	8	21	4.88	0	0	0	0.00	29	8	21	4.88
13NR	62	23	39	5.98	1	5	-4	2.31	63	28	35	5.19	29	46	-17	2.78	2	3	-1	0.63	31	49	-18	2.85
13NT	24	36	-12	2.19	4	0	4	2.83	28	36	-8	1.41	38	42	-4	0.63	7	0	7	3.74	45	42	3	0.45
13SL	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
13ST	55	14	41	6.98	3	2	1	0.63	58	16	42	6.90	23	34	-11	2.06	0	1	-1	1.41	23	35	-12	2.23
13WL	112	37	75	8.69	5	5	0	0.00	117	42	75	8.41	36	57	-21	3.08	2	1	1	0.82	38	58	-20	2.89
13WR	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69	13	8	5	1.54	0	0	0	0.00	13	8	5	1.54
14EL	245	211	34	2.25	11	13	-2	0.58	256	224	32	2.07	122	109	13	1.21	12	10	2	0.60	134	119	15	1.33
14ER	0	3	-3	2.45	0	1	-1	1.41	0	4	-4	2.83	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
14NL	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41
14NT	281	299	-18	1.06	22	28	-6	1.20	303	327	-24	1.35	258	275	-17	1.04	9	12	-3	0.93	267	287	-20	1.20
14SR	71	102	-31	3.33	7	6	1	0.39	78	108	-30	3.11	102	102	0	0.00	1	8	-7	3.30	103	110	-7	0.68
14ST	540	473	67	2.98	35	31	4	0.70	575	504	71	3.06	507	420	87	4.04	16	13	3	0.79	523	433	90	4.12
15EL	0	2	-2	2.00	0	0	0	0.00	0	2	-2	2.00	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69
15ER	5	4	1	0.47	0	1	-1	1.41	5	5	0	0.00	10	12	-2	0.60	0	1	-1	1.41	10	13	-3	0.88
15ET	242	200	42	2.83	11	14	-3	0.85	253	214	39	2.55	111	90	21	2.09	6	10	-4	1.41	117	100	17	1.63
15NL	17	19.84	-2.844	0.66	0	0	0	0.00	17	19.84	-2.844	0.66	36	30.43	5.565	0.97	0	0	0	0.00	36	30.43	5.565	0.97
15NR	2	17.76	-15.76	5.01	4	0	4	2.83	6	17.76	-11.76	3.41	10	15.22	-5.217	1.47	7	0	7	3.74	17	15.22	1.783	0.44
15NT	4	9.4	-5.4	2.09	0	0	0	0.00	4	9.4	-5.4	2.09	5	4.348	0.652	0.30	0	0	0	0.00	5	4.348	0.652	0.30
15SL	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83
15SR	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74	0	9	-9	4.24	0	1	-1	1.41	0	10	-10	4.47
15ST	0	5	-5	3.16	0	1	-1	1.41	0	6	-6	3.46	0	12	-12	4.90	0	0	0	0.00	0	12	-12	4.90
15WL	51	11	40	7.18	3	0	3	2.45	54	11	43	7.54	12	15	-3	0.82	0	0	0	0.00	12	15	-3	0.82
15WR	19	1	18	5.69	0	0	0	0.00	19	1	18	5.69	17	3	14	4.43	0	1	-1	1.41	17	4	13	4.01
15WT	39	97	-58	7.03	4	6	-2	0.89	43	103	-60	7.02	99	98	1	0.10	1	7	-6	3.00	100	105	-5	0.49
11EL	468	499	-31	1.41	19	35	-16	3.08	490	534	-44	1.94	287	336	-49	2.78	16	28	-12	2.56	305	364	-59	3.23
11ER	289	243	46	2.82	8	8	0	0.00	297	251	46	2.78	255	227	28	1.80	11	6	5	1.71	266	233	33	2.09
11ET	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NL	300	258	42	2.51	16	18	-2	0.49	317	276	41	2.38	373	277	96	5.33	10	11	-1	0.31	383	288	95	5.19
11NR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NT	44	61	-17	2.35	0	0	0	0.00	44	61	-17	2.35	75	71	4	0.47	0	0	0	0.00	75	71	4	0.47
11SL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11SR	315	310	5	0.28	20	32	-12	2.35	336	342	-6	0.33	358	358	0	0.00	12	24	-12	2.83	370	382	-12	0.62
11ST	46	61	-15	2.05	0	0	0	0.00	46	61	-15	2.05	55	75	-20	2.48	1	0	1	1.41	56	75	-19	2.35
11WL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WT	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11EL	468	499	-31	1.41	19	35	-16	3.08	490	534	-44	1.94	287	336	-49	2.78	16	28	-12	2.56	305	364	-59	3.23
11ER	289	243	46	2.82	8	8	0	0.00	297	251	46	2.78	255	227	28	1.80	11	6	5	1.71	266	233	33	2.09
11ET	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NL	300	258	42	2.51	16	18	-2	0.49	317	276	41	2.38	373	277	96	5.33	10	11	-1	0.31	383	288	95	5.19
11NR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NT	44	61	-17	2.35	0	0	0	0.00	44	61	-17	2.35	75	71	4	0.47	0	0	0	0.00	75	71	4	0.47
11SL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11SR	315	310	5	0.28	20	32	-12	2.35	336	342	-6	0.33	358	358	0	0.00	12	24	-12	2.83	370	382	-12	0.62
11ST	46	61	-15	2.05	0	0	0	0.00	46	61	-15	2.05	55	75	-20	2.48	1	0	1	1.41	56	75	-19	2.35
11WL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WT	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

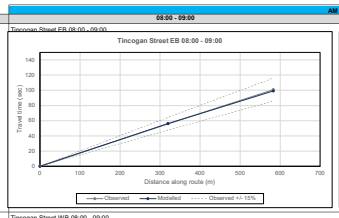
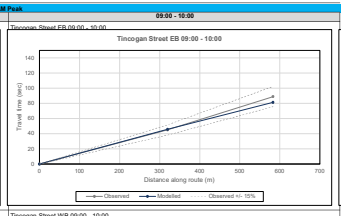
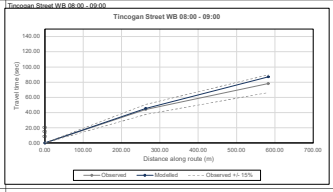
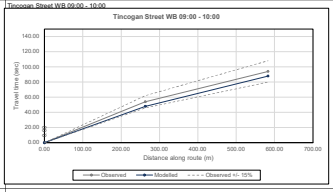
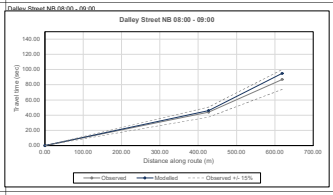
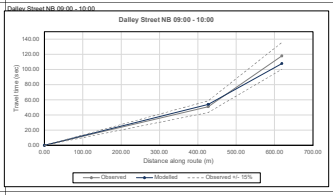
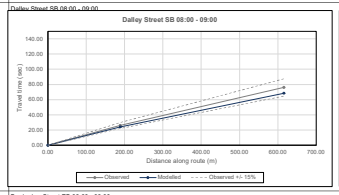
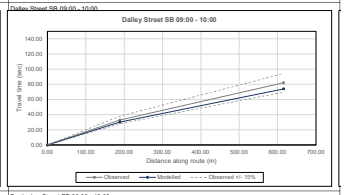
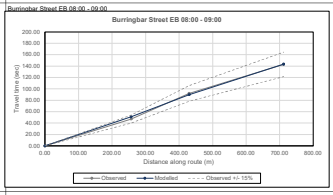
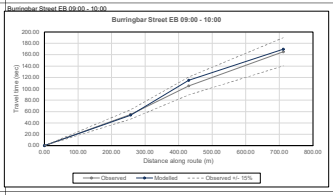
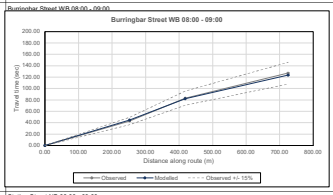
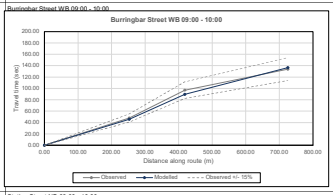
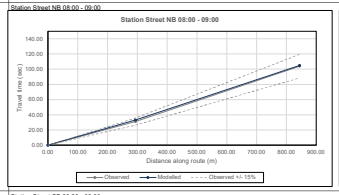
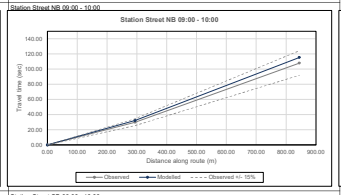
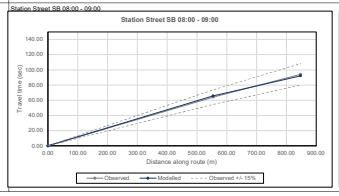
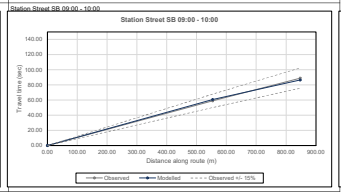
Turn	PM Peak																							
	15:00 - 16:00												16:00 - 17:00											
	Light vehicles				Heavy vehicles				All vehicles				Light vehicles				Heavy vehicles				All vehicles			
	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH	Model	Obs	Diff	GEH
1EL	1	3	-2	1.41	0	0	0	0.00	1	3	-2	1.41	1	6	-5	2.67	0	0	0	0.00	1	6	-5	2.67
1ER	0	5	-5	3.16	0	1	-1	1.41	0	6	-6	3.46	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83
1ET	329	289	40	2.28	19	14	5	1.23	348	303	45	2.49	301	296	5	0.29	7	11	-4	1.33	308	307	1	0.06
1NL	0	4	-4	2.83	1	1	0	0.00	1	5	-4	2.31	11	8	3	0.97	0	1	-1	1.41	11	9	2	0.63
1NR	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45
1NT	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41	3	0	3	2.45	0	0	0	0.00	3	0	3	2.45
1SL	84	74	10	1.13	2	7	-5	2.36	86	81	5	0.55	51	49	2	0.28	3	0	3	2.45	54	49	5	0.70
1SR	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	3	4	-1	0.53	0	0	0	0.00	3	4	-1	0.53
1ST	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41
1WL	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
1WR	14	10	4	1.15	1	2	-1	0.82	15	12	3	0.82	24	15	9	2.04	0	0	0	0.00	24	15	9	2.04
1WT	230	261	-31	1.98	6	10	-4	1.41	236	271	-35	2.20	249	257	-8	0.50	7	9	-2	0.71	256	266	-10	0.62
2EL	1	9	-8	3.58	0	0	0	0.00	1	9	-8	3.58	4	4	0	0.00	0	0	0	0.00	4	4	0	0.00
2ER	7	13	-6	1.90	0	1	-1	1.41	7	14	-7	2.16	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74
2ET	317	287	30	1.73	19	14	5	1.23	336	301	35	1.96	300	307	-7	0.40	7	11	-4	1.33	307	318	-11	0.62
2NL	15	9	6	1.73	0	1	-1	1.41	15	10	5	1.41	5	8	-3	1.18	0	0	0	0.00	5	8	-3	1.18
2NR	0	6	-6	3.46	0	1	-1	1.41	0	7	-7	3.74	0	2	-2	2.00	0	0	0	0.00	0	2	-2	2.00
2NT	0	5	-5	3.16	1	0	1	1.41	1	5	-4	2.31	6	3	3	1.41	0	0	0	0.00	6	3	3	1.41
2SL	15	10	5	1.41	0	0	0	0.00	15	10	5	1.41	1	4	-3	1.90	0	0	0	0.00	1	4	-3	1.90
2SR	3	10	-7	2.75	0	0	0	0.00	3	10	-7	2.75	4	4	0	0.00	0	0	0	0.00	4	4	0	0.00
2ST	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45
2WL	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16	0	9	-9	4.24	0	0	0	0.00	0	9	-9	4.24
2WR	17	14	3	0.76	0	0	0	0.00	17	14	3	0.76	4	10	-6	2.27	1	0	1	1.41	5	10	-5	1.83
2WT	217	255	-38	2.47	7	12	-5	1.62	224	267	-43	2.74	259	257	2	0.12	6	10	-4	1.41	265	267	-2	0.12
3EL	33	78	-45	6.04	0	2	-2	2.00	33	80	-47	6.25	23	40	-17	3.03	0	1	-1	1.41	24	41	-17	2.98
3ER	10	3	7	2.75	0	0	0	0.00	10	3	7	2.75	1	5	-4	2.31	0	0	0	0.00	1	5	-4	2.31
3ET	203	180	23	1.66	14	8	6	1.81	217	188	29	2.04	236	197	39	2.65	7	4	3	1.28	243	201	42	2.82
3NL	13	8	5	1.54	0	0	0	0.00	13	8	5	1.54	1	11	-10	4.08	0	0	0	0.00	1	11	-10	4.08
3NR	9	10	-1	0.32	0	0	0	0.00	9	10	-1	0.32	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16
3NT	0	9	-9	4.24	0	2	-2	2.00	0	11	-11	4.69	0	10	-10	4.47	0	0	0	0.00	0	10	-10	4.47
3SL	113	119	-6	0.56	4	7	-3	1.28	117	126	-9	0.82	71	106	-35	3.72	0	7	-7	3.74	71	113	-42	4.38
3SR	54	100	-46	5.24	0	0	0	0.00	54	100	-46	5.24	34	76	-42	5.66	0	2	-2	2.00	34	78	-44	5.88
3ST	9	15	-6	1.73	0	0	0	0.00	9	15	-6	1.73	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00
3WL	0	3	-3	2.45	0	1	-1	1.41	0	4	-4	2.83	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83
3WR	115	118	-3	0.28	4	6	-2	0.89	119	124	-5	0.45	71	107	-36	3.82	0	6	-6	3.46	71	113	-42	4.38
3WT	119	153	-34	2.92	3	6	-3	1.41	122	159	-37	3.12	198	158	40	3.00	6	4	2	0.89	204	162	42	3.10
4EL	35	35	0	0.00	0	0	0	0.00	35	35	0	0.00	15	36	-21	4.16	3	0	3	2.45	18	36	-18	3.46
4ER	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46	0	9	-9	4.24	0	0	0	0.00	0	9	-9	4.24
4ET	216	193	23	1.61	11	5	6	2.12	227	198	29	1.99	216	203	13	0.90	6	1	5	2.67	222	204	18	1.23
4NL	16	11	5	1.36	0	0	0	0.00	16	11	5	1.36	19	14	5	1.23	0	0	0	0.00	19	14	5	1.23
4NR	0	7	-7	3.74	0	0	0	0.00	0	7	-7	3.74	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46
4NT	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00	0	11	-11	4.69	0	1	-1	1.41	0	12	-12	4.90
4SL	32	86	-54	7.03	3	5	-2	1.00	35	91	-56	7.06	31	64	-33	4.79	1	4	-3	1.90	33	68	-35	4.93
4SR	29	50	-21	3.34	3	0	3	2.45	32	50	-18	2.81	35	62	-27	3.88	1	1	0	0.00	37	63	-26	3.68
4ST	13	11	2	0.58	0	0	0	0.00	13	11	2	0.58	1	1	0	0.00	0	0	0	0.00	1	1	0	0.00
4WL	0	5	-5	3.16	0	0	0	0.00	0	5	-5	3.16	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00
4WR	33	48	-15	2.36	2	1	1	0.82	35	49	-14	2.16	29	47	-18	2.92	0	0	0	0.00	29	47	-18	2.92
4WT	124	189	-65	5.20	1	5	-4	2.31	125	194	-69	5.46	209	190	19	1.35	6	8	-2	0.76	215	198	17	1.18
5NR	5	4	1	0.47	0	1	-1	1.41	5	5	0	0.00	17	5	12	3.62	0	0	0	0.00	17	5	12	3.62
5NT	53	28	25	3.93	2	1	1	0.82	55	29	26	4.01	43	34	9	1.45	2	2	0	0.00	45	36	9	1.41
5SL	212	214	-2	0.14	10	4	6	2.27	222	218	4	0.27	203	217	-14	0.97	11	2	9	3.53	214	219	-5	0.34
5ST	32	24	8	1.51	0	2	-2	2.00	32	26	6	1.11	43	25	18	3.09	1	0	1	1.41	44	25	19	3.23
5WL	19	15	4	0.97	0	0	0	0.00	19	15	4	0.97	28	13	15	3.31	0	2	-2	2.00	28	15	13	2.80
5WR	175	249	-74	5.08	4	6	-2	0.89	179	255	-76	5.16	253	258	-5	0.31	7	7	0	0.00	261	265	-4	0.25
6EL	153	190	-37	2.83	0	0	0	0.00	153	190	-37	2.83	207	192	15	1.06	0	0	0	0.00	207	192	15	1.06
6ER	55	29	26	4.01	0	0	0	0.00	55	29	26	4.01	41	21	20	3.59	0	0	0	0.00	41	21	20	3.59
6NL	48	73	-25	3.21	0	0	0	0.00	48	73	-25	3.21	62	66	-4	0.50	0	0	0	0.00	62	66	-4	0.50
6NT	180	214	-34	2.42	5	7	-2	0.82	185	221	-36	2.53	234	226	8	0.53	10	9	1	0.32	245	235	10	0.65
6SR	159	141	18	1.47	0	0	0	0.00	159	141	18	1.47	147	117	30	2.61	0	0	0	0.00	147	117	30	2.61
6ST	189	219	-30	2.10	10	6	4	1.41	199	225	-26	1.79	205	221	-16	1.10	12	2	10	3.78	217	223	-6	0.40
7EL	10	16	-6	1.66	0	0	0	0.00	10	16	-6	1.66	25	10	15	3.59	0	0	0	0.00	25	10	15	3.59
7ET	64	59	5	0.64	2	1	1	0.82	66	60	6	0.76	40	53	-13	1.91	3	0	3	2.45	43	53	-10	1.44
7SL	39	40	-1	0.16	0	5	-5	3.16	39	45	-6	0.93	29	20	9	1.82	0	0	0	0.00	29	20	9	1.82
7SR	17	16	1	0.25	0	3	-3	2.45	18	19	-1	0.23	19	18	1	0.23	0	6	-6	3.46	19	24	-5	1.08
7WR	17	13	4	1.03	0	2	-2	2.00	17	15	2	0.50	14	19	-5	1.23	0	0	0	0.00	14	19	-5	1.23
7WT	20	27	-7	1.44	2	0	2	2.00	22	27	-5	1.01	33	15	18	3.67	1	0	1	1.41	34	15	19	3.84
8EL	209	153	56	4.16	5	4	1	0.47	216	157	59	4.32	240	181	59	4.07	1	2	-1	0.82	242	183	59	4.05
8ER	23	41	-18	3.18	1	0	1	1.41	24	41	-17	2.98	29	52	-23	3.61	0	1	-1	1.41	29	53	-24	3.75
8ET	15	28	-13	2.80	0	0	0	0.00	15	28	-13	2.80	37	32	5	0.85	0	0	0	0.00	37	32	5	0.85
8NL	27	92	-65	8.43	0	0	0	0.00	27	92	-65	8.43	15	78	-63	9.24	3	3	0	0.00	18	81	-63	8.95
8NR	0	12	-12	4.90	0	0	0	0.00	0	12	-12	4.90	0	8	-8	4.00	1	0	1	1.41	1	8	-7	3.30
8NT	135	109	26	2.35	4	9	-5	1.96	139	118	21	1.85	107	145	-38	3.39	0	3	-3	2.45	108	148	-40	3.54
8SL	61	35	26	3.75	2	1	1	0.82	63	36	27	3.84	26	23	3	0.61	2	0	2	2.00	28	23	5	0.99
8SR	341	264	77	4.43	15	10	5	1.41	356	274	82	4.62	269	222	47	3.00	6	8	-2	0.76	275	230	45	2.83
8ST	105	147	-42	3.74	3	6	-3	1.41	108	153	-45	3.94	57	116	-59	6.34	0	2	-2	2.00	57	118	-61	6.52
8WL	10	21	-11	2.79	0	0	0	0.00	10	21	-11	2.79	4	11	-7	2.56	0	0	0	0.00	4	11	-7	2.56
8WR	15	3	12	4.00	2	0	2	2.00	17	3	14	4.43	33	20	13	2.53	0	0	0	0.00	33	20	13	2.53
8WT	12	19	-7	1.78	0	3	-3	2.45	13	22	-9	2.15	15	16	-1	0.25	1	6	-5	2.67	16	22	-6	1.38
9EL	45	82	-37	4.64	8	5	3	1.18	53	87	-34	4.06	34	60	-26	3.79	2	1	1	0.82	36	61	-25	3.59
9ER	47	75	-28	3.59	2	4	-2	1.15	49	79	-30	3.75	44	67	-23	3.09	0	4	-4	2.83	45	71	-26	3.41
9ET	221	180	41	2.90	6	7	-1	0.39	229	187	42	2.91	244	183	61	4.17	1	5	-4	2.31	246	188	58	3.94
9NL	20	66	-46	7.01	0	2	-2	2.00	20	68	-48	7.24	19	62	-43	6.76	0	1	-1	1.41	19	63	-44	6.87
9NR	10	17	-7	1.91	0	0	0	0.00	10	17	-7	1.91	1	11	-10	4.08	2	0	2	2.00	3	11	-8	3.02
9NT	16	21	-5	1.16	2	0	2	2.00	18	21	-3	0.68	17	17	0	0.00	1	0	1	1.41	18	17	1	0.24
9SL	6	43	-37	7.48	0	0	0	0.00	6	43	-37	7.48	12	40	-28	5.49	0	0	0	0.00	12	40	-28	5.49
9SR	26	56	-30	4.69	2	0	2	2.00	28	56	-28	4.32	28	52	-24	3.79	1	0	1	1.41	29	52	-23	3.61
9ST	34	27	7	1.27	7	2	5	2.36	41	29	12	2.03	38	25	13	2.32	1	0	1	1.41	39	25	14	2.47
9WL	23	42	-19	3.33	0	0	0	0.00	23	42	-19	3.33	8	45	-37	7.19	0	1	-1	1.41	8	46	-38	7.31
9WR	2	38	-36	8.05	0	0	0	0.00	2	38	-36	8.05	0	32	-32	8.00	0	0	0	0.00	0	32	-32	8.00
9WT	344	302	42	2.34	15	13	2	0.53	360	315	45	2.45	265	257	8	0.50	10	15	-5	1.41	275	272	3	0.18
10NR	286	322	-36	2.06	11	20	-9	2.29	299	342	-43	2.40	304	291	13	0.75	3	9	-6	2.45	309	300	9	0.52
10NT	105	193	-88	7.21	10	5	5	1.83	115	198	-83	6.63	102	134	-32	2.95	1	2	-1	0.82	103	136	-33	3.02
10SL	9	37	-28	5.84	0	0	0	0.00	9	37	-28	5.84	11	24	-13	3.11	0	0	0	0.00	11	24	-13	3.11
10ST	79	167	-88	7.93	1	6	-5	2.67	80	173	-93	8.27	57	130	-73	7.55	0	0	0	0.00	57	130	-73	7.55

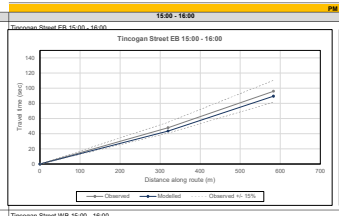
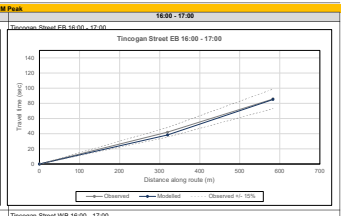
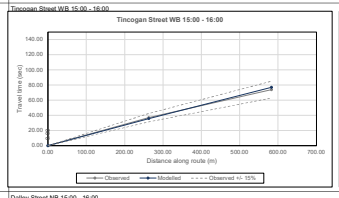
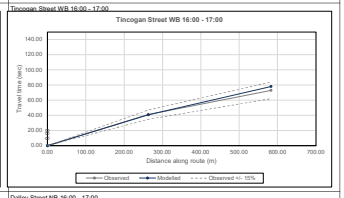
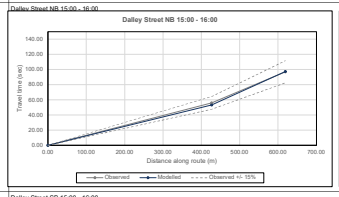
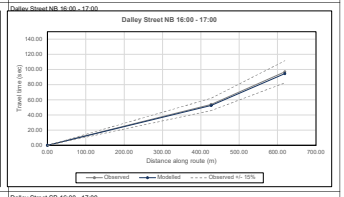
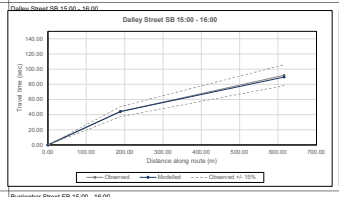
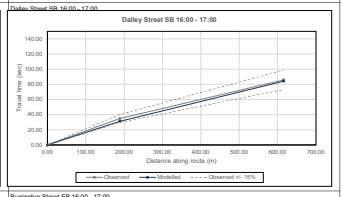
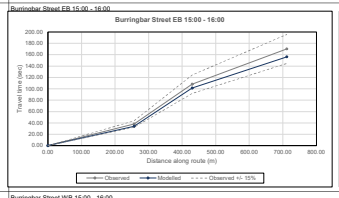
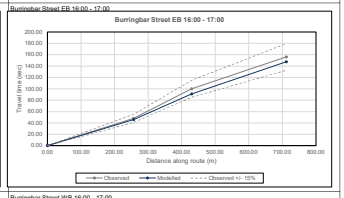
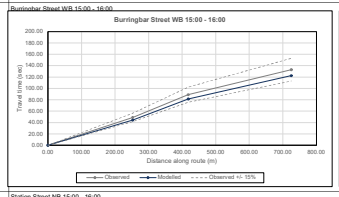
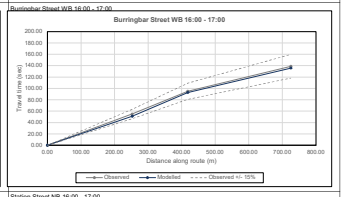
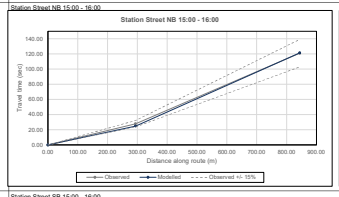
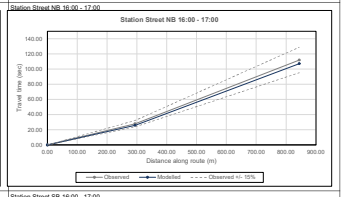
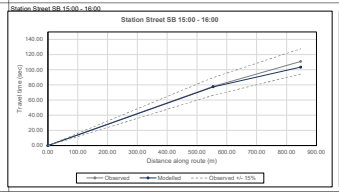
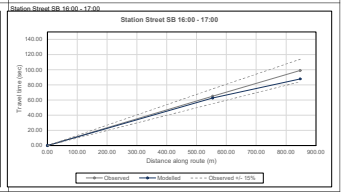
10WL	358	399	-41	2.11	24	19	5	1.08	383	418	-35	1.75	302	345	-43	2.39	11	15	-4	1.11	313	360	-47	2.56
10WR	8	27	-19	4.54	0	0	0	0.00	8	27	-19	4.54	0	7	-7	3.74	0	1	-1	1.41	0	8	-8	4.00
12EL	6	44	-38	7.60	5	7	-2	0.82	11	51	-40	7.18	56	40	16	2.31	0	0	0	0.00	56	40	16	2.31
12ER	17	30	-13	2.68	0	1	-1	1.41	17	31	-14	2.86	8	41	-33	6.67	0	2	-2	2.00	8	43	-35	6.93
12ET	0	6	-6	3.46	0	0	0	0.00	0	6	-6	3.46	0	8	-8	4.00	0	0	0	0.00	0	8	-8	4.00
12NL	12	27	-15	3.40	0	0	0	0.00	12	27	-15	3.40	10	17	-7	1.91	0	0	0	0.00	10	17	-7	1.91
12NR	18	19	-1	0.23	0	0	0	0.00	20	19	1	0.23	16	10	6	1.66	0	2	-2	2.00	17	12	5	1.31
12NT	317	207	110	6.80	12	14	-2	0.55	329	221	108	6.51	301	210	91	5.69	0	3	-3	2.45	302	213	89	5.55
12SL	63	33	30	4.33	8	8	0	0.00	71	41	30	4.01	1	9	-8	3.58	0	3	-3	2.45	1	12	-11	4.31
12SR	19	27	-8	1.67	1	2	-1	0.82	20	29	-9	1.82	23	16	7	1.59	0	1	-1	1.41	23	17	6	1.34
12ST	502	450	52	2.38	17	13	4	1.03	519	463	56	2.53	423	336	87	4.47	10	12	-2	0.60	433	348	85	4.30
12WL	8	16	-8	2.31	1	1	0	0.00	9	17	-8	2.22	0	17	-17	5.83	0	0	0	0.00	0	17	-17	5.83
12WR	11	21	-10	2.50	0	1	-1	1.41	11	22	-11	2.71	5	22	-17	4.63	0	0	0	0.00	5	22	-17	4.63
12WT	5	4	1	0.47	1	0	1	1.41	6	4	2	0.89	0	4	-4	2.83	0	0	0	0.00	0	4	-4	2.83
13NR	6	28	-22	5.34	5	6	-1	0.43	11	34	-23	4.85	2	37	-35	7.93	0	1	-1	1.41	2	38	-36	8.05
13NT	8	58	-50	8.70	2	0	2	2.00	10	58	-48	8.23	15	42.2	-27.2	5.09	1	0	1	1.41	16	42.2	-26.2	4.86
13SL	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	2	4	-2	1.15	0	0	0	0.00	2	4	-2	1.15
13ST	34	37	-3	0.50	5	1	4	2.31	39	38	1	0.16	28	23	5	0.99	2	0	2	2.00	30	23	7	1.36
13WL	15	63	-48	7.69	2	3	-1	0.63	17	66	-49	7.61	16	39	-23	4.39	0	1	-1	1.41	16	40	-24	4.54
13WR	22	19	3	0.66	0	0	0	0.00	22	19	3	0.66	21	11.8	9.203	2.27	0	1	-1	1.41	21	12.8	8.203	2.00
14EL	105	196	-91	7.42	12	9	3	0.93	117	205	-88	6.94	102	169	-67	5.76	2	2	0	0.00	104	171	-67	5.71
14ER	2	9	-7	2.98	0	0	0	0.00	2	9	-7	2.98	0	4	-4	2.83	0	1	-1	1.41	0	5	-5	3.16
14NL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	1	-1	1.41	0	0	0	0.00	0	1	-1	1.41
14NT	329	272	57	3.29	17	22	-5	1.13	346	294	52	2.91	367	271	96	5.37	0	3	-3	2.45	368	274	94	5.25
14SR	66	123	-57	5.86	5	8	-3	1.18	71	131	-60	5.97	28	62	-34	5.07	2	1	1	0.82	30	63	-33	4.84
14ST	574	501	73	3.15	26	23	3	0.61	600	524	76	3.21	440	358	82	4.11	10	15	-5	1.41	450	373	77	3.80
15EL	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69
15ER	7	5	2	0.82	0	0	0	0.00	7	5	2	0.82	12	8	4	1.26	0	0	0	0.00	12	8	4	1.26
15ET	88	182	-94	8.09	10	8	2	0.67	98	190	-92	7.67	97	150	-53	4.77	1	3	-2	1.41	98	153	-55	4.91
15NL	0	36.36	-36.36	8.53	0	0	0	0.00	0	36.36	-36.36	8.53	14	34	-20	4.08	0	1	-1	1.41	14	35	-21	4.24
15NR	8	19	-11	2.99	2	0	2	2.00	10	19	-9	2.36	1	30	-29	7.37	1	0	1	1.41	2	30	-28	7.00
15NT	22	11.76	10.24	2.49	0	0	0	0.00	22	11.76	10.24	2.49	21	10	11	2.79	0	0	0	0.00	21	10	11	2.79
15SL	14	3	11	3.77	0	1	-1	1.41	14	4	10	3.33	6	1	5	2.67	0	0	0	0.00	6	1	5	2.67
15SR	0	11	-11	4.69	0	0	0	0.00	0	11	-11	4.69	0	9	-9	4.24	0	0	0	0.00	0	9	-9	4.24
15ST	10	16	-6	1.66	0	1	-1	1.41	10	17	-7	1.91	4	11	-7	2.56	0	0	0	0.00	4	11	-7	2.56
15WL	17	19	-2	0.47	5	0	5	3.16	22	19	3	0.66	14	8	6	1.81	2	0	2	2.00	16	8	8	2.31
15WR	0	3	-3	2.45	0	0	0	0.00	0	3	-3	2.45	0	2	-2	2.00	0	1	-1	1.41	0	3	-3	2.45
15WT	49	116	-67	7.38	0	8	-8	4.00	49	124	-75	8.06	21	66	-45	6.82	0	0	0	0.00	21	66	-45	6.82
11EL	315	375	-60	3.23	21	25	-4	0.83	338	400	-62	3.23	335	308	27	1.51	4	10	-6	2.27	341	318	23	1.27
11ER	293	233	60	3.70	10	6	4	1.41	303	239	64	3.89	311	239	72	4.34	12	2	10	3.78	323	241	82	4.88
11ET	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NL	255	250	5	0.31	5	7	-2	0.82	260	257	3	0.19	348	270	78	4.44	10	8	2	0.67	359	278	81	4.54
11NR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NT	75	101	-26	2.77	0	0	0	0.00	75	101	-26	2.77	72	107	-35	3.70	0	1	-1	1.41	72	108	-36	3.79
11SL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11SR	362	420	-58	2.93	25	25	0	0.00	388	445	-57	2.79	286	366	-80	4.43	11	15	-4	1.11	297	381	-84	4.56
11ST	78	127	-49	4.84	0	0	0	0.00	78	127	-49	4.84	73	99	-26	2.80	0	0	0	0.00	73	99	-26	2.80
11WL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WT	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11EL	315	375	-60	3.23	21	25	-4	0.83	338	400	-62	3.23	335	308	27	1.51	4	10	-6	2.27	341	318	23	1.27
11ER	293	233	60	3.70	10	6	4	1.41	303	239	64	3.89	311	239	72	4.34	12	2	10	3.78	323	241	82	4.88
11ET	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NL	255	250	5	0.31	5	7	-2	0.82	260	257	3	0.19	348	270	78	4.44	10	8	2	0.67	359	278	81	4.54
11NR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11NT	75	101	-26	2.77	0	0	0	0.00	75	101	-26	2.77	72	107	-35	3.70	0	1	-1	1.41	72	108	-36	3.79
11SL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11SR	362	420	-58	2.93	25	25	0	0.00	388	445	-57	2.79	286	366	-80	4.43	11	15	-4	1.11	297	381	-84	4.56
11ST	78	127	-49	4.84	0	0	0	0.00	78	127	-49	4.84	73	99	-26	2.80	0	0	0	0.00	73	99	-26	2.80
11WL	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WR	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
11WT	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

APPENDIX B

TRAVEL TIME GRAPHS

Cardno now Stantec

Route	Dir	AM Peak 08:00 - 09:00	AM Peak 09:00 - 10:00
Tincogan Street	EB		
Tincogan Street	WB		
Dalley Street	NB		
Dalley Street	SB		
Burringbar Street	EB		
Burringbar Street	WB		
Station Street	NB		
Station Street	SB		

Route	Dir	PM Peak 15:00 - 16:00	PM Peak 16:00 - 17:00
Tincogan Street	EB		
Tincogan Street	WB		
Dalley Street	NB		
Dalley Street	SB		
Burringbar Street	EB		
Burringbar Street	WB		
Station Street	NB		
Station Street	SB		

APPENDIX B

INTERSECTION PERFORMANCE RESULTS

Cardno now Stantec

2022 Base Model	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	1	1.8	A	0	1	3.3	A	0	1	2.3	A	0	1	2.7	A	0
		Through	437	0.2	A	0	421	0.3	A	0	346	0.2	A	0	301	0.2	A	0
	South	Left	59	11.2	A	4	84	14.1	B	8	77	9.0	A	6	49	9.9	A	6
		Right	0	0.0	A	2	0	0.0	A	4	0	0.0	A	3	2	10.7	A	4
	West	Through	526	6.7	A	4	453	3.3	A	3	236	4.3	A	3	256	0.2	A	1
		Right	98	10.8	A	3	68	6.2	A	2	15	6.5	A	1	24	2.9	A	2
		Total	1121	11.2	A	4	1027	14.1	B	8	675	9.0	A	6	633	10.7	A	6
Tincogan St / Gordon St	North	Left	2	2.9	A	1	9	3.0	A	1	15	4.0	A	1	5	4.5	A	1
		Through	4	16.2	B	2	0	0.0	A	0	1	2.9	A	0	6	1.3	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	17	2.5	A	0	3	3.0	A	0	1	2.9	A	0	4	1.7	A	0
		Through	442	0.8	A	0	418	0.7	A	0	336	0.7	A	0	307	0.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	7	2.4	A	1	0	0.0	A	0
	South	Left	3	5.6	A	1	0	0.0	A	0	2	2.2	A	1	0	0.0	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	1	20.5	B	1	0	0.0	A	0	0	0.0	A	1	4	16.9	B	2
	West	Left	13	3.5	A	3	14	2.0	A	0	0	0.0	A	0	0	0.0	A	1
		Through	469	1.8	A	10	429	0.4	A	2	221	0.3	A	1	259	0.2	A	2
		Right	44	6.8	A	4	11	7.4	A	1	15	5.0	A	1	5	2.9	A	2
		Total	995	20.5	B	10	884	7.4	A	2	598	5.0	A	1	590	16.9	B	2
Tincogan St / Dalley St	North	Left	5	1.1	A	1	5	0.7	A	0	13	1.6	A	1	1	0.8	A	0
		Through	19	0.0	A	0	16	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	10	3.3	A	2	4	1.1	A	0	9	1.5	A	1	0	0.0	A	0
	East	Left	6	20.7	B	11	14	27.8	B	11	17	21.8	B	7	4	51.9	D	6
		Through	274	22.9	B	17	270	21.7	B	16	210	12.8	A	9	243	17.5	B	12
		Right	3	38.2	C	10	0	0.0	A	9	10	16.5	B	5	1	70.2	F	8
	South	Left	170	35.7	C	12	141	41.5	C	17	111	31.6	C	9	55	22.0	B	6
		Through	5	41.4	C	6	0	0.0	A	7	0	0.0	A	5	0	0.0	A	3
		Right	17	41.6	C	9	3	33.4	C	9	21	33.7	C	7	32	42.9	D	8
	West	Left	13	8.6	A	1	15	3.0	A	1	0	0.0	A	0	0	0.0	A	0
		Through	338	10.0	A	12	365	6.4	A	11	122	1.9	A	2	204	2.3	A	6
		Right	128	15.2	B	6	58	7.0	A	3	119	4.7	A	2	71	3.1	A	2
		Total	988	41.6	C	17	891	41.5	C	17	632	33.7	C	9	611	70.2	F	12
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	16	0.9	A	0	19	1.1	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	2	6.7	A	1	7	3.5	A	1	9	8.0	A	1	18	6.2	A	2
		Through	278	3.8	A	11	236	7.0	A	8	220	3.4	A	6	211	4.0	A	7
		Right	13	2.7	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	South	Left	54	1.6	A	3	28	4.6	A	2	4	2.9	A	1	22	2.1	A	2
		Through	4	0.6	A	1	2	1.5	A	0	13	0.7	A	0	1	0.5	A	1
		Right	17	2.6	A	2	19	1.2	A	1	26	1.3	A	1	24	2.1	A	3
	West	Left	0	0.0	A	8	0	0.0	A	6	0	0.0	A	5	0	0.0	A	9
		Through	271	22.8	B	14	336	14.1	B	12	125	26.2	B	9	215	26.0	B	16
		Right	16	18.1	B	11	15	21.1	B	9	26	26.3	B	8	29	34.3	C	11
		Total	655	22.8	B	14	643	21.1	B	12	439	26.3	B	9	539	34.3	C	16
Tincogan St / Station St	North	Through	37	0.0	A	0	65	0.0	A	0	55	0.0	A	0	45	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	5	2.2	A	1	17	2.2	A	1
	South	Left	268	0.1	A	0	208	0.1	A	0	168	0.1	A	0	181	0.1	A	0
		Through	19	0.0	A	0	33	0.1	A	0	31	0.1	A	0	36	0.1	A	0
	West	Left	5	2.7	A	0	24	2.5	A	0	19	2.7	A	1	28	3.0	A	1
		Right	281	2.2	A	3	345	3.4	A	8	154	1.9	A	3	241	2.6	A	4
		Total	610	2.7	A	3	675	3.4	A	8	432	2.7	A	3	548	3.0	A	4
Woolworths carpark / Station Street	North	Left	21	0.3	A	0	36	0.3	A	0	48	0.3	A	0	62	0.3	A	0
		Through	301	0.2	A	2	376	0.2	A	0	185	0.2	A	0	248	0.2	A	0
	East	Left	59	1.7	A	2	91	3.7	A	3	153	1.4	A	2	207	1.9	A	2
	South	Through	274	0.5	A	0	241	0.5	A	0	199	0.5	A	0	217	0.5	A	0
		Right	63	2.5	A	3	69	2.6	A	2	159	1.1	A	3	147	1.1	A	2
		Total	718	2.5	A	3	813	3.7	A	3	744	1.4	A	3	878	1.9	A	2
Burringbar Street / River Terrace	East	Left	14	14.3	B	2	26	11.8	A	2	10	7.8	A	1	25	12.5	A	2
		Through	91	5.2	A	3	84	10.3	A	4	66	4.7	A	3	43	10.6	A	3
	South	Left	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1
		Right	0	0.0	A	1	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1
	West	Through	72	16.1	B	5	74	13.2	A	3	22	7.1	A	2	34	13.5	A	3
		Right	41	12.7	A	2	22	11.8	A	1	17	4.3	A	1	14	13.8	A	1
		Total	218	16.1	B	5	206	13.2	A	4	115	7.8	A	3	116	13.8	A	3
Burringbar St / Dalley St	North	Left	4	10.5	A	7	5	19.8	B	6	0	0.0	A	7	0	0.0	A	4
		Through	143	11.9	A	9	73	18.3	B	8	132	31.7	C	10	77	19.0	B	7
		Right	5	3.5	A	5	11	13.4	A	5	0	0.0	A	4	0	0.0	A	4
	East	Left	137	20.8	B	14	146	18.0	B	15	198	13.9	A	13	225	14.1	B	15
		Through	45	18.0	B	14	19	21.6	B	15	15	20.0	B	12	16	19.2	B	14
		Right	4	11.8	A	14	1	17.2	B	15	4	49.7	D	13	1	10.4	A	15
	South	Left	54	18.5	B	21	68	28.3	C	24	62	25.5	B	22	28	18.7	B	16
		Through	188	14.9	B	22	148	22.1	B	25	107	24.2	B	22	57	26.9	B	16
		Right	245	21.7	B	23	282	25.8	B	26	356	21.7	B	23	275	25.3	B	17
	West	Left	0	0.0	A	0	0	0.0	A	0	10	33.4	C	2	4	14.0	A	1
		Through	10	13.2	A	2	15	25.5	B	2	13	24.0	B	2	16	7.2	A	1
		Right	62	20.7	B	9	60	20.2	B	2	17	44.4	D	5	33	13.0	A	4
		Total	897	21.7	B	23	828	28.3	C	26	914	49.7	D	23	732	26.9	B	17
Burringbar St / Stuart St	North	Left	0	0.0	A	1	2	3.3	A	2	0	0.0	A	3	0	0.0	A	3
		Through	12	6.2	A	2	10	9.8	A	2	11	4.1	A	2	15	7.5	A	3
		Right	0	0.0	A	1	1	4.6	A	2	9	2.5	A	3	2	11.7	A	2
	East	Left	58	17.4	B	16	46	21.4	B	12	51	23.9	B	16	28	23.6	B	15
		Through	203	18.9	B	16	160	20.3	B	13	216	20.4	B	16	246	23.8	B	16
		Right	23	23.9	B	16	16	26.8	B	13	32	26.8	B	17	27	26.7	B	16
	South	Left	0	0.0	A	2	5	4.1	A	1	1	2.1	A	1	2	1.5	A	2
		Through	61	11.8	A	6	32	4.0	A	2	28	6.0	A	1	16	9.6	A	2
		Right	4	8.6	A	2	12	10.8	A	1	2	9.8	A	2	4	25.6	B	2
	West	Left	4	17.3	B	6	5	31.9	C	7	1	6.5	A	8	5	19.9	B	8
		Through	236	20.0	B	14	284	18.0	B	13	360	15.3	B	14	275	30.4	C	15
		Right	0	0.0	A	6	16	23.1	B	10	0	0.0	A	8	0	0.0	A	7
		Total	669	23.9	B	16	589	31.9	C	13	711	26.8	B	17	620	30.4	C	16
Burringbar St / Station St	North	Left	251	2.9	A	2	149	2.5	A	3	115	2.2	A	0	103	2.0	A	1
		Through	284	1.7	A	3	231	1.9	A	3	299	1.4	A	5	309	3.1	A	7
	South	Left	0	0.0	A	2	0	0.0	A	5	0	0.0	A	6	0	0.0	A	4
		Right	50	29.5	C	5	101	32.9	C	7	21	51.1	D	8	42	36.9	C	4
	West	Through	307	19.3	B	13	314	19.5	B	15	373	21.3	B	21	313	20.6	B	13
		Right	0	0.0	A	8	0	0.0	A	10	0	0.0	A	12	0	0.0	A	8
		Total	892	29.5	C	13	795	32.9	C	15	809	51.1	D	21	747	36.9	C	13
Argyle St / Station St	North	Left	317	6.6	A	9	383	4.5	A	7	260	3.4	A	4	359	3.4	A	5
		Through	44	2.9	A	2	75	4.6	A	3	75	3.2	A	2	72	3.5	A	3
		Right	0	0.0	A	2	0	0.0	A	3	0	0.0	A	2	0	0.0	A	3
	East	Left	490	2.6	A	6	305	2.1	A	2	338	2.2	A	2	341	3.2	A	6
		Through	0	0.0	A	7	0	0.0	A	2	0	0.0	A	2	0	0.0	A	4
		Right	297	4.3	A	7	266	3.7	A	2	303	3.4	A	2	323	4.2	A	4
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	46	3.4	A	6	56	5.7	A	6	78	6.2	A	6	73	5.5	A	6
		Right	336	5.3	A	6	370	6.2	A	6	388	6.8	A	6	297	6.2	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	1530	6.6	A	9	1455	6.2	A	7	1442	6.6	A	6	1465	6.2	A	6
Dalley St / Whian St	North	Left	8	6.1	A	12	1	2.5	A	10	0	0.0	A	13	0	0.0	A	13
		Through	285	17.4	B	17	273	17.3	B	14	328	18.8	B	21	302	26.5	B	18
		Right	21	25.1	B	13	3	43.1	D	10	20	32.9	C	14	17	29.8	C	13
	East	Left	35	5.8	A	2	6	5.5	A	1	11	8.3	A	1	2	8.4	A	2
		Through	4	13.6	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	1	2	26.8	B	1	0	0.0	A	2	2	12.4	A	2
	South	Left	17	5.1	A	1	0	0.0	A	7	71	5.7	A	13	1	1.0	A	0
		Through	486	2.3	A	7	517	3.8	A	17	509	5.0	A	19	426	2.0	A	6
		Right	62	5.3	A	2	14	12.1	A	9	20	5.1	A	11	23	4.6	A	1
	West	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	3	0	0.0	A	3	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1
		Total	918	25.1	B	17	816	43.1	D	17	959	32.9	C	21	773	29.8	C	10
Stuart St / Whian St	North	Left	10	0.7	A	0	36	1.3	A	0	7	2.4	A	0	16	0.5	A	0
		Right	63	3.7	A	4	31	2.8	A	0	8	4.4	A	0	2	1.8	A	0
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	2	1.9	A	0
		Through	58	1.2	A	0	23	1.0	A	0	39	1.1	A	0	30	1.0	A	0
	West	Left	117	2.5	A	3	28	2.3	A	1	11	2.0	A	0	2	2.5	A	0
		Right	0	0.0	A	0	13	1.4	A	0	0	0.0	A	1	0	0.0	A	1
		Total	248	3.7	A	4	131	2.8	A	1	65	4.4	A	1	52	2.5	A	1
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	299	0.4	A	0	266	0.3	A	0	346	0.4	A	0	368	0.4	A	0
	East	Left	256	4.1	A	7	122	3.4	A	4	113	3.5	A	6	98	3.2	A	3
		Right	0	0.0	A	1	0	0.0	A	0	0	0.0	A	1	0	0.0	A	0
	South	Through	575	9.9	A	8	523	6.0	A	3	600	10.1	A	6	450	1.2	A	3
		Right	78	12.7	A	3	103	7.6	A	3	71	13.9	A	3	30	5.9	A	2
		Total	1208	12.7	A	8	1014	7.6	A	4	1130	13.9	A	6	946	5.9	A	3
Stuart St / Fern St	North	Left	17	2.1	A	1	36	3.2	A	2	0	0.0	A	0	14	2.0	A	0
		Through	4	0.3	A	1	5	0.2	A	0	22	1.1	A	1	21	0.9	A	0
		Right	6	2.4	A	2	17	4.2	A	2	10	1.3	A	1	2	1.0	A	0
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	224	2.6	A	0	101	2.1	A	0	92	2.6	A	0	94	2.0	A	0
		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0
	South	Left	0	0.0	A	0	0	0.0	A	0	14	0.7	A	0	6	0.4	A	0
		Through	0	0.0	A	0	0	0.0	A	0	10	0.6	A	1	4	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	37	3.4	A	3	9	2.1	A	0	20	2.7	A	0	14	2.2	A	0
		Through	42	1.7	A	2	77	1.0	A	0	27	0.7	A	0	16	0.7	A	0
		Right	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	330	3.4	A	3	245	4.2	A	2	195	2.7	A	1	171	2.2	A	0

2032 Do Minimum	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	6	1.7	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	539	0.2	A	0	640	0.3	A	0	330	0.2	A	0	361	0.2	A	0
	South	Left	89	13.5	A	6	58	16.5	B	8	179	11.5	A	10	85	8.4	A	7
		Right	0	0.0	A	3	0	0.0	A	4	0	0.0	A	6	0	0.0	A	3
	West	Through	759	9.1	A	4	662	4.5	A	4	308	4.5	A	2	345	0.3	A	1
		Right	117	13.5	A	2	50	9.3	A	2	29	7.5	A	2	9	2.2	A	1
		Total	**1510**	**13.5**	**A**	**6**	**1410**	**16.5**	**B**	**8**	**846**	**11.5**	**A**	**10**	**600**	**8.4**	**A**	**7**
Tincogan St / Gordon St	North	Left	21	7	10.6	A	1	12	6.7	A	1	21	4.0	A	2	12	4.0	A	1
		Through	6	16.5	B	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	49	2.6	A	0	19	2.7	A	0	0	0.0	A	0	4	2.0	A	0
		Through	548	0.9	A	0	608	0.8	A	0	311	0.5	A	0	362	0.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	6	3.5	A	1	0	0.0	A	0
	South	Left	9	11.1	A	1	28	7.6	A	1	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	2	0	0.0	A	0
	West	Left	13	14.4	B	10	13	2.2	A	0	0	0.0	A	0	0	0.0	A	2
		Through	683	6.9	A	19	651	0.4	A	1	292	0.2	A	1	357	0.2	A	2
		Right	68	12.9	A	12	1	0.9	A	0	13	3.1	A	1	1	1.7	A	2
		Total	**1383**	**16.5**	**B**	**19**	**1330**	**7.6**	**A**	**1**	**643**	**4.0**	**A**	**2**	**736**	**4.0**	**A**	**2**
Tincogan St / Dalley St	North	Left	2	46.2	D	1	0	0.0	A	0	26	20.0	B	3	0	0.0	A	0
		Through	29	16.8	B	3	36	16.2	B	2	0	0.0	A	0	0	0.0	A	0
		Right	2	9.7	A	2	8	10.3	A	1	13	9.5	A	1	0	0.0	A	0
	East	Left	13	4.1	A	11	10	9.1	A	14	50	10.4	A	11	53	21.2	B	11
		Through	384	10.6	A	15	420	14.2	B	14	253	7.8	A	13	289	16.3	B	16
		Right	0	0.0	A	11	0	0.0	A	14	16	10.6	A	12	0	0.0	A	11
	South	Left	200	53.0	D	16	198	80.1	F	21	44	41.9	C	7	80	43.1	D	13
		Through	13	73.2	F	8	2	75.7	F	10	6	33.8	C	4	1	7.1	A	5
		Right	61	78.9	F	12	35	110.9	F	14	131	58.3	E	15	77	42.2	D	12
	West	Left	15	14.0	B	1	31	8.2	A	2	0	0.0	A	0	0	0.0	A	0
		Through	443	17.3	B	12	487	11.9	A	13	176	19.3	B	8	246	6.0	A	7
		Right	232	17.1	B	6	146	12.1	A	5	146	18.7	B	10	126	7.2	A	4
		Total	**1404**	**78.9**	**F**	**16**	**1373**	**110.9**	**F**	**21**	**861**	**58.3**	**E**	**15**	**872**	**43.1**	**D**	**16**
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	23	4.4	A	2	25	2.9	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	18	3.6	A	1	18	10.9	A	8	23	2.4	A	1	16	7.5	A	2
		Through	371	2.8	A	8	352	15.9	B	19	291	2.2	A	8	285	4.5	A	8
		Right	14	5.8	A	1	0	0.0	A	7	0	0.0	A	0	0	0.0	A	0
	South	Left	45	11.1	A	4	32	14.4	B	4	3	8.6	A	2	49	10.0	A	4
		Through	9	26.9	B	3	0	0.0	A	0	20	7.2	A	1	0	0.0	A	1
		Right	2	26.0	B	3	9	16.4	B	4	12	8.2	A	2	23	9.0	A	3
	West	Left	4	22.2	B	5	0	0.0	A	5	0	0.0	A	6	0	0.0	A	7
		Through	374	23.1	B	11	454	14.5	B	11	263	34.8	C	11	293	22.7	B	13
		Right	8	13.6	A	7	9	14.4	B	7	37	55.0	D	9	36	31.7	C	9
		Total	**845**	**26.9**	**B**	**11**	**874**	**16.4**	**B**	**19**	**672**	**55.0**	**D**	**11**	**727**	**31.7**	**C**	**13**
Tincogan St / Station St	North	Through	73	0.0	A	0	74	0.0	A	0	51	0.0	A	0	72	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	15	1.3	A	1	18	3.3	A	2
	South	Left	385	0.1	A	0	332	0.1	A	0	208	0.1	A	0	208	0.1	A	0
		Through	27	0.1	A	0	82	0.1	A	0	68	0.1	A	0	70	0.1	A	0
	West	Left	0	0.0	A	10	20	3.7	A	2	25	3.0	A	1	20	3.5	A	1
		Right	374	4.2	A	14	462	3.5	A	5	296	2.4	A	4	342	2.8	A	6
		Total	**859**	**4.2**	**A**	**14**	**970**	**3.7**	**A**	**5**	**663**	**3.0**	**A**	**4**	**730**	**3.5**	**A**	**5**
Woolworths carpark / Station Street	North	Left	25	0.3	A	0	48	0.4	A	0	127	0.3	A	1	118	0.3	A	0
		Through	425	0.2	A	0	490	0.2	A	0	259	0.2	A	0	323	0.2	A	0
	East	Left	74	3.3	A	3	102	3.9	A	3	183	4.5	A	4	213	3.7	A	4
	South	Through	388	0.5	A	0	415	0.5	A	0	277	0.5	A	0	277	0.6	A	0
		Right	79	2.6	A	2	79	1.7	A	3	197	2.2	A	5	147	2.4	A	3
		Total	**991**	**3.3**	**A**	**3**	**1134**	**3.9**	**A**	**3**	**1043**	**4.5**	**A**	**5**	**1078**	**3.7**	**A**	**4**
Burringbar Street / River Terrace	East	Left	18	11.6	A	2	23	12.8	A	1	18	9.3	A	2	45	16.8	B	4
		Through	75	6.5	A	3	68	9.3	A	4	169	6.1	A	5	76	18.3	B	7
	South	Left	40	2.5	A	1	38	2.2	A	1	42	5.0	A	2	31	3.5	A	1
		Right	1	2.8	A	1	0	0.0	A	0	31	3.0	A	1	32	2.5	A	3
	West	Through	61	12.1	A	3	42	17.3	B	4	36	8.4	A	2	19	17.8	B	2
		Right	63	15.4	B	4	29	22.7	B	3	24	7.9	A	1	17	9.1	A	1
		Total	**258**	**15.4**	**B**	**4**	**198**	**22.7**	**B**	**4**	**317**	**9.3**	**A**	**5**	**220**	**18.3**	**B**	**7**
Burringbar St / Dalley St	North	Left	10	12.3	A	9	9	27.8	B	11	0	0.0	A	11	0	0.0	A	6
		Through	260	20.7	B	16	172	23.3	B	17	189	54.3	D	21	180	21.3	B	14
		Right	5	31.1	C	6	7	27.2	B	9	0	0.0	A	9	0	0.0	A	6
	East	Left	38	11.3	A	7	17	16.4	B	4	36	14.3	B	6	46	12.4	A	11
		Through	9	7.7	A	6	4	9.2	A	4	18	21.8	B	7	7	14.6	B	10
		Right	2	11.1	A	8	2	0.6	A	5	0	0.0	A	7	0	0.0	A	11
	South	Left	78	7.5	A	13	60	10.6	A	14	168	13.7	A	18	68	20.8	B	13
		Through	243	8.2	A	16	199	13.0	A	16	68	17.3	B	20	60	15.6	B	12
		Right	77	10.5	A	14	46	16.4	B	14	124	15.4	B	19	112	16.2	B	13
	West	Left	0	0.0	A	0	0	0.0	A	0	30	33.6	C	3	22	9.1	A	2
		Through	9	10.1	A	2	14	19.1	B	2	3	46.5	D	1	10	17.9	B	1
		Right	52	20.7	B	4	28	26.0	B	4	34	40.4	C	5	17	11.7	A	1
		Total	**793**	**31.1**	**C**	**16**	**558**	**27.5**	**B**	**17**	**670**	**54.3**	**D**	**21**	**522**	**21.3**	**B**	**14**
Burringbar St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	2	0	0.0	A	2	0	0.0	A	2
		Through	0	0.0	A	0	7	2.2	A	2	11	2.3	A	2	10	1.4	A	1
		Right	1	7.3	A	1	0	0.0	A	1	4	4.8	A	2	0	0.0	A	2
	East	Left	33	8.7	A	8	55	17.2	B	8	65	20.8	B	13	22	17.6	B	9
		Through	59	11.4	A	7	26	20.2	B	8	57	17.1	B	13	69	21.7	B	9
		Right	5	10.2	A	8	6	15.9	B	9	28	22.9	B	14	19	14.2	B	9
	South	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
		Through	18	1.3	A	1	3	2.4	A	2	0	0.0	A	1	0	0.0	A	3
		Right	0	0.0	A	0	2	0.7	A	0	0	0.0	A	1	0	0.0	A	2
	West	Left	19	19.1	B	5	20	9.7	A	5	15	18.7	B	4	15	13.2	A	6
		Through	55	12.0	A	5	47	14.6	B	5	88	12.1	A	5	87	25.1	B	7
		Right	0	0.0	A	3	19	12.6	A	5	0	0.0	A	3	0	0.0	A	5
		Total	**190**	**19.1**	**B**	**8**	**185**	**20.2**	**B**	**9**	**268**	**22.9**	**B**	**14**	**222**	**25.1**	**B**	**9**
Burringbar St / Station St	North	Left	540	2.0	A	7	396	2.2	A	5	383	1.3	A	5	338	0.8	A	4
		Through	98	0.6	A	1	95	1.9	A	2	150	0.8	A	3	125	0.7	A	2
	South	Left	0	0.0	A	7	11	37.8	C	8	19	22.8	B	8	7	10.2	A	8
		Right	439	19.6	B	10	568	28.3	C	10	487	32.0	C	10	589	18.3	B	10
	West	Through	58	17.8	B	5	61	16.6	B	6	114	19.9	B	10	116	20.6	B	8
		Right	2	1.9	A	2	10	28.4	C	4	0	0.0	A	5	0	0.0	A	5
		Total	**1137**	**19.6**	**B**	**10**	**1141**	**37.8**	**C**	**10**	**1153**	**32.0**	**C**	**10**	**975**	**20.6**	**B**	**10**
Argyle St / Station St	North	Left	439	6.4	A	7	487	8.4	A	10	354	4.9	A	6	444	4.7	A	6
		Through	61	7.2	A	3	96	7.2	A	2	76	5.2	A	3	74	4.8	A	2
		Right	0	0.0	A	3	0	0.0	A	2	0	0.0	A	3	0	0.0	A	2
	East	Left	582	6.7	A	12	391	9.6	A	11	458	3.9	A	6	389	2.8	A	3
		Through	0	0.0	A	7	0	0.0	A	7	0	0.0	A	4	0	0.0	A	3
		Right	427	7.1	A	7	415	8.8	A	7	405	4.8	A	4	386	4.1	A	3
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	51	7.5	A	6	97	9.5	A	6	107	9.0	A	6	78	9.1	A	6
		Right	454	8.6	A	6	536	9.6	A	6	499	8.6	A	6	428	7.7	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	**2014**	**8.6**	**A**	**12**	**2022**	**9.6**	**A**	**11**	**1899**	**9.0**	**A**	**6**	**1799**	**9.1**	**A**	**6**
Dalley St / Whian St	North	Left	21	17.6	B	14	11	11.8	A	8	0	0.0	A	14	0	0.0	A	10
		Through	244	19.7	B	17	196	13.4	A	11	231	21.5	B	16	202	25.1	B	14
		Right	38	20.7	B	15	3	34.7	C	7	20	16.0	B	14	20	24.5	B	10
	East	Left	0	0.0	A	0	0	0.0	A	0	3	10.3	A	1	0	0.0	A	2
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	2	0	0.0	A	2	12	8.4	A	2	7	8.4	A	1
	South	Left	17	3.4	A	1	2	9.8	A	1	83	3.1	A	1	3	4.4	A	0
		Through	371	1.8	A	7	311	1.0	A	3	324	2.3	A	7	312	2.0	A	6
		Right	0	0.0	A	0	14	2.1	A	1	27	3.7	A	1	39	4.8	A	3
	West	Left	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	3	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	2
		Total	**691**	**20.7**	**B**	**17**	**537**	**34.7**	**C**	**11**	**700**	**21.5**	**B**	**16**	**583**	**25.1**	**B**	**14**
Stuart St / Whian St	North	Left	0	0.0	A	0	29	0.1	A	0	1	0.0	A	0	0	0.0	A	0
		Right	33	1.1	A	1	32	0.5	A	0	1	0.6	A	1	0	0.0	A	0
	South	Left	0	0.0	A	0	3	3.1	A	0	12	2.2	A	0	7	1.9	A	0
		Through	29	1.1	A	0	2	1.1	A	0	20	0.7	A	0	6	1.2	A	0
	West	Left	43	1.9	A	1	31	1.9	A	0	1	2.9	A	1	4	2.3	A	0
		Right	14	2.9	A	2	20	2.1	A	0	0	0.0	A	1	0	0.0	A	0
		Total	**119**	**2.9**	**A**	**2**	**117**	**3.1**	**A**	**0**	**35**	**2.9**	**A**	**1**	**17**	**2.3**	**A**	**0**
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	1	1.8	A	0	0	0.0	A	0	0	0.0	A	0
		Through	229	0.4	A	0	177	0.3	A	0	246	0.3	A	0	289	0.5	A	0
	East	Left	518	4.9	A	17	351	3.9	A	12	357	4.3	A	9	321	5.0	A	7
		Right	0	0.0	A	10	0	0.0	A	5	0	0.0	A	2	0	0.0	A	1
	South	Through	391	13.1	A	7	327	7.9	A	5	436	12.1	A	5	355	4.4	A	7
		Right	429	14.8	B	8	497	8.8	A	5	453	13.3	A	6	308	6.3	A	6
		Total	**1567**	**14.8**	**B**	**17**	**1353**	**8.8**	**A**	**12**	**1492**	**13.3**	**A**	**9**	**1273**	**6.3**	**A**	**7**
Stuart St / Fern St	North	Left	26	5.2	A	1	37	5.2	A	1	0	0.0	A	0	0	0.0	A	0
		Through	14	14.5	B	2	11	11.4	A	2	26	6.9	A	1	24	4.7	A	2
		Right	0	0.0	A	0	8	3.4	A	1	7	12.4	A	1	0	0.0	A	0
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	479	3.7	A	0	322	3.6	A	0	341	3.7	A	0	315	3.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	South	Left	0	0.0	A	0	0	0.0	A	0	12	5.2	A	0	7	1.7	A	0
		Through	0	0.0	A	0	0	0.0	A	0	25	7.7	A	2	7	4.6	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	18	3.6	A	6	5	2.1	A	0	7	2.4	A	0	6	1.9	A	0
		Through	408	2.5	A	15	462	1.8	A	7	418	0.9	A	0	299	0.9	A	2
		Right	0	0.0	A	7	1	2.1	A	1	0	0.0	A	0	0	0.0	A	0
		Total	**945**	**14.5**	**B**	**15**	**846**	**11.4**	**A**	**7**	**836**	**12.4**	**A**	**2**	**658**	**4.7**	**A**	**2**

2032 Option 1	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	7	1.9	A	0	0	0.0	A	0	2	1.8	A	0	1	1.5	A	0
		Through	522	0.3	A	0	620	0.3	A	0	334	0.2	A	0	315	0.2	A	0
	South	Left	94	13.5	A	6	89	23.9	B	11	175	11.6	A	11	129	8.3	A	7
		Right	0	0.0	A	3	0	0.0	A	5	0	0.0	A	7	0	0.0	A	4
	West	Through	751	11.9	A	4	669	8.5	A	4	322	4.4	A	2	328	0.3	A	1
		Right	115	15.8	B	3	53	13.1	A	2	15	7.3	A	2	26	2.0	A	1
		Total	**1489**	**15.8**	**B**	**6**	**1431**	**23.9**	**B**	**11**	**848**	**11.6**	**A**	**11**	**799**	**8.3**	**A**	**7**
Tincogan St / Gordon St	North	Left	11	6.4	A	1	9	13.6	A	1	21	4.8	A	2	12	4.1	A	1
		Through	2	24.9	B	1	3	4.4	A	1	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	52	2.5	A	0	22	2.7	A	0	0	0.0	A	0	3	2.3	A	0
		Through	531	0.9	A	0	600	0.9	A	0	316	0.6	A	0	314	0.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	6	2.3	A	1	0	0.0	A	0
	South	Left	7	9.9	A	1	18	12.5	A	2	1	5.3	A	2	1	2.9	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	2	2	18.6	B	1
	West	Left	13	22.1	B	13	13	8.6	A	11	0	0.0	A	0	0	0.0	A	5
		Through	662	10.4	A	23	670	7.6	A	21	305	0.3	A	3	338	0.4	A	5
		Right	68	20.1	B	16	3	2.0	A	10	16	3.8	A	1	4	1.7	A	5
		Total	**1346**	**24.9**	**B**	**23**	**1336**	**13.6**	**A**	**21**	**665**	**8.3**	**A**	**3**	**874**	**18.6**	**B**	**5**
Tincogan St / Dalley St	North	Left	2	2.0	A	1	0	0.0	A	0	26	10.6	A	2	0	0.0	A	0
		Through	29	12.0	A	3	36	15.7	B	2	0	0.0	A	0	0	0.0	A	0
		Right	12	10.8	A	2	8	10.4	A	1	13	8.6	A	1	0	0.0	A	0
	East	Left	10	14.8	B	15	8	10.3	A	14	43	12.9	A	12	60	19.0	B	10
		Through	381	10.3	A	17	403	13.8	A	14	242	7.8	A	13	280	17.0	B	15
		Right	0	0.0	A	13	0	0.0	A	14	16	12.5	A	12	0	0.0	A	10
	South	Left	193	67.7	E	23	206	115.4	F	29	61	43.6	D	8	60	41.6	C	11
		Through	13	65.7	E	15	2	204.5	F	17	6	23.3	B	4	1	9.5	A	5
		Right	61	104.2	F	19	36	140.0	F	23	121	59.2	E	13	90	40.2	C	13
	West	Left	14	16.2	B	1	32	13.8	A	2	0	0.0	A	0	0	0.0	A	0
		Through	410	20.6	B	16	500	21.4	B	17	169	10.2	A	6	244	6.4	A	7
		Right	240	22.8	B	9	160	21.4	B	7	165	9.2	A	5	110	7.4	A	5
		Total	**1365**	**104.2**	**F**	**23**	**1391**	**204.5**	**F**	**29**	**862**	**59.2**	**E**	**13**	**825**	**41.6**	**C**	**15**
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	23	4.2	A	2	25	3.2	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	19	3.5	A	1	20	9.3	A	5	26	2.5	A	1	21	6.3	A	3
		Through	366	2.6	A	7	341	11.2	A	16	276	1.9	A	8	280	4.0	A	8
		Right	14	6.7	A	1	0	0.0	A	4	0	0.0	A	0	0	0.0	A	1
	South	Left	45	19.3	A	5	25	17.5	B	3	2	2.0	A	2	32	9.7	A	4
		Through	9	16.6	B	3	0	0.0	A	0	20	2.8	A	1	0	0.0	A	1
		Right	4	16.8	B	3	17	12.4	A	3	14	8.6	A	2	18	8.5	A	4
	West	Left	4	22.6	B	6	0	0.0	A	5	0	0.0	A	7	0	0.0	A	7
		Through	342	21.6	B	10	463	14.8	B	11	247	33.6	C	13	303	23.9	B	13
		Right	8	14.4	B	7	13	18.7	B	7	36	44.8	D	10	36	25.1	B	10
		Total	**811**	**22.6**	**B**	**10**	**879**	**18.7**	**B**	**16**	**644**	**44.8**	**D**	**13**	**715**	**25.1**	**B**	**13**
Tincogan St / Station St	North	Through	73	0.0	A	0	74	0.0	A	0	50	0.0	A	0	70	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	16	1.5	A	1	20	2.6	A	1
	South	Left	380	0.1	A	0	323	0.1	A	0	199	0.1	A	0	198	0.1	A	0
		Through	27	0.1	A	0	82	0.1	A	0	70	0.1	A	0	70	0.1	A	0
	West	Left	0	0.0	A	10	20	3.2	A	1	23	3.5	A	1	20	3.9	A	1
		Right	344	3.5	A	4	480	3.3	A	6	287	2.5	A	3	346	2.6	A	3
		Total	**824**	**3.5**	**A**	**14**	**979**	**3.3**	**A**	**6**	**645**	**3.5**	**A**	**3**	**724**	**3.9**	**A**	**3**
Woolworths carpark / Station Street	North	Left	25	0.3	A	0	48	0.4	A	0	121	0.3	A	1	120	0.3	A	0
		Through	395	0.2	A	0	508	0.2	A	0	255	0.2	A	0	323	0.2	A	0
	East	Left	74	2.2	A	3	102	5.9	A	4	186	4.0	A	3	205	3.9	A	4
	South	Through	383	0.5	A	0	406	0.5	A	0	269	0.5	A	0	268	0.5	A	0
		Right	78	2.0	A	2	80	2.8	A	3	203	2.2	A	3	145	2.2	A	3
		Total	**955**	**2.2**	**A**	**3**	**1144**	**5.9**	**A**	**4**	**1034**	**4.0**	**A**	**3**	**1061**	**3.9**	**A**	**4**
Burringbar Street / River Terrace	East	Left	18	11.8	A	2	21	14.2	B	1	18	5.0	A	2	45	16.5	B	3
		Through	73	5.5	A	3	87	11.3	A	6	161	5.1	A	4	124	18.5	B	8
	South	Left	41	2.8	A	1	37	2.6	A	2	42	3.3	A	1	33	4.1	A	2
		Right	1	2.8	A	1	0	0.0	A	0	31	2.9	A	1	30	2.6	A	2
	West	Through	56	11.2	A	3	45	17.3	B	4	23	7.9	A	2	39	10.7	A	2
		Right	63	14.3	B	4	31	18.5	B	2	24	7.7	A	1	17	11.7	A	2
		Total	**252**	**14.3**	**B**	**4**	**221**	**18.5**	**B**	**6**	**299**	**7.9**	**A**	**4**	**288**	**18.5**	**B**	**8**
Burringbar St / Dalley St	North	Left	24	26.7	B	18	17	80.5	F	17	5	33.7	C	9	6	22.8	B	8
		Through	251	32.5	C	27	177	39.9	C	21	196	44.5	D	21	165	23.2	B	15
		Right	4	32.9	C	15	4	57.3	E	12	0	0.0	A	8	0	0.0	A	7
	East	Left	67	18.4	B	9	38	22.5	B	8	56	17.8	B	10	47	20.3	B	12
		Through	4	8.7	A	8	11	32.9	C	8	17	24.7	B	9	26	32.0	C	12
		Right	9	24.6	B	10	14	42.4	D	9	12	22.2	B	11	11	18.9	B	12
	South	Left	77	10.0	A	18	75	17.1	B	16	163	15.5	B	19	97	18.7	B	11
		Through	238	12.0	A	19	190	23.0	B	18	66	16.2	B	20	38	19.0	B	11
		Right	98	15.0	B	18	49	22.2	B	16	119	18.4	B	19	72	14.7	B	10
	West	Left	0	0.0	A	0	0	0.0	A	0	28	25.1	B	2	23	9.4	A	2
		Through	9	21.2	B	2	14	17.4	B	2	7	28.4	C	1	5	25.4	B	1
		Right	47	25.7	B	4	32	28.2	C	5	19	47.7	D	4	39	18.5	B	3
		Total	**828**	**32.9**	**C**	**27**	**621**	**80.5**	**F**	**21**	**688**	**47.7**	**D**	**21**	**529**	**32.0**	**C**	**15**
Burringbar St / Stuart St	North	Left	0	0.0	A	1	2	0.3	A	3	0	0.0	A	2	0	0.0	A	1
		Through	3	14.9	B	2	9	3.8	A	3	12	1.6	A	2	14	2.0	A	2
		Right	1	0.4	A	1	0	0.0	A	2	7	3.0	A	2	1	2.1	A	2
	East	Left	33	9.7	A	8	55	16.1	B	8	65	21.0	B	14	20	20.5	B	11
		Through	93	11.7	A	9	60	19.0	B	9	83	18.0	B	14	82	25.1	B	11
		Right	5	12.5	A	10	4	14.8	B	9	28	24.3	B	15	19	14.1	B	12
	South	Left	0	0.0	A	1	1	0.6	A	0	0	0.0	A	1	0	0.0	A	1
		Through	23	2.3	A	2	10	4.4	A	1	3	3.2	A	1	5	0.0	A	2
		Right	0	0.0	A	0	10	4.4	A	1	4	1.7	A	1	2	1.0	A	1
	West	Left	16	15.6	B	5	20	14.3	B	5	15	16.3	B	6	7	11.9	A	4
		Through	91	12.1	A	5	59	15.5	B	5	92	11.5	A	6	55	18.0	B	5
		Right	0	0.0	A	3	19	11.5	A	5	0	0.0	A	4	0	0.0	A	3
		Total	**265**	**15.6**	**B**	**10**	**249**	**19.0**	**B**	**9**	**309**	**24.3**	**B**	**15**	**205**	**25.1**	**B**	**12**
Burringbar St / Station St	North	Left	559	1.4	A	7	374	1.7	A	5	368	1.5	A	7	327	0.8	A	4
		Through	133	0.8	A	2	127	1.5	A	2	176	1.3	A	2	136	0.6	A	1
	South	Left	0	0.0	A	7	11	31.3	C	8	19	28.3	C	8	7	17.7	B	8
		Right	420	19.0	B	10	542	28.7	C	10	485	33.8	C	10	420	17.4	B	10
	West	Through	95	25.4	B	8	81	23.2	B	11	121	16.8	B	8	88	19.0	B	7
		Right	0	0.0	A	4	15	26.2	B	7	0	0.0	A	6	0	0.0	A	3
		Total	**1157**	**25.4**	**B**	**10**	**1150**	**31.3**	**C**	**11**	**1169**	**33.8**	**C**	**10**	**978**	**19.0**	**B**	**10**
Argyle St / Station St	North	Left	410	5.3	A	7	503	7.6	A	10	351	4.1	A	5	443	4.7	A	8
		Through	61	6.2	A	3	96	7.5	A	4	78	5.7	A	2	64	4.7	A	2
		Right	0	0.0	A	3	0	0.0	A	4	0	0.0	A	2	0	0.0	A	2
	East	Left	584	5.2	A	8	403	7.9	A	12	467	4.3	A	8	399	2.5	A	3
		Through	0	0.0	A	6	0	0.0	A	7	0	0.0	A	5	0	0.0	A	3
		Right	424	6.3	A	6	404	7.9	A	7	398	4.9	A	5	376	3.8	A	3
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	50	7.6	A	6	97	8.3	A	6	113	8.2	A	6	76	8.0	A	6
		Right	475	8.2	A	6	528	9.5	A	6	496	8.7	A	6	435	8.2	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	**2004**	**8.2**	**A**	**8**	**2031**	**9.5**	**A**	**12**	**1901**	**8.7**	**A**	**8**	**1793**	**8.2**	**A**	**8**
Dalley St / Whian St	North	Left	25	18.5	B	13	6	6.0	A	12	0	0.0	A	11	0	0.0	A	10
		Through	246	20.8	B	21	239	25.1	B	22	244	18.1	B	13	214	27.5	B	14
		Right	36	23.2	B	14	5	72.0	F	14	20	16.2	B	11	20	26.7	B	10
	East	Left	3	3.3	A	0	4	5.7	A	1	4	8.8	A	1	0	0.0	A	2
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	2	1	22.9	B	1	20	9.3	A	3	6	10.7	A	2
	South	Left	17	3.7	A	1	2	8.7	A	1	83	3.4	A	1	3	8.7	A	1
		Through	395	1.5	A	7	321	1.5	A	5	315	2.8	A	8	281	1.9	A	4
		Right	3	6.4	A	1	20	2.8	A	1	27	2.7	A	1	41	4.8	A	3
	West	Left	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	2	0	0.0	A	1	0	0.0	A	2
		Total	**725**	**23.2**	**B**	**21**	**600**	**72.0**	**F**	**22**	**713**	**18.1**	**B**	**13**	**585**	**27.5**	**B**	**14**
Stuart St / Whian St	North	Left	2	1.1	A	0	26	0.0	A	0	2	0.0	A	0	0	0.0	A	0
		Right	36	1.0	A	1	35	0.5	A	0	2	0.6	A	1	2	2.9	A	1
	South	Left	0	0.0	A	0	1	3.1	A	0	19	2.2	A	0	4	2.0	A	0
		Right	29	1.1	A	0	6	1.5	A	0	23	0.8	A	0	11	1.2	A	0
	West	Left	47	2.0	A	1	36	2.5	A	0	5	2.4	A	1	6	2.4	A	0
		Right	18	2.5	A	1	16	2.3	A	1	0	0.0	A	1	0	0.0	A	0
		Total	**132**	**2.5**	**A**	**1**	**120**	**3.1**	**A**	**1**	**81**	**2.4**	**A**	**1**	**23**	**2.9**	**A**	**1**
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	6	2.4	A	0	0	0.0	A	0	0	0.0	A	0
		Through	239	0.4	A	0	218	0.4	A	0	261	0.4	A	0	300	0.5	A	0
	East	Left	488	4.4	A	15	330	4.0	A	13	342	4.8	A	11	310	4.9	A	6
		Right	0	0.0	A	7	0	0.0	A	6	0	0.0	A	4	0	0.0	A	0
	South	Through	419	12.9	A	7	341	10.9	A	8	428	12.2	A	5	323	4.1	A	7
		Right	401	14.5	B	7	483	11.7	A	12	462	14.3	B	7	339	6.0	A	6
		Total	**1547**	**14.5**	**B**	**15**	**1378**	**11.7**	**A**	**13**	**1493**	**14.3**	**B**	**11**	**1272**	**6.0**	**A**	**7**
Stuart St / Fern St	North	Left	26	5.5	A	1	31	6.3	A	1	0	0.0	A	0	0	0.0	A	0
		Through	18	13.9	A	2	8	8.5	A	2	26	5.9	A	2	24	6.5	A	2
		Right	2	14.3	B	1	8	12.9	A	1	7	8.8	A	1	0	0.0	A	0
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	447	3.5	A	0	299	3.5	A	0	326	3.6	A	0	304	3.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	South	Left	0	0.0	A	0	0	0.0	A	0	5	8.4	A	0	10	1.7	A	0
		Through	0	0.0	A	0	0	0.0	A	0	32	8.2	A	1	4	4.7	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	18	2.6	A	1	7	5.9	A	1	11	2.5	A	0	6	2.2	A	0
		Through	380	0.9	A	1	451	1.5	A	5	424	1.2	A	7	329	0.8	A	0
		Right	0	0.0	A	1	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
		Total	**891**	**14.3**	**B**	**2**	**804**	**12.9**	**A**	**5**	**831**	**8.8**	**A**	**7**	**677**	**6.5**	**A**	**2**

2032 Option 2	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	8	1.7	A	0	1	2.3	A	0	2	1.6	A	0	1	3.6	A	0
		Through	502	0.2	A	0	629	0.3	A	0	334	0.2	A	0	319	0.2	A	0
	South	Left	92	13.9	A	6	101	21.6	B	13	173	12.0	A	13	128	9.2	A	7
		Right	0	0.0	A	3	0	0.0	A	7	0	0.0	A	7	0	0.0	A	4
	West	Through	758	12.3	A	4	656	5.5	A	4	322	4.4	A	2	334	0.3	A	1
		Right	118	15.4	B	3	56	11.8	A	2	15	6.2	A	2	20	2.2	A	2
		Total	1478	15.4	B	6	1443	21.6	B	13	846	12.0	A	13	802	9.2	A	7
Tincogan St / Gordon St	North	Left	9	4.6	A	1	9	15.2	B	1	20	3.8	A	2	12	4.1	A	1
		Through	4	22.9	B	1	3	1.5	A	0	1	23.2	B	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	52	2.5	A	0	21	2.5	A	0	0	0.0	A	0	2	1.9	A	0
		Through	515	0.8	A	0	612	0.8	A	0	316	0.4	A	0	318	0.4	A	0
		Right	0	0.0	A	0	0	0.0	A	0	6	1.7	A	1	0	0.0	A	0
	South	Left	4	5.3	A	1	15	9.5	A	2	1	14.3	B	2	1	2.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	1	36.4	C	1	0	0.0	A	0	0	0.0	A	2	2	16.2	B	1
	West	Left	13	17.1	B	11	13	3.2	A	4	0	0.0	A	0	0	0.0	A	4
		Through	681	14.3	B	21	646	1.5	A	13	304	0.3	A	2	345	0.3	A	4
		Right	68	23.8	B	14	2	0.8	A	4	15	4.0	A	1	4	3.2	A	5
		Total	1347	36.4	C	21	1321	15.2	B	13	663	23.2	B	2	884	16.2	B	5
Tincogan St / Dalley St	North	Left	2	42.3	D	1	0	0.0	A	0	26	25.5	B	3	0	0.0	A	0
		Through	29	11.6	A	2	36	16.8	B	2	0	0.0	A	0	0	0.0	A	0
		Right	12	14.5	B	1	8	11.0	A	1	13	10.1	A	1	0	0.0	A	0
	East	Left	11	5.7	A	11	5	13.0	A	12	42	10.1	A	10	60	19.5	B	11
		Through	393	8.7	A	12	417	14.3	B	12	262	7.6	A	12	275	17.5	B	16
		Right	0	0.0	A	11	0	0.0	A	12	16	12.3	A	11	0	0.0	A	11
	South	Left	163	108.7	F	27	205	115.8	F	25	40	52.0	D	6	48	38.7	C	9
		Through	11	156.5	F	17	4	266.2	F	14	6	34.1	C	4	1	9.5	A	5
		Right	55	132.3	F	21	43	118.0	F	18	119	77.0	F	15	88	37.7	C	12
	West	Left	15	21.1	B	2	31	12.0	A	2	0	0.0	A	0	0	0.0	A	0
		Through	454	25.7	B	15	490	16.7	B	15	187	13.1	A	6	250	5.8	A	7
		Right	222	23.0	B	7	136	17.0	B	6	145	13.5	A	6	111	7.1	A	4
		Total	1367	156.5	F	27	1375	266.2	F	25	856	77.0	F	15	833	38.7	C	16
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	23	4.4	A	1	25	2.9	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	18	3.0	A	1	21	15.4	B	16	26	2.7	A	1	21	7.1	A	2
		Through	378	2.8	A	8	359	24.1	B	26	293	2.7	A	9	294	4.4	A	9
		Right	14	8.8	A	1	0	0.0	A	14	0	0.0	A	0	0	0.0	A	1
	South	Left	46	9.4	A	5	19	19.6	B	4	4	1.7	A	3	33	11.9	A	6
		Through	8	11.5	A	2	0	0.0	A	0	20	5.8	A	2	0	0.0	A	3
		Right	2	23.4	B	3	5	5.8	A	3	19	7.0	A	3	20	10.9	A	7
	West	Left	5	29.3	C	7	0	0.0	A	5	0	0.0	A	6	0	0.0	A	7
		Through	384	23.9	B	11	457	14.8	B	10	262	34.9	C	11	309	23.8	B	13
		Right	6	15.2	B	8	10	21.6	B	8	36	54.3	D	9	36	25.6	B	9
		Total	861	29.3	C	11	871	24.1	B	26	653	54.3	D	11	738	25.6	B	13
Tincogan St / Station St	North	Through	73	0.0	A	0	74	0.0	A	0	50	0.0	A	0	70	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	16	1.6	A	1	20	2.4	A	2
	South	Left	391	0.1	A	0	345	0.9	A	1	215	0.1	A	0	212	0.1	A	0
		Through	27	0.1	A	0	82	0.6	A	0	70	0.1	A	0	70	0.1	A	0
	West	Left	0	0.0	A	6	20	2.9	A	1	23	3.4	A	1	20	4.8	A	2
		Right	385	3.3	A	10	463	3.5	A	5	307	2.7	A	3	353	3.0	A	9
		Total	876	3.3	A	10	984	3.5	A	5	681	3.4	A	3	745	4.8	A	9
Woolworths carpark / Station Street	North	Left	26	0.3	A	0	43	0.3	A	0	122	0.3	A	1	121	0.3	A	0
		Through	435	0.2	A	0	497	0.2	A	0	274	0.2	A	0	328	0.2	A	0
	East	Left	75	2.9	A	3	102	5.0	A	4	186	4.5	A	4	205	4.2	A	4
	South	Through	394	0.5	A	0	428	0.7	A	3	286	0.6	A	0	281	0.6	A	0
		Right	79	2.4	A	3	83	3.2	A	3	200	2.1	A	4	145	2.3	A	4
		Total	1009	2.9	A	3	1153	5.0	A	4	1068	4.5	A	4	1080	4.2	A	4
Burringbar Street / River Terrace	East	Left	17	12.9	A	2	22	11.3	A	1	18	6.1	A	2	45	17.0	B	3
		Through	69	6.5	A	3	97	11.7	A	5	159	5.6	A	4	124	17.8	B	8
	South	Left	41	3.3	A	2	37	2.6	A	1	42	5.0	A	2	33	3.9	A	2
		Right	1	6.0	A	1	0	0.0	A	0	31	2.3	A	1	30	2.6	A	2
	West	Through	61	12.1	A	3	50	14.6	B	4	25	6.8	A	2	33	10.7	A	2
		Right	63	13.5	A	3	31	22.9	B	3	24	7.2	A	1	17	11.3	A	2
		Total	252	13.5	A	3	237	22.9	B	5	299	7.2	A	4	282	17.8	B	8
Burringbar St / Dalley St	North	Left	11	30.2	C	18	5	21.9	B	17	1	36.2	C	9	0	0.0	A	19
		Through	237	32.2	C	25	177	40.8	C	20	181	44.8	D	20	171	22.1	B	17
		Right	3	36.3	C	15	2	21.9	B	14	0	0.0	A	8	0	0.0	A	9
	East	Left	36	28.0	C	9	17	53.5	D	10	40	14.8	B	5	47	20.2	B	12
		Through	4	41.3	C	8	16	46.3	D	10	15	17.9	B	6	25	24.1	B	12
		Right	4	19.1	B	10	2	104.8	F	12	1	43.1	D	5	0	0.0	A	12
	South	Left	76	22.7	B	26	81	59.8	E	31	163	14.0	A	16	97	18.3	B	12
		Through	228	19.6	B	28	183	46.2	D	33	57	13.3	A	16	38	14.7	B	11
		Right	76	21.3	B	27	37	83.5	F	31	108	15.6	B	17	64	16.1	B	11
	West	Left	0	0.0	A	0	0	0.0	A	0	28	28.8	B	2	23	8.5	A	2
		Through	11	1.9	A	2	19	18.6	B	2	6	36.6	C	1	5	24.7	B	1
		Right	50	22.2	B	4	32	28.0	B	4	22	41.8	C	3	33	17.2	B	3
		Total	736	41.3	C	28	571	104.8	F	33	622	44.8	D	20	503	24.7	B	17
Burringbar St / Stuart St	North	Left	0	0.0	A	1	3	4.0	A	2	0	0.0	A	2	0	0.0	A	2
		Through	1	19.6	B	1	7	1.3	A	1	12	2.6	A	3	13	1.9	A	2
		Right	0	0.0	A	1	2	2.8	A	1	7	3.1	A	2	2	5.5	A	2
	East	Left	33	8.2	A	7	55	19.0	B	9	65	21.1	B	14	20	18.9	B	9
		Through	58	9.8	A	7	26	18.4	B	9	56	18.2	B	14	69	22.7	B	9
		Right	5	14.1	B	8	3	21.6	B	9	28	22.8	B	15	19	13.9	A	9
	South	Left	0	0.0	A	1	2	0.0	A	0	0	0.0	A	0	0	0.0	A	1
		Through	21	1.5	A	1	4	2.6	A	1	5	0.2	A	1	3	0.0	A	1
		Right	1	2.7	A	1	15	1.1	A	1	2	0.9	A	2	2	0.0	A	1
	West	Left	17	15.6	B	5	19	15.6	B	6	17	15.0	B	6	10	18.5	B	5
		Through	60	15.8	B	5	37	15.0	B	6	75	11.1	A	6	40	16.2	B	5
		Right	0	0.0	A	3	19	19.4	B	5	0	0.0	A	4	0	0.0	A	3
		Total	196	19.6	B	8	194	21.6	B	9	267	22.8	B	15	178	22.7	B	9
Burringbar St / Station St	North	Left	540	1.9	A	7	402	2.1	A	6	397	1.3	A	5	330	0.8	A	4
		Through	98	0.5	A	1	93	0.7	A	1	149	0.9	A	2	123	0.6	A	1
	South	Left	0	0.0	A	11	11	30.8	C	8	19	37.0	C	12	7	10.7	A	8
		Right	432	20.5	B	14	577	30.1	C	10	490	32.8	C	13	444	19.7	B	10
	West	Through	63	19.8	B	8	69	16.6	B	5	100	16.3	B	7	73	17.9	B	7
		Right	0	0.0	A	5	15	27.8	B	5	0	0.0	A	5	0	0.0	A	4
		Total	1141	20.5	B	14	1167	30.8	C	10	1155	37.0	C	13	977	19.7	B	10
Argyle St / Station St	North	Left	437	7.4	A	9	492	9.9	A	13	358	4.9	A	5	447	4.7	A	5
		Through	75	8.9	A	3	99	7.6	A	3	90	6.5	A	3	65	5.2	A	3
		Right	0	0.0	A	3	0	0.0	A	3	0	0.0	A	3	0	0.0	A	3
	East	Left	571	7.7	A	14	396	10.6	A	10	457	4.9	A	9	388	2.6	A	5
		Through	0	0.0	A	9	0	0.0	A	8	0	0.0	A	6	0	0.0	A	2
		Right	425	8.8	A	9	422	10.5	A	8	406	5.6	A	6	387	3.9	A	2
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	59	6.8	A	5	109	9.1	A	6	116	8.9	A	6	79	8.5	A	6
		Right	447	8.4	A	5	540	10.0	A	6	479	8.1	A	6	439	8.6	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	2014	8.9	A	14	2058	10.6	A	13	1906	9.1	A	9	1805	8.6	A	6
Dalley St / Whian St	North	Left	17	18.4	B	12	3	10.2	A	11	0	0.0	A	10	0	0.0	A	10
		Through	227	18.8	B	15	206	14.6	B	13	216	19.3	B	12	212	26.0	B	14
		Right	37	23.9	B	12	4	47.0	D	12	20	14.0	B	10	20	25.6	B	10
	East	Left	0	0.0	A	0	0	0.0	A	0	5	5.3	A	1	0	0.0	A	2
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	2	3	15.6	B	1	20	12.7	A	3	5	14.1	B	1
	South	Left	17	3.2	A	1	2	3.7	A	0	83	2.8	A	1	3	4.4	A	0
		Through	366	1.3	A	7	303	1.1	A	4	296	1.9	A	6	273	1.3	A	4
		Right	3	11.1	A	1	12	3.1	A	1	28	2.8	A	1	40	4.4	A	3
	West	Left	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	2	0	0.0	A	1	0	0.0	A	2
		Total	667	23.9	B	15	533	47.0	D	13	668	19.3	B	12	553	26.0	B	14
Stuart St / Whian St	North	Left	5	0.4	A	0	26	0.1	A	0	0	0.0	A	0	0	0.0	A	0
		Right	33	1.0	A	1	35	0.8	A	1	3	0.8	A	1	1	0.5	A	0
	South	Left	0	0.0	A	0	7	3.3	A	0	19	2.3	A	0	4	2.0	A	0
		Through	29	1.2	A	0	8	1.9	A	0	22	0.9	A	0	10	1.2	A	0
	West	Left	47	2.1	A	1	34	2.2	A	0	6	3.0	A	1	5	2.4	A	0
		Through	10	3.5	A	1	9	2.2	A	1	0	0.0	A	1	0	0.0	A	0
		Total	124	3.5	A	1	119	3.3	A	1	59	3.0	A	1	20	2.4	A	0
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	9	2.2	A	0	0	0.0	A	0	0	0.0	A	0
		Through	208	0.3	A	0	179	0.4	A	0	234	0.4	A	0	298	0.5	A	0
	East	Left	530	5.1	A	22	358	3.2	A	7	369	3.2	A	13	313	5.1	A	7
		Right	0	0.0	A	16	0	0.0	A	1	0	0.0	A	6	0	0.0	A	0
	South	Through	388	13.5	A	8	317	8.6	A	6	409	11.7	A	5	315	4.6	A	7
		Right	430	15.4	B	9	509	9.8	A	6	480	13.8	A	6	348	6.4	A	7
		Total	1556	15.4	B	22	1373	9.8	A	7	1492	13.8	A	13	1274	6.4	A	7
Stuart St / Fern St	North	Left	26	6.3	A	1	30	6.6	A	1	0	0.0	A	0	0	0.0	A	0
		Through	10	13.1	A	2	3	15.7	B	2	26	9.3	A	2	24	6.9	A	2
		Right	5	10.4	A	1	10	13.2	A	1	5	13.2	A	1	0	0.0	A	0
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	486	4.2	A	4	327	8.3	A	0	355	3.9	A	0	307	3.5	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	South	Left	0	0.0	A	0	0	0.0	A	0	5	7.3	A	0	10	1.7	A	0
		Through	0	0.0	A	0	0	0.0	A	0	32	9.6	A	2	4	4.7	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	18	3.8	A	8	16	3.7	A	2	10	2.5	A	0	6	2.3	A	0
		Through	409	2.6	A	14	473	2.3	A	8	443	1.0	A	1	338	1.0	A	4
		Right	0	0.0	A	10	0	0.0	A	4	0	0.0	A	0	0	0.0	A	0
		Total	954	13.1	A	14	859	15.7	B	8	876	13.2	A	2	689	6.9	A	4

2032 Option 3	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	7	2.0	A	0	1	2.7	A	0	2	1.5	A	0	1	1.3	A	0
		Through	525	0.3	A	0	606	0.3	A	0	337	0.2	A	0	313	0.2	A	0
	South	Left	89	14.4	B	5	105	18.0	B	12	172	12.0	A	10	131	9.0	A	8
		Right	0	0.0	A	2	0	0.0	A	5	0	0.0	A	6	0	0.0	A	5
	West	Through	740	22.6	B	5	673	31.7	C	5	322	4.4	A	2	328	0.3	A	1
		Right	115	25.3	B	3	60	43.5	D	2	15	6.6	A	2	26	2.1	A	1
		Total	**1476**	**25.3**	**B**	**5**	**1445**	**43.5**	**D**	**12**	**848**	**12.0**	**A**	**10**	**739**	**9.0**	**A**	**8**
Tincogan St / Gordon St	North	Left	9	9.0	A	1	6	11.7	A	1	19	4.5	A	2	12	4.1	A	1
		Through	4	24.8	B	1	6	16.6	B	1	2	3.6	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	52	2.5	A	0	22	2.4	A	0	0	0.0	A	0	3	2.5	A	0
		Through	535	0.8	A	0	597	0.8	A	0	319	0.4	A	0	312	0.4	A	0
		Right	0	0.0	A	0	0	0.0	A	0	6	2.2	A	1	0	0.0	A	0
	South	Left	7	7.9	A	1	6	14.7	B	1	1	12.8	A	1	1	2.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	1	0	0.0	A	0	0	0.0	A	1	4	10.6	A	1
	West	Left	13	24.4	B	14	13	16.6	B	14	0	0.0	A	0	0	0.0	A	5
		Through	651	18.8	B	23	675	20.4	B	24	305	0.3	A	2	332	0.5	A	5
		Right	66	24.9	B	16	0	0.0	A	15	16	4.3	A	1	8	1.6	A	5
		Total	**1337**	**24.9**	**B**	**23**	**1325**	**20.4**	**B**	**24**	**668**	**12.0**	**A**	**2**	**870**	**10.6**	**A**	**5**
Tincogan St / Dalley St	North	Left	2	25.6	B	1	0	0.0	A	0	26	21.0	B	3	0	0.0	A	0
		Through	29	16.0	B	3	36	30.5	C	3	0	0.0	A	0	0	0.0	A	0
		Right	12	12.7	A	2	8	31.6	C	1	13	6.6	A	1	0	0.0	A	0
	East	Left	11	7.3	A	13	8	10.0	A	14	43	11.1	A	11	63	18.9	B	12
		Through	399	13.3	A	15	421	16.1	B	16	266	8.0	A	13	271	9.8	B	13
		Right	0	0.0	A	12	0	0.0	A	13	16	12.2	A	12	0	0.0	A	10
	South	Left	177	108.2	F	28	187	112.1	F	22	40	45.3	D	6	47	39.8	C	10
		Through	13	171.3	F	17	2	225.2	F	13	6	32.5	C	4	1	9.5	A	5
		Right	53	131.2	F	21	43	129.2	F	18	121	68.2	E	15	90	42.4	D	15
	West	Left	14	32.5	C	2	32	14.2	B	2	0	0.0	A	0	0	0.0	A	0
		Through	432	30.3	C	14	511	22.8	B	17	187	15.8	B	8	250	7.3	A	9
		Right	208	31.8	C	8	146	24.4	B	6	145	15.7	B	7	100	8.0	A	4
		Total	**1350**	**171.3**	**F**	**28**	**1394**	**225.2**	**F**	**22**	**863**	**68.2**	**E**	**15**	**822**	**42.2**	**D**	**15**
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	23	4.0	A	1	25	3.2	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	18	7.6	A	13	20	18.3	B	12	26	2.6	A	1	19	9.7	A	3
		Through	364	6.7	A	23	346	19.7	B	24	275	1.8	A	8	283	6.0	A	9
		Right	14	18.3	B	14	0	0.0	A	11	0	0.0	A	0	0	0.0	A	1
	South	Left	66	18.7	B	5	39	62.4	E	8	26	10.3	A	4	43	17.5	B	6
		Through	8	17.8	B	2	0	0.0	A	5	20	9.1	A	3	0	0.0	A	4
		Right	3	72.5	F	2	4	76.2	F	8	18	5.3	A	3	19	12.6	A	8
	West	Left	5	25.7	B	7	0	0.0	A	4	0	0.0	A	7	0	0.0	A	7
		Through	339	22.6	B	13	457	13.6	A	9	247	34.5	C	12	304	23.4	B	13
		Right	33	32.8	C	9	26	18.7	B	6	53	47.4	D	9	43	30.5	C	9
		Total	**850**	**72.5**	**F**	**23**	**892**	**76.2**	**F**	**24**	**688**	**47.4**	**D**	**12**	**736**	**30.5**	**C**	**13**
Tincogan St / Station St	North	Through	73	0.0	A	0	74	0.0	A	0	90	0.1	A	0	70	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	16	1.6	A	1	20	2.6	A	2
	South	Left	379	0.1	A	0	327	0.1	A	0	198	0.1	A	0	198	0.1	A	0
		Through	27	0.1	A	1	88	0.1	A	0	70	0.1	A	0	70	0.1	A	0
	West	Left	0	0.0	A	6	14	4.3	A	1	23	3.2	A	1	20	3.7	A	1
		Right	340	3.5	A	0	462	3.3	A	5	291	2.5	A	3	347	2.7	A	5
		Total	**819**	**3.5**	**A**	**10**	**965**	**4.3**	**A**	**5**	**648**	**3.2**	**A**	**3**	**723**	**3.7**	**A**	**5**
Woolworths carpark / Station Street	North	Left	23	0.3	A	0	44	0.4	A	0	123	0.3	A	1	122	0.3	A	0
		Through	393	0.2	A	0	495	0.3	A	1	257	0.2	A	1	321	0.2	A	0
	East	Left	75	3.0	A	3	102	5.7	A	4	186	4.5	A	4	202	4.2	A	4
	South	Through	382	0.5	A	0	416	0.5	A	0	269	0.5	A	0	285	0.5	A	0
		Right	80	1.4	A	1	84	4.5	A	3	201	2.1	A	3	142	2.4	A	3
		Total	**953**	**3.0**	**A**	**3**	**1141**	**5.7**	**A**	**4**	**1036**	**4.5**	**A**	**4**	**1052**	**4.2**	**A**	**4**
Burringbar Street / River Terrace	East	Left	18	11.5	A	2	21	10.2	A	1	18	5.1	A	2	45	17.0	B	3
		Through	72	5.8	A	3	89	9.3	A	5	158	5.8	A	4	126	19.0	B	8
	South	Left	38	2.4	A	3	40	3.0	A	2	42	4.7	A	2	33	3.8	A	2
		Right	1	3.2	A	1	0	0.0	A	0	31	2.3	A	1	30	2.6	A	2
	West	Through	62	11.9	A	4	53	13.5	A	3	25	6.9	A	2	43	8.9	A	2
		Right	63	11.8	A	3	31	17.8	B	2	24	7.7	A	1	17	11.4	A	2
		Total	**254**	**11.9**	**A**	**4**	**234**	**17.8**	**B**	**5**	**298**	**7.7**	**A**	**4**	**294**	**19.0**	**B**	**8**
Burringbar St / Dalley St	North	Left	9	63.1	E	18	5	21.8	B	26	0	0.0	A	9	0	0.0	A	8
		Through	234	47.1	D	25	176	52.0	D	25	184	50.5	D	21	162	23.2	B	15
		Right	4	39.4	C	15	5	49.8	D	17	0	0.0	A	8	0	0.0	A	7
	East	Left	34	25.2	B	9	19	27.2	B	7	38	15.8	B	6	47	16.2	B	12
		Through	4	82.1	F	8	11	15.5	B	8	14	20.9	B	6	26	23.9	B	12
		Right	1	155.0	F	10	2	15.4	B	8	1	43.1	D	5	0	0.0	A	12
	South	Left	78	28.7	C	28	76	13.9	A	13	163	13.6	A	16	99	18.1	B	12
		Through	228	28.5	C	30	180	13.6	A	14	58	13.4	A	16	38	15.8	B	11
		Right	72	26.6	B	28	35	15.1	B	13	113	15.5	B	17	69	14.9	B	11
	West	Left	0	0.0	A	0	0	0.0	A	0	29	26.9	B	2	23	9.1	A	2
		Through	11	6.0	A	2	23	20.2	B	2	8	30.2	C	1	5	23.8	B	1
		Right	49	20.5	B	4	33	26.3	B	3	19	51.4	D	4	43	15.7	B	3
		Total	**724**	**155.0**	**F**	**30**	**565**	**52.0**	**D**	**26**	**627**	**51.4**	**D**	**21**	**512**	**23.9**	**B**	**15**
Burringbar St / Stuart St	North	Left	14	3.8	A	3	14	8.5	A	4	5	5.4	A	4	6	2.5	A	3
		Through	14	7.6	A	3	12	7.3	A	4	24	5.5	A	4	12	2.2	A	3
		Right	1	7.0	A	2	0	0.0	A	3	7	3.0	A	4	2	3.0	A	3
	East	Left	65	10.5	A	8	74	18.0	B	9	82	22.9	B	14	24	23.3	B	11
		Through	53	11.3	A	8	26	22.2	B	9	56	17.1	B	14	68	24.6	B	11
		Right	15	13.1	A	9	15	18.5	B	10	39	21.6	B	15	31	22.0	B	11
	South	Left	0	0.0	A	1	2	0.0	A	0	0	0.0	A	0	0	0.0	A	1
		Through	33	1.1	A	1	6	7.3	A	2	12	0.5	A	1	4	1.0	A	1
		Right	29	5.1	A	2	29	5.5	A	2	14	3.1	A	2	14	2.2	A	1
	West	Left	17	17.4	B	5	19	13.7	A	5	17	15.4	B	6	9	14.8	B	4
		Through	51	13.4	A	5	38	12.8	A	5	79	11.0	A	6	46	17.5	B	5
		Right	0	0.0	A	3	18	24.6	B	6	2	9.0	A	5	0	0.0	A	3
		Total	**292**	**17.4**	**B**	**9**	**253**	**24.6**	**B**	**10**	**337**	**22.9**	**B**	**15**	**216**	**24.6**	**B**	**11**
Burringbar St / Station St	North	Left	559	1.4	A	7	377	1.9	A	4	368	1.5	A	7	324	0.8	A	4
		Through	135	0.7	A	2	123	1.8	A	3	177	1.4	A	2	138	0.8	A	2
	South	Left	0	0.0	A	7	11	31.0	C	8	19	28.5	C	8	7	14.2	B	8
		Right	415	22.2	B	10	552	32.6	C	10	487	33.6	C	10	404	16.9	B	10
	West	Through	97	28.2	C	8	102	23.2	B	8	121	20.8	B	9	97	17.9	B	6
		Right	0	0.0	A	4	15	31.4	C	6	0	0.0	A	6	0	0.0	A	3
		Total	**1156**	**28.2**	**C**	**10**	**1180**	**32.6**	**C**	**10**	**1172**	**33.6**	**C**	**10**	**970**	**17.9**	**B**	**10**
Argyle St / Station St	North	Left	408	5.9	A	9	494	10.5	A	12	353	4.3	A	5	441	4.8	A	8
		Through	62	6.6	A	3	97	8.2	A	2	78	6.1	A	3	61	5.8	A	2
		Right	0	0.0	A	3	0	0.0	A	2	0	0.0	A	3	0	0.0	A	2
	East	Left	585	5.4	A	8	401	6.9	A	13	468	4.4	A	7	401	2.6	A	5
		Through	0	0.0	A	6	0	0.0	A	5	0	0.0	A	5	0	0.0	A	3
		Right	423	6.5	A	6	466	8.8	A	5	395	5.2	A	5	374	3.9	A	3
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	52	8.2	A	6	113	8.2	A	6	113	7.7	A	6	71	8.8	A	6
		Right	469	8.5	A	6	545	9.0	A	6	498	8.4	A	6	433	7.9	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	**1999**	**8.5**	**A**	**9**	**2056**	**10.5**	**A**	**13**	**1905**	**8.4**	**A**	**7**	**1781**	**8.8**	**A**	**8**
Dalley St / Whian St	North	Left	25	19.5	B	13	7	11.8	A	7	0	0.0	A	11	0	0.0	A	10
		Through	205	19.5	B	19	214	12.1	A	14	213	18.2	B	13	214	25.8	B	14
		Right	36	23.0	B	14	5	25.3	B	7	20	15.1	B	11	20	28.4	C	11
	East	Left	5	9.7	A	1	2	3.6	A	0	7	6.2	A	1	0	0.0	A	2
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	2	0	0.0	A	1	12	5.7	A	2	4	11.4	A	1
	South	Left	17	3.1	A	1	2	9.9	A	1	83	2.9	A	1	3	4.4	A	0
		Through	357	1.4	A	6	303	0.9	A	4	301	2.1	A	6	280	1.8	A	5
		Right	3	12.5	A	1	12	5.8	A	1	28	2.5	A	1	40	4.5	A	3
	West	Left	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	2	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	2
		Total	**648**	**23.0**	**B**	**19**	**545**	**25.3**	**B**	**14**	**664**	**18.2**	**B**	**13**	**581**	**28.4**	**C**	**14**
Stuart St / Whian St	North	Left	45	1.1	A	1	46	0.6	A	0	30	0.8	A	0	3	1.1	A	0
		Right	38	1.9	A	2	34	1.0	A	1	5	0.7	A	1	1	0.5	A	0
	South	Left	0	0.0	A	0	7	3.3	A	0	11	2.6	A	0	3	2.2	A	0
		Right	67	2.1	A	0	19	2.3	A	0	41	1.9	A	0	23	2.1	A	0
	West	Left	48	2.2	A	1	39	2.0	A	0	5	2.2	A	1	5	2.4	A	0
		Right	18	3.1	A	1	14	1.7	A	0	0	0.0	A	1	0	0.0	A	0
		Total	**216**	**3.1**	**A**	**2**	**159**	**3.3**	**A**	**1**	**92**	**2.6**	**A**	**1**	**35**	**2.4**	**A**	**0**
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	9	2.3	A	0	0	0.0	A	0	0	0.0	A	0
		Through	199	0.4	A	0	192	0.4	A	0	233	0.3	A	0	300	0.5	A	0
	East	Left	528	4.3	A	16	355	3.8	A	5	370	4.2	A	10	310	5.4	A	7
		Right	0	0.0	A	9	0	0.0	A	0	0	0.0	A	3	0	0.0	A	0
	South	Through	380	13.2	A	8	316	9.0	A	5	414	11.8	A	5	322	4.8	A	7
		Right	440	14.8	B	11	508	10.1	A	8	475	13.8	A	7	341	6.6	A	7
		Total	**1547**	**14.8**	**B**	**16**	**1380**	**10.1**	**A**	**8**	**1492**	**13.8**	**A**	**10**	**1273**	**6.6**	**A**	**7**
Stuart St / Fern St	North	Left	26	11.9	A	2	31	7.5	A	2	0	0.0	A	0	0	0.0	A	0
		Through	18	17.6	B	2	6	9.1	A	2	26	11.1	A	2	24	6.9	A	2
		Right	45	29.0	C	5	30	17.8	B	3	35	16.7	B	3	3	5.4	A	1
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	447	3.5	A	0	302	3.8	A	0	326	3.6	A	0	301	3.4	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	South	Left	0	0.0	A	0	0	0.0	A	0	13	4.8	A	0	11	1.6	A	0
		Through	0	0.0	A	0	0	0.0	A	0	24	8.4	A	1	3	6.3	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	56	4.2	A	10	27	3.6	A	1	28	3.4	A	0	19	3.4	A	0
		Through	381	2.2	A	15	461	1.4	A	4	420	1.0	A	1	318	0.8	A	0
		Right	0	0.0	A	9	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
		Total	**973**	**29.0**	**C**	**15**	**857**	**17.8**	**B**	**4**	**872**	**16.7**	**B**	**3**	**679**	**6.9**	**A**	**2**

2032 Option 4	Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	East	Left	7	2.3	A	0	0	0.0	A	0	2	1.6	A	0	1	1.5	A	0
		Through	507	0.3	A	0	591	0.3	A	0	315	0.2	A	0	308	0.2	A	0
	South	Left	117	14.6	B	8	112	20.6	B	12	194	11.8	A	12	136	8.1	A	7
		Right	0	0.0	A	4	0	0.0	A	7	0	0.0	A	7	0	0.0	A	4
	West	Through	729	9.9	A	4	646	8.3	A	4	304	4.5	A	2	335	0.4	A	2
		Right	147	13.7	A	3	66	10.8	A	2	33	6.7	A	2	19	2.6	A	1
		Total	**1507**	**14.6**	**B**	**8**	**1415**	**20.6**	**B**	**12**	**848**	**11.8**	**A**	**12**	**739**	**8.1**	**A**	**7**
Tincogan St / Gordon St	North	Left	12	7.8	A	1	9	18.3	B	1	21	4.6	A	2	12	4.1	A	1
		Through	1	23.0	B	1	3	4.3	A	1	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	53	2.5	A	0	21	2.5	A	0	0	0.0	A	0	3	2.3	A	0
		Through	521	0.9	A	0	574	0.7	A	0	297	0.4	A	0	307	0.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	6	2.3	A	1	0	0.0	A	0
	South	Left	3	27.2	B	1	13	10.8	A	1	1	5.3	A	2	1	1.9	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	2	2	10.2	A	1
	West	Left	13	7.5	A	6	13	2.7	A	0	0	0.0	A	0	0	0.0	A	0
		Through	652	4.8	A	15	640	1.5	A	9	290	0.2	A	2	344	0.1	A	0
		Right	67	11.3	A	8	2	13.4	A	1	13	3.2	A	1	4	1.7	A	0
		Total	**1322**	**27.2**	**B**	**15**	**1275**	**18.3**	**B**	**9**	**628**	**5.3**	**A**	**2**	**873**	**10.2**	**A**	**1**
Tincogan St / Dalley St	North	Left	2	33.4	C	1	0	0.0	A	0	26	7.1	A	1	0	0.0	A	0
		Through	29	16.6	B	3	36	12.4	A	2	0	0.0	A	0	0	0.0	A	0
		Right	12	7.9	A	1	8	10.2	A	1	13	8.8	A	1	0	0.0	A	0
	East	Left	13	6.7	A	14	6	10.0	A	13	43	12.1	A	10	60	18.6	B	10
		Through	382	9.8	A	17	401	14.7	B	13	243	7.9	A	12	258	17.3	B	15
		Right	0	0.0	A	13	0	0.0	A	13	16	12.4	A	11	0	0.0	A	10
	South	Left	180	78.4	F	24	184	78.6	F	20	41	31.8	C	5	55	39.1	C	10
		Through	13	112.6	F	13	2	54.4	D	7	6	25.4	B	4	1	9.5	A	5
		Right	61	92.2	F	16	37	116.8	F	11	120	47.8	D	13	83	39.0	C	11
	West	Left	15	18.2	B	1	31	12.1	A	2	0	0.0	A	0	0	0.0	A	0
		Through	424	17.8	B	12	484	14.4	B	14	173	6.7	A	5	244	5.2	A	7
		Right	224	17.6	B	8	135	15.2	B	6	145	7.4	A	5	116	7.3	A	4
		Total	**1355**	**112.6**	**F**	**24**	**1324**	**116.8**	**F**	**20**	**826**	**47.8**	**D**	**13**	**817**	**39.1**	**C**	**15**
Tincogan St / Stuart St	North	Left	0	0.0	A	0	0	0.0	A	0	23	3.9	A	1	25	3.2	A	1
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	East	Left	20	3.4	A	1	19	9.8	A	3	26	2.5	A	1	21	6.4	A	3
		Through	368	2.8	A	7	339	10.4	A	13	277	1.6	A	8	280	4.1	A	9
		Right	14	7.7	A	1	0	0.0	A	2	0	0.0	A	0	0	0.0	A	1
	South	Left	46	9.1	A	5	22	12.6	A	3	2	4.7	A	2	30	9.6	A	4
		Through	9	19.0	B	3	0	0.0	A	0	20	4.0	A	2	0	0.0	A	1
		Right	3	13.2	A	3	8	3.7	A	2	16	6.2	A	2	21	8.6	A	3
	West	Left	4	9.4	A	7	0	0.0	A	4	0	0.0	A	6	0	0.0	A	7
		Through	355	21.6	B	11	451	14.5	B	10	247	32.6	C	12	297	21.8	B	13
		Right	8	27.2	B	9	11	19.0	B	6	39	44.9	D	9	36	23.3	B	9
		Total	**827**	**27.2**	**B**	**11**	**850**	**19.0**	**B**	**13**	**650**	**44.9**	**D**	**12**	**710**	**23.3**	**B**	**13**
Tincogan St / Station St	North	Through	73	0.0	A	0	74	0.0	A	0	90	0.0	A	0	70	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	16	1.6	A	1	20	2.7	A	1
	South	Left	382	0.1	A	0	320	0.1	A	0	200	0.1	A	0	198	0.1	A	0
		Through	27	0.1	A	0	82	0.1	A	0	71	0.1	A	0	70	0.1	A	0
	West	Left	0	0.0	A	10	20	3.2	A	1	22	3.1	A	1	20	3.4	A	1
		Right	356	3.7	A	16	459	3.6	A	6	290	2.6	A	4	343	2.4	A	3
		Total	**838**	**3.7**	**A**	**16**	**955**	**3.6**	**A**	**6**	**649**	**3.1**	**A**	**4**	**721**	**3.4**	**A**	**3**
Woolworths carpark / Station Street	North	Left	26	0.3	A	0	47	0.3	A	0	122	0.3	A	1	119	0.3	A	0
		Through	406	0.2	A	0	488	0.2	A	1	257	0.2	A	0	321	0.2	A	0
	East	Left	73	3.7	A	3	102	4.4	A	2	186	3.8	A	3	205	3.6	A	4
	South	Through	385	0.5	A	0	402	0.5	A	0	272	0.5	A	0	267	0.5	A	0
		Right	78	1.9	A	1	80	2.6	A	3	202	2.1	A	3	146	2.2	A	3
		Total	**968**	**3.7**	**A**	**3**	**1119**	**4.4**	**A**	**3**	**1039**	**3.8**	**A**	**3**	**1058**	**3.6**	**A**	**4**
Burringbar Street / River Terrace	East	Left	18	13.1	A	2	21	13.8	A	1	18	5.2	A	2	45	18.2	B	3
		Through	92	5.7	A	3	106	10.9	A	6	180	5.3	A	4	131	19.7	B	7
	South	Left	41	3.1	A	1	37	3.0	A	1	42	3.5	A	1	33	4.1	A	2
		Right	1	3.2	A	1	0	0.0	A	0	31	3.4	A	1	30	2.7	A	2
	West	Through	84	15.2	B	4	60	16.1	B	3	39	7.9	A	2	33	12.5	A	2
		Right	63	17.6	B	4	31	25.9	B	2	24	9.0	A	1	17	10.8	A	1
		Total	**299**	**17.6**	**B**	**4**	**255**	**25.9**	**B**	**6**	**334**	**9.0**	**A**	**4**	**289**	**19.7**	**B**	**7**
Burringbar St / Dalley St	North	Left	10	26.7	B	19	5	21.6	B	10	1	36.2	C	8	0	0.0	A	8
		Through	252	26.1	B	26	164	19.8	B	13	181	48.1	D	19	176	22.2	B	15
		Right	4	34.4	C	16	3	24.7	B	7	0	0.0	A	6	0	0.0	A	7
	East	Left	66	15.8	B	9	38	20.4	B	7	56	15.9	B	8	47	17.1	B	12
		Through	13	16.0	B	8	24	21.1	B	8	28	16.9	B	8	38	24.5	B	12
		Right	1	15.3	B	10	2	8.5	A	8	0	0.0	A	10	0	0.0	A	12
	South	Left	89	9.8	A	16	82	12.6	A	13	171	14.2	B	19	92	18.1	B	11
		Through	231	10.3	A	18	178	13.1	A	15	57	14.8	B	20	41	16.7	B	10
		Right	99	12.1	A	17	48	14.8	B	13	119	16.9	B	19	77	15.6	B	10
	West	Left	0	0.0	A	0	0	0.0	A	0	28	27.1	B	2	23	8.4	A	2
		Through	22	21.3	B	3	27	26.4	B	2	10	18.2	B	1	11	18.4	B	1
		Right	60	29.5	C	6	36	25.9	B	2	31	49.3	D	5	28	17.2	B	2
		Total	**847**	**34.4**	**C**	**26**	**607**	**26.4**	**B**	**15**	**682**	**49.3**	**D**	**20**	**533**	**24.5**	**B**	**15**
Burringbar St / Stuart St	North	Left	0	0.0	A	1	2	0.6	A	2	0	0.0	A	2	0	0.0	A	1
		Through	1	20.0	B	1	7	3.9	A	2	15	3.4	A	2	14	3.1	A	2
		Right	1	0.4	A	1	0	0.0	A	1	7	3.0	A	2	1	0.8	A	2
	East	Left	33	10.1	A	9	55	17.4	B	8	65	22.5	B	14	20	19.6	B	11
		Through	95	11.5	A	9	59	18.6	B	8	83	18.0	B	14	82	25.1	B	11
		Right	4	11.6	A	9	5	10.1	A	9	28	25.0	B	15	19	14.2	B	12
	South	Left	0	0.0	A	1	1	0.0	A	0	0	0.0	A	1	0	0.0	A	1
		Through	22	1.3	A	1	7	5.5	A	2	4	1.6	A	1	4	0.0	A	2
		Right	1	1.0	A	0	14	7.4	A	2	4	1.6	A	2	2	0.0	A	1
	West	Left	16	15.8	B	5	17	11.8	A	6	14	15.5	B	5	10	20.8	B	5
		Through	92	13.0	A	5	57	14.1	B	6	92	10.6	A	5	60	18.4	B	6
		Right	0	0.0	A	3	19	13.1	A	6	0	0.0	A	3	0	0.0	A	4
		Total	**265**	**20.0**	**B**	**9**	**243**	**18.6**	**B**	**9**	**312**	**25.0**	**B**	**15**	**212**	**25.1**	**B**	**12**
Burringbar St / Station St	North	Left	510	1.4	A	7	372	1.6	A	5	368	1.5	A	7	327	0.8	A	4
		Through	133	0.7	A	2	129	2.0	A	3	176	1.4	A	2	136	0.6	A	1
	South	Left	0	0.0	A	7	11	32.3	C	8	19	27.0	B	8	7	17.5	B	8
		Right	412	22.0	B	10	552	30.5	C	10	491	33.0	C	10	412	17.2	B	10
	West	Through	97	23.6	B	7	87	19.9	B	8	119	16.9	B	7	93	18.6	B	7
		Right	0	0.0	A	4	15	24.3	B	5	0	0.0	A	6	0	0.0	A	4
		Total	**1152**	**23.6**	**B**	**10**	**1166**	**32.3**	**C**	**10**	**1173**	**33.0**	**C**	**10**	**975**	**18.6**	**B**	**10**
Argyle St / Station St	North	Left	421	6.3	A	11	483	8.5	A	11	353	4.0	A	4	443	4.7	A	8
		Through	60	7.7	A	3	97	6.7	A	2	78	5.2	A	2	64	5.1	A	2
		Right	0	0.0	A	3	0	0.0	A	2	0	0.0	A	2	0	0.0	A	2
	East	Left	587	5.3	A	8	401	6.7	A	13	467	4.1	A	8	399	2.7	A	5
		Through	0	0.0	A	5	0	0.0	A	5	0	0.0	A	5	0	0.0	A	2
		Right	424	5.9	A	5	403	6.4	A	5	398	4.8	A	5	376	3.8	A	2
	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	50	9.4	A	6	98	8.5	A	6	116	7.6	A	6	77	8.7	A	6
		Right	468	8.3	A	6	544	9.4	A	6	499	8.3	A	6	430	8.1	A	6
	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Total	**2010**	**9.4**	**A**	**11**	**2024**	**9.4**	**A**	**13**	**1909**	**8.3**	**A**	**8**	**1789**	**8.7**	**A**	**8**
Dalley St / Whian St	North	Left	25	14.6	B	13	6	6.7	A	10	0	0.0	A	11	0	0.0	A	10
		Through	266	16.8	B	17	222	15.3	B	12	241	20.3	B	17	214	25.6	B	14
		Right	37	18.0	B	14	4	44.3	D	10	20	17.5	B	11	20	23.1	B	10
	East	Left	3	3.2	A	0	0	0.0	A	0	4	9.5	A	1	0	0.0	A	2
		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Right	0	0.0	A	2	0	0.0	A	1	20	13.9	A	4	7	9.0	A	1
	South	Left	17	3.5	A	1	2	3.1	A	0	83	3.2	A	1	3	8.7	A	1
		Through	395	1.6	A	7	320	1.6	A	6	314	2.6	A	8	285	2.1	A	5
		Right	3	3.5	A	1	18	5.0	A	2	27	2.8	A	1	41	5.0	A	3
	West	Left	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1	0	0.0	A	0
		Through	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1	0	0.0	A	0
		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	2
		Total	**746**	**10.0**	**B**	**17**	**574**	**44.3**	**D**	**12**	**709**	**20.3**	**B**	**17**	**570**	**25.6**	**B**	**14**
Stuart St / Whian St	North	Left	2	0.7	A	0	28	0.0	A	0	5	0.2	A	0	0	0.0	A	0
		Through	36	1.3	A	1	32	0.7	A	1	2	0.6	A	0	2	0.4	A	0
	South	Left	0	0.0	A	0	1	3.1	A	0	19	2.2	A	0	5	2.0	A	0
		Right	29	1.1	A	0	6	1.8	A	0	24	0.9	A	0	10	1.2	A	0
	West	Left	47	2.2	A	1	37	2.3	A	0	5	3.1	A	1	6	2.2	A	0
		Right	18	2.4	A	1	16	2.8	A	1	0	0.0	A	1	0	0.0	A	0
		Total	**132**	**2.4**	**A**	**1**	**120**	**3.1**	**A**	**1**	**55**	**3.1**	**A**	**1**	**23**	**2.2**	**A**	**0**
Jubilee Ave / Fern St	North	Left	0	0.0	A	0	4	2.3	A	0	0	0.0	A	0	0	0.0	A	0
		Through	258	0.4	A	0	200	0.4	A	0	258	0.4	A	0	300	0.5	A	0
	East	Left	482	5.0	A	12	334	3.5	A	7	345	4.9	A	11	310	4.6	A	6
		Right	0	0.0	A	5	0	0.0	A	1	0	0.0	A	4	1	1.6	A	0
	South	Through	418	14.1	B	6	339	8.4	A	6	427	12.4	A	6	328	4.5	A	7
		Right	399	15.9	B	10	488	9.4	A	5	463	14.4	B	8	336	6.6	A	6
		Total	**1557**	**15.9**	**B**	**12**	**1365**	**9.4**	**A**	**7**	**1493**	**14.4**	**B**	**11**	**1273**	**6.6**	**A**	**7**
Stuart St / Fern St	North	Left	26	4.5	A	1	31	6.2	A	1	0	0.0	A	0	0	0.0	A	0
		Through	18	8.4	A	2	8	8.7	A	2	26	8.1	A	2	24	6.4	A	2
		Right	2	1.4	A	0	12	11.2	A	1	10	9.0	A	1	0	0.0	A	0
	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
		Through	446	3.3	A	0	299	3.1	A	0	326	3.6	A	0	304	3.5	A	0
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	South	Left	0	0.0	A	0	0	0.0	A	0	5	7.6	A	0	9	1.2	A	0
		Through	0	0.0	A	0	0	0.0	A	0	32	7.4	A	2	5	5.1	A	1
		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	West	Left	18	3.3	A	1	8	5.1	A	1	12	2.7	A	0	5	2.2	A	0
		Through	378	1.6	A	6	454	1.5	A	5	424	1.4	A	7	327	0.8	A	0
		Right	0	0.0	A	3	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
		Total	**888**	**8.4**	**A**	**6**	**812**	**11.2**	**A**	**5**	**835**	**9.0**	**A**	**7**	**674**	**6.4**	**A**	**2**

2032 Option 4	Turn					Subpath		Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
	ID1	ID2	ID3	ID4	ID5	Name	ID			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	611	849				1EL	898	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	610	849				1ET	897		Through	341	0.2	A	0	402	0.3	A	0	299	0.2	A	0	280	0.2	A	0
	614	830				1SL	893	South	Left	294	19.3	B	17	296	17.4	B	20	209	11.4	A	13	168	10.6	A	15
	615	830				1SR	894		Right	0	0.0	A	9	0	0.0	A	10	0	0.0	A	6	0	0.0	A	6
	612					1WT	895	West	Through	551	11.4	A	4	542	5.0	A	4	220	4.9	A	2	257	0.8	A	3
	613					1WR	896		Right	325	14.8	B	4	169	7.7	A	3	117	7.4	A	4	97	4.0	A	4
	Priority								**Total**	**1511**	**19.3**	**B**	**17**	**1409**	**17.4**	**B**	**20**	**845**	**11.4**	**A**	**13**	**802**	**10.6**	**A**	**15**
Tincogan St / Gordon St	567					2NL	921	North	Left	13	3.9	A	1	12	5.5	A	1	18	4.1	A	1	10	3.9	A	1
	566					2NT	923		Through	0	0.0	A	0	0	0.0	A	0	3	4.2	A	2	2	5.9	A	1
	568					2NR	922		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	560					2EL	924	East	Left	41	2.3	A	0	10	2.3	A	0	0	0.0	A	0	0	0.0	A	0
	561					2ET	926		Through	352	0.5	A	0	397	0.5	A	0	280	0.3	A	0	279	0.4	A	0
	562					2ER	925		Right	0	0.0	A	0	0	0.0	A	0	6	1.4	A	1	0	0.0	A	0
	558	1251				2SL	899	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1
	559	1251				2ST	901		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	557	1251				2SR	900		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1	0	0.0	A	0
	565	846				2WL	904	West	Left	13	4.3	A	1	13	2.2	A	0	0	0.0	A	0	0	0.0	A	0
	564	846				2WT	903		Through	476	1.4	A	8	530	0.3	A	0	202	0.2	A	1	254	0.1	A	0
	563	846				2WR	902		Right	61	4.8	A	3	0	0.0	A	0	13	3.6	A	1	1	6.6	A	1
	Priority								**Total**	**956**	**4.8**	**A**	**8**	**962**	**5.5**	**A**	**1**	**522**	**4.2**	**A**	**2**	**546**	**6.6**	**A**	**1**
Tincogan St / Dalley St	553					3NL	942	North	Left	2	32.0	C	1	0	0.0	A	0	26	24.7	B	3	0	0.0	A	0
	554					3NT	944		Through	29	9.3	A	3	35	13.0	A	2	0	0.0	A	0	0	0.0	A	0
	555					3NR	943		Right	12	4.2	A	1	8	7.7	A	1	13	10.6	A	1	0	0.0	A	0
	544	2154	571			3EL	939	East	Left	26	3.8	A	6	13	9.5	A	9	95	12.2	A	11	92	10.4	A	8
	545	2154	571			3ET	941		Through	372	7.2	A	7	391	11.7	A	9	253	9.7	A	10	250	13.6	A	10
	546	2154	571			3ER	940		Right	0	0.0	A	6	0	0.0	A	9	16	13.4	A	10	0	0.0	A	8
	548	1259				3SL	945	South	Left	10	68.5	E	2	6	65.2	E	1	13	106.3	F	13	29	24.4	B	3
	549	1259				3ST	947		Through	13	46.7	D	2	2	39.6	C	1	6	68.6	E	12	1	54.3	D	1
	547	1259				3SR	946		Right	99	60.1	E	7	62	61.2	E	6	201	130.5	F	17	102	29.9	C	6
	552					3WL	948	West	Left	15	8.9	A	1	30	4.7	A	2	0	0.0	A	0	0	0.0	A	0
	550					3WT	950		Through	443	7.8	A	8	486	9.2	A	10	176	33.4	C	6	246	5.0	A	7
	551					3WR	949		Right	30	5.4	A	1	27	11.1	A	2	52	28.6	C	3	21	10.7	A	2
	Priority								**Total**	**1051**	**68.5**	**E**	**8**	**1060**	**65.2**	**E**	**10**	**851**	**130.5**	**F**	**17**	**741**	**54.3**	**D**	**10**
Tincogan St / Stuart St	520					4NL	954	North	Left	0	0.0	A	0	0	0.0	A	0	23	5.9	A	2	25	4.1	A	2
	519					4NT	956		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	521					4NR	955		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	513	777				4EL	951	East	Left	19	1.4	A	0	19	13.5	A	3	23	1.4	A	1	16	8.4	A	3
	514	777				4ET	953		Through	370	3.4	A	7	346	12.5	A	9	335	2.6	A	9	318	8.6	A	10
	515	777				4ER	952		Right	14	7.7	A	1	0	0.0	A	2	0	0.0	A	0	0	0.0	A	2
	511	1289	1336			4SL	957	South	Left	29	8.9	A	3	13	16.0	B	3	3	6.3	A	2	14	22.5	B	3
	512	1289	1336			4ST	959		Through	0	0.0	A	1	0	0.0	A	0	20	13.3	A	2	0	0.0	A	1
	510	1289	1336			4SR	958		Right	2	34.1	C	3	8	15.0	B	2	2	5.4	A	2	10	25.9	B	2
	518	574				4WL	960	West	Left	13	13.5	A	7	0	0.0	A	6	0	0.0	A	7	0	0.0	A	8
	517	574				4WT	962		Through	387	20.9	B	10	481	12.4	A	9	333	34.7	C	10	316	22.8	B	11
	516	574				4WR	961		Right	8	22.6	B	10	9	13.9	A	8	37	50.0	D	10	35	29.8	C	10
	Priority								**Total**	**842**	**34.1**	**C**	**10**	**876**	**16.0**	**B**	**9**	**776**	**50.0**	**D**	**10**	**734**	**29.8**	**C**	**11**
Tincogan St / Station St	480					5NT	968	North	Through	73	0.0	A	0	74	0.0	A	0	47	0.0	A	0	70	0.0	A	0
	481					5NR	967		Right	0	0.0	A	0	0	0.0	A	0	19	2.0	A	1	20	2.5	A	2
	476					5SL	969	South	Left	374	0.1	A	0	322	0.1	A	0	208	0.1	A	0	203	0.1	A	0
	477					5ST	970		Through	27	0.1	A	0	82	0.1	A	0	41	0.1	A	0	69	0.1	A	0
	479	780				5WL	972	West	Left	0	0.0	A	1	20	3.2	A	1	52	4.1	A	3	21	2.8	A	0
	478	780				5WR	973		Right	387	3.0	A	5	488	3.7	A	5	330	3.3	A	5	348	2.8	A	4
	Priority								**Total**	**861**	**3.0**	**A**	**5**	**986**	**3.7**	**A**	**5**	**697**	**4.1**	**A**	**5**	**731**	**2.8**	**A**	**4**
Woolworths carpark / Station Street	537					6NL	978	North	Left	36	0.3	A	0	70	0.4	A	0	161	0.4	A	1	125	0.4	A	0
	538					6NT	980		Through	427	0.2	A	0	494	0.2	A	0	255	0.2	A	0	320	0.2	A	0
	539					6EL	975	East	Left	62	4.2	A	3	99	5.1	A	4	142	4.0	A	3	178	4.0	A	3
	440	1324				6ST	983	South	Through	377	0.5	A	0	404	0.5	A	0	249	0.5	A	0	272	0.6	A	0
	540	443	1324			6SR	982		Right	68	2.4	A	3	56	2.5	A	2	164	2.5	A	3	137	2.8	A	3
	Priority								**Total**	**970**	**4.2**	**A**	**3**	**1123**	**5.1**	**A**	**4**	**971**	**4.0**	**A**	**3**	**1032**	**4.0**	**A**	**3**
Burringbar Street / River Terrace	697					7EL	1002	East	Left	18	8.2	A	1	23	10.7	A	1	18	5.1	A	0	45	17.0	B	2
	692					7ET	1004		Through	283	7.0	A	4	287	11.1	A	4	196	6.5	A	5	167	11.9	A	3
	694					7SL	1008	South	Left	41	8.2	A	2	37	5.6	A	2	42	5.3	A	2	31	4.3	A	1
	695					7SR	1009		Right	1	2.8	A	1	0	0.0	A	0	31	10.0	A	2	30	2.7	A	2
	689					7WT	1013	West	Through	262	24.8	B	7	160	20.6	B	7	126	28.4	C	6	125	16.9	B	6
	696					7WR	1012		Right	63	27.2	B	4	29	35.8	C	3	24	20.6	B	2	19	16.1	B	4
	Priority								**Total**	**668**	**27.2**	**B**	**7**	**536**	**35.8**	**C**	**7**	**437**	**28.4**	**C**	**6**	**417**	**17.0**	**B**	**6**
Burringbar St / Dalley St	819	1262				8NL	1017	North	Left	0	0.0	A	6	0	0.0	A	3	0	0.0	A	10	0	0.0	A	4
	818	1262				8NT	1019		Through	78	14.9	B	6	68	17.4	B	5	147	72.2	F	13	113	20.6	B	7
	820	1262				8NR	1018		Right	7	29.7	C	4	7	20.1	B	3	0	0.0	A	8	0	0.0	A	4
	815	788	583			8EL	1014	East	Left	30	8.2	A	4	17	15.8	B	6	33	14.8	B	5	45	26.7	B	11
	817	788	583			8ET	1016		Through	20	9.7	A	4	32	19.8	B	7	18	12.9	A	5	46	10.9	A	11
	816	788	583			8ER	1015		Right	2	5.3	A	5	2	3.3	A	7	1	43.1	D	7	0	0.0	A	11
	814	810	1350			8SL	1020	South	Left	269	8.6	A	10	256	11.6	A	9	199	12.3	A	11	118	15.6	B	6
	813	810	1350			8ST	1022		Through	90	7.9	A	10	22	10.7	A	8	108	12.8	A	13	31	17.0	B	6
	812	810	1350			8SR	1021		Right	68	10.3	A	10	34	16.7	B	8	37	11.7	A	11	26	13.3	A	6
	823					8WL	1023	West	Left	0	0.0	A	0	0	0.0	A	0	30	27.1	B	3	22	16.9	B	2
	822					8WT	1025		Through	19	20.2	B	3	23	14.1	B	1	3	32.8	C	2	9	3.4	A	1
	821					8WR	1024		Right	241	11.9	A	5	139	16.5	B	4	122	29.9	C	5	123	11.3	A	4
	Priority								**Total**	**824**	**29.7**	**C**	**10**	**600**	**20.1**	**B**	**9**	**698**	**72.2**	**F**	**13**	**533**	**26.7**	**B**	**11**
Burringbar St / Stuart St	634	502	1333	1292		9NL	1029	North	Left	0	0.0	A	0	0	0.0	A	2	0	0.0	A	2	0	0.0	A	1
	635	502	1333	1292		9NT	1031		Through	0	0.0	A	0	8	1.9	A	2	11	1.2	A	2	10	1.8	A	2
	633	502	1333	1292		9NR	1030		Right	1	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	2
	638	507	749			9EL	1026	East	Left	40	9.0	A	7	54	17.1	B	9	65	21.4	B	13	22	15.8	B	8
	637	507	749			9ET	1028		Through	62	9.8	A	7	36	18.6	B	9	58	17.2	B	14	72	13.4	A	8
	636	507	749			9ER	1027		Right	5	10.6	A	8	6	18.4	B	10	28	24.3	B	14	19	13.3	A	9
	640	1628				9SL	1032	South	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	639	1628				9ST	1034		Through	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1
	641	1628				9SR	1033		Right	0	0.0	A	0	16	2.3	A	2	0	0.0	A	1	0	0.0	A	1
	630	580				9WL	1035	West	Left	10	12.5	A	5	20	12.2	A	4	4	27.6	B	4	2	12.3	A	3
	631	580				9WT	1037		Through	53	15.4	B	5	28	10.6	A	4	12	6.9	A	2	13	24.1	B	3
	632	580				9WR	1036		Right	0	0.0	A	3	19	17.7	B	5	0	0.0	A	1	0	0.0	A	2
	Priority								**Total**	**171**	**15.4**	**B**	**8**	**187**	**18.6**	**B**	**10**	**178**	**27.6**	**B**	**14**	**138**	**24.1**	**B**	**9**
Burringbar St / Station St	531					10NL	993	North	Left	533	1.8	A	7	390	2.0	A	6	338	0.6	A	3	302	0.5	A	2
	527					10NT	995		Through	110	0.5	A	1	102	0.5	A	2	151	0.9	A	3	128	0.2	A	2
	529	469				10SL	996	South	Left	0	0.0	A	7	11	28.4	C	8	19	17.0	B	8	7	21.2	B	8
	530	469				10SR	997		Right	431	18.8	B	10	547	23.5	B	10	512	19.2	B	10	447	17.5	B	10
	524	752				10WT	1001	West	Through	55	14.1	B	5	54	16.7	B	6	37	20.7	B	5	44	17.7	B	4
	532	752				10WR	1000		Right	0	0.0	A	2	0	0.0	A	2	0	0.0	A	4	0	0.0	A	2
	Priority								**Total**	**1129**	**18.8**	**B**	**10**	**1104**	**28.4**	**C**	**10**	**1057**	**20.7**	**B**	**10**	**928**	**21.2**	**B**	**10**
Argyle St / Station St	449					11NL	987	North	Left	441	7.0	A	9	491	8.4	A	11	354	4.9	A	5	445	4.8	A	7
	450					11NT	989		Through	49	5.0	A	3	93	7.3	A	3	31	6.1	A	2	37	4.9	A	2
	450					11NR	1436		Right	0	0.0	A	3	0	0.0	A	3	0	0.0	A	2	0	0.0	A	2
	457					11EL	984	East	Left	596	6.7	A	14	398	6.6	A	11	459	2.8	A	4	393	2.4	A	3
	456					11ET	1435		Through	0	0.0	A	7	0	0.0	A	6	0	0.0	A	2	0	0.0	A	3
	456					11ER	985		Right	417	7.2	A	7	404	6.6	A	6	404	3.7	A	2	382	3.7	A	3
	1307					11SL	1437	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	460					11ST	992		Through	40	8.8	A	6	72	8.6	A	6	50	9.2	A	6	65	7.3	A	5
	460					11SR	991		Right	455	8.4	A	6	529	9.1	A	6	505	9.4	A	6	425	7.7	A	5
	1309					11WL	1438	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	1310					11WT	1439		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	1310					11WR	1440		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	Priority								**Total**	**1998**	**8.8**	**A**	**14**	**1987**	**9.1**	**A**	**11**	**1803**	**9.4**	**A**	**6**	**1747**	**7.7**	**A**	**7**
Dalley St / Whian St	704	1353				12NL	1041	North	Left	8	17.6	B	15	22	10.1	A	8	0	0.0	A	18	0	0.0	A	13
	705	1353				12NT	1043		Through	257	18.2	B	17	189	18.0	B	9	272	21.9	B	23	246	31.1	C	16
	706	1353				12NR	1042		Right	39	17.0	B	16	2	7.8	A	8	20	5.7	A	19	23	4.3	A	14
	708	743				12EL	1038	East	Left	2	2.4	A	1	1	6.9	A	1	10	3.9	A	1	0	0.0	A	2
	709	743				12ET	1040		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	707	743				12ER	1039		Right	0	0.0	A	2	0	0.0	A	1	10	20.5	B	3	5	10.4	A	1
	712	1152				12SL	1044	South	Left	17	2.8	A	1	2	7.2	A	1	83	2.5	A	2	3	11.7	A	1
	710	1152				12ST	1046		Through	400	1.7	A	7	333	1.4	A	4	309	2.9	A	5	248	2.8	A	4
	711	1152				12SR	1045		Right	0	0.0	A	0	18	2.1	A	1	35	3.9	A	2	44	5.3	A	3
	701					12WL	1047	West	Left	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1	0	0.0	A	0
	702					12WT	1049		Through	0	0.0	A	2	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
	703					12WR	1048		Right	0	0.0	A	0	0	0.0	A	1	0	0.0	A	1	0	0.0	A	2
	Priority								**Total**	**723**	**18.2**	**B**	**17**	**567**	**18.0**	**B**	**9**	**739**	**21.9**	**B**	**23**	**569**	**31.1**	**C**	**16**
Stuart St / Whian St	671	1625				13NT	1055	North	Through	0	0.0	A	0	38	0.1	A	0	0	0.0	A	0	0	0.0	A	0
	670	1625				13NR	1054		Right	42	0.9	A	1	33	0.7	A	0	2	0.6	A	0	0	0.0	A	0
	669					13SL	1056	South	Left	0	0.0	A	0	0	0.0	A	0	10	2.2	A	0	5	2.3	A	0
	668					13ST	1058		Through	11	1.2	A	0	0	0.0	A	0	13	0.6	A	0	0	0.0	A	0
	666	738				13WL	1050	West	Left	43	1.6	A	1	31	1.7	A	0	8	2.4	A	1	9	2.3	A	0
	667	738				13WR	1051		Right	8	1.9	A	1	36	2.2	A	2	0	0.0	A	0	0	0.0	A	0
	Priority								**Total**	**104**	**1.9**	**A**	**1**	**138**	**2.2**	**A**	**2**	**33**	**2.4**	**A**	**1**	**14**	**2.3**	**A**	**0**
Jubilee Ave / Fern St	681	1150				14NL	1062	North	Left	1	3.3	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	682	1150				14NT	1064		Through	239	0.4	A	0	182	0.3	A	0	295	0.4	A	0	332	0.5	A	0
	680	1122	769			14EL	1059	East	Left	509	8.4	A	23	346	3.3	A	10	308	6.2	A	17	281	6.3	A	8
	679	1122	769			14ER	1060		Right	0	0.0	A	16	0	0.0	A	4	1	24.9	B	11	1	24.0	B	1
	684					14ST	1067	South	Through	420	14.6	B	8	352	8.3	A	5	427	13.3	A	5	293	4.3	A	5
	683					14SR	1066		Right	400	16.0	B	10	472	8.9	A	7	462	14.3	B	7	364	6.2	A	6
	Priority								**Total**	**1569**	**16.0**	**B**	**23**	**1352**	**8.9**	**A**	**10**	**1493**	**24.9**	**B**	**17**	**1271**	**24.0**	**B**	**8**
Stuart St / Fern St	658					15NL	933	North	Left	26	5.8	A	1	52	6.3	A	2	0	0.0	A	0	0	0.0	A	0
	657					15NT	935		Through	8	7.9	A	1	22	10.1	A	2	26	6.2	A	1	24	4.3	A	1
	656					15NR	934		Right	0	0.0	A	0	7	11.3	A	1	0	0.0	A	0	0	0.0	A	0
	664					15EL	936	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	662					15ET	938		Through	470	3.6	A	0	316	3.1	A	0	299	3.2	A	0	274	3.3	A	0
	663					15ER	937		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	569					15SL	927	South	Left	0	0.0	A	0	0	0.0	A	0	14	2.2	A	0	9	1.7	A	0
	660					15ST	929		Through	0	0.0	A	0	0	0.0	A	0	23	7.2	A	2	5	4.5	A	1
	661					15SR	928		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	653	766	1119			15WL	930	West	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	655	766	1119			15WT	932		Through	397	1.2	A	3	444	1.6	A	4	434	1.4	A	5	363	1.2	A	4
	654	766	1119			15WR	931		Right	1	13.3	A	3	0	0.0	A	2	0	0.0	A	0	0	0.0	A	0
	Priority								**Total**	**902**	**13.3**	**A**	**3**	**841**	**11.3**	**A**	**4**	**796**	**7.2**	**A**	**5**	**675**	**4.5**	**A**	**4**

2032 Mitigation Scenario	Subpath		Approach	Movement	AM1 Peak				AM2 Peak				PM1 Peak				PM2 Peak			
	Name	ID			Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)	Modelled Volume (veh)	Delay (s)	LoS	Modelled Max Queue (veh)
Murwillumbah Rd / Brunswick Terrace / Tincogan St	1EL	898	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	1ET	897		Through	344	0.1	A	0	407	0.2	A	0	295	0.2	A	0	287	0.1	A	0
	1SL	893	South	Left	290	21.2	B	18	289	16.4	B	17	212	11.3	A	11	164	10.7	A	11
	1SR	894		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	6	0.0	A	0
	1WT	895	West	Through	534	15.3	B	4	521	5.6	A	4	188	5.7	A	3	246	0.9	A	3
	1WR	896		Right	342	20.7	B	4	190	8.4	A	3	149	8.3	A	5	108	4.4	A	4
				Total	1510	21.2	B	18	1407	16.4	B	17	844	11.3	A	11	805	10.7	A	11
Tincogan St / Gordon St	2NL	921	North	Left	1	1.6	A	0	7	6.5	A	1	3	2.0	A	0	0	0.0	A	0
	2NT	923		Through	12	6.2	A	1	5	2.1	A	1	18	4.5	A	2	12	3.6	A	2
	2NR	922		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	2EL - upgr	2807	East	Left	7	4.5	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	2ET - upgr	2809		Through	353	1.0	A	0	402	1.0	A	0	277	1.2	A	3	283	1.1	A	0
	2ER - upgr	2808		Right	0	0.0	A	0	0	0.0	A	0	6	5.2	A	1	0	0.0	A	0
	2SL	899	South	Left	2	9.5	A	1	0	0.0	A	1	0	0.0	A	1	2	12.6	A	1
	2ST	901		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	2SR	900		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	2WL	904	West	Left	13	3.1	A	1	13	2.3	A	0	0	0.0	A	0	0	0.0	A	0
	2WT	903		Through	459	1.2	A	5	509	0.3	A	0	170	0.2	A	0	243	0.1	A	0
	2WR	902		Right	61	4.3	A	2	0	0.0	A	0	13	2.0	A	1	1	9.0	A	1
				Total	908	9.5	A	5	936	6.5	A	1	467	5.2	A	3	541	12.6	A	2
Tincogan St / Dalley St	3NL - upgr	2834	North	Left	2	1.1	A	0	0	0.0	A	0	26	2.0	A	0	0	0.0	A	0
	3NT - upgr	2836		Through	29	6.1	A	0	35	2.1	A	0	0	0.0	A	0	0	0.0	A	0
	3NR - upgr	2835		Right	12	3.8	A	0	8	4.4	A	0	13	0.5	A	0	0	0.0	A	0
	3EL - upgr	2831	East	Left	11	10.7	A	5	7	17.1	B	6	13	2.0	A	3	16	5.7	A	6
	3ET - upgr	2833		Through	341	7.7	A	5	394	8.6	A	6	251	7.2	A	3	257	9.7	A	6
	3ER - upgr	2832		Right	0	0.0	A	5	0	0.0	A	6	16	14.9	B	3	0	0.0	A	6
	3SL - upgr	2837	South	Left	11	11.2	A	1	6	20.5	B	0	13	11.5	A	0	27	14.2	B	0
	3ST - upgr	2839		Through	14	22.5	B	1	2	4.9	A	0	6	11.5	A	0	1	36.7	C	0
	3SR - upgr	2838		Right	84	25.7	B	1	35	19.9	B	0	53	25.7	B	0	19	18.1	B	0
	3WL - upgr	2840	West	Left	15	4.4	A	0	30	3.0	A	0	0	0.0	A	0	0	0.0	A	0
	3WT - upgr	2842		Through	445	7.2	A	0	485	3.6	A	0	171	2.1	A	0	247	1.8	A	0
	3WR - upgr	2841		Right	1	2.9	A	0	0	0.0	A	0	3	3.0	A	0	0	0.0	A	0
				Total	965	25.7	B	5	992	24.5	B	6	555	25.7	B	3	567	36.7	C	6
Tincogan St / Stuart St	4NL - upgr	2846	North	Left	0	0.0	A	0	0	0.0	A	0	23	0.5	A	0	25	1.3	A	0
	4NT - upgr	2848		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	4NR - upgr	2847		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	4EL - upgr	2843	East	Left	19	0.1	A	0	19	0.6	A	0	23	0.4	A	0	18	0.6	A	0
	4ET - upgr	2845		Through	319	1.4	A	0	332	1.7	A	0	251	1.2	A	0	244	0.8	A	0
	4ER - upgr	2844		Right	14	1.5	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	4SL - upgr	2849	South	Left	29	0.8	A	1	19	0.5	A	0	18	0.6	A	0	29	1.0	A	1
	4ST - upgr	2851		Through	0	0.0	A	1	0	0.0	A	0	20	1.6	A	0	0	0.0	A	1
	4SR - upgr	2850		Right	1	6.8	A	1	2	0.7	A	0	2	0.6	A	0	5	3.2	A	1
	4WL - upgr	2852	West	Left	13	18.5	B	6	0	0.0	A	7	0	0.0	A	6	0	0.0	A	5
	4WT - upgr	2854		Through	375	16.3	B	6	447	19.1	A	7	213	21.4	B	6	270	16.3	B	5
	4WR - upgr	2853		Right	42	4.5	A	6	39	6.0	A	7	10	13.9	A	6	1	3.2	A	5
				Total	812	18.5	B	6	858	18.1	A	7	560	21.4	B	6	592	16.3	B	5
Tincogan St / Station St	5NT	968	North	Through	73	0.0	A	0	74	0.0	A	0	81	0.0	A	0	84	0.0	A	0
	5NR	967		Right	0	0.0	A	0	0	0.0	A	0	5	1.3	A	1	6	1.6	A	1
	5SL	969	South	Left	339	0.1	A	0	315	0.1	A	0	208	0.1	A	0	203	0.1	A	0
	5ST	970		Through	27	0.1	A	0	82	0.1	A	0	77	0.1	A	0	69	0.1	A	0
	5WL - upgr	2855	West	Left	0	0.0	A	1	20	4.5	A	1	16	4.1	A	1	20	4.1	A	1
	5WR - upgr	2856		Right	378	2.4	A	4	432	3.1	A	4	265	2.8	A	3	325	2.8	A	3
				Total	817	2.4	A	4	943	4.5	A	4	652	4.1	A	3	707	4.1	A	3
Woolworths carpark / Station Street	6NL	978	North	Left	26	0.3	A	0	42	0.3	A	0	98	0.3	A	1	94	0.3	A	1
	6NT	980		Through	425	0.2	A	0	484	0.2	A	0	248	0.2	A	0	315	0.2	A	0
	6EL	975	East	Left	79	2.5	A	3	104	6.3	A	5	212	3.0	A	3	236	3.2	A	4
	6ST	983	South	Through	342	0.5	A	0	397	0.5	A	0	285	0.5	A	0	272	0.6	A	0
	6SR	982		Right	79	3.3	A	3	84	2.6	A	3	226	2.0	A	3	171	1.8	A	3
				Total	951	3.3	A	3	1111	6.3	A	5	1069	3.0	A	3	1088	3.2	A	4
Burringbar Street / River Terrace	7EL - upgr	2857	East	Left	18	3.4	A	1	23	2.2	A	1	29	2.6	A	1	43	3.1	A	1
	7ET - upgr	2858		Through	316	9.1	A	4	290	7.5	A	4	199	5.8	A	3	163	10.6	A	4
	7SL	1008	South	Left	41	4.9	A	2	37	6.5	A	2	42	4.4	A	1	31	5.9	A	2
	7SR	1009		Right	1	4.4	A	1	0	0.0	A	0	31	15.2	B	3	30	2.5	A	2
	7WT	1013	West	Through	286	25.1	B	7	192	28.9	C	8	180	35.3	C	7	144	17.3	B	6
	7WR	1012		Right	63	27.0	B	4	29	40.1	C	3	24	26.3	B	3	19	16.0	B	4
				Total	725	27.0	B	7	571	40.1	C	8	496	35.3	C	7	430	17.3	B	6
Burringbar St / Dalley St	8NL - upgr	2862	North	Left	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1	0	0.0	A	1
	8NT - upgr	2864		Through	33	8.0	A	1	35	2.7	A	1	16	12.0	A	1	16	14.9	B	1
	8NR - upgr	2863		Right	8	2.6	A	1	7	2.3	A	1	0	0.0	A	1	0	0.0	A	1
	8EL - upgr	2859	East	Left	30	8.8	A	2	17	15.1	B	2	33	12.2	A	2	47	15.6	B	3
	8ET - upgr	2861		Through	54	7.8	A	2	35	11.1	A	2	20	13.7	A	2	41	10.9	A	3
	8ER - upgr	2860		Right	2	4.6	A	2	2	32.4	C	2	1	31.5	C	2	0	0.0	A	3
	8SL - upgr	2865	South	Left	270	7.1	A	0	253	9.9	A	0	199	10.4	A	0	120	13.6	A	0
	8ST - upgr	2867		Through	78	7.2	A	0	1	10.0	A	0	9	9.7	A	0	0	0.0	A	0
	8SR - upgr	2866		Right	68	8.2	A	0	34	15.0	B	0	37	11.1	A	0	26	14.7	B	0
	8WL - upgr	2868	West	Left	0	0.0	A	0	0	0.0	A	0	30	30.0	C	0	22	12.9	A	0
	8WT - upgr	2870		Through	18	7.6	A	0	24	13.8	A	0	7	15.6	B	0	9	4.6	A	0
	8WR - upgr	2869		Right	265	10.4	A	0	170	13.2	A	0	172	24.4	B	0	142	8.1	A	0
				Total	826	10.4	A	2	579	32.4	C	2	524	31.5	C	2	423	15.6	B	3
Burringbar St / Stuart St	9NL - upgr	2871	North	Left	0	0.0	A	0	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1
	9NT - upgr	2873		Through	0	0.0	A	0	8	4.2	A	2	11	2.7	A	2	10	2.6	A	2
	9NR - upgr	2872		Right	1	0.0	A	0	0	0.0	A	1	0	0.0	A	1	2	0.0	A	2
	9EL	1026	East	Left	40	8.2	A	9	54	17.9	B	10	65	22.2	B	13	22	15.6	B	8
	9ET	1028		Through	95	11.8	A	9	45	20.6	B	10	58	18.6	B	13	72	13.7	A	8
	9ER	1027		Right	5	10.9	A	9	6	16.6	B	10	28	23.0	B	14	19	13.3	A	10
	9SL	1032	South	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	1
	9ST	1034		Through	0	0.0	A	0	1	0.5	A	1	0	0.0	A	1	0	0.0	A	1
	9SR	1033		Right	0	0.0	A	0	16	2.8	A	2	0	0.0	A	1	0	0.0	A	1
	9WL	1035	West	Left	10	16.3	B	4	20	15.2	B	4	36	17.5	B	6	37	14.7	B	4
	9WT	1037		Through	59	13.4	A	4	33	11.9	A	4	33	14.0	A	6	31	20.7	B	4
	9WR	1036		Right	0	0.0	A	2	19	18.6	B	5	0	0.0	A	4	0	0.0	A	2
				Total	210	16.3	B	9	202	20.6	B	10	231	23.0	B	14	193	20.7	B	10
Burringbar St / Station St	10NL	993	North	Left	546	1.8	A	6	399	2.1	A	6	422	1.2	A	5	374	0.9	A	5
	10NT	995		Through	141	0.8	A	2	113	1.7	A	2	151	1.2	A	3	128	0.4	A	2
	10SL	996	South	Left	0	0.0	A	7	11	29.8	C	9	19	28.3	C	8	7	19.5	B	8
	10SR	997		Right	442	19.1	B	10	567	24.7	B	10	609	28.8	C	10	477	19.6	B	10
	10WT	1001	West	Through	62	17.2	B	6	66	15.2	B	7	58	19.6	B	7	67	18.8	B	7
	10WR	1000		Right	0	0.0	A	3	0	0.0	A	3	0	0.0	A	4	0	0.0	A	4
				Total	1191	19.1	B	10	1156	29.8	C	10	1259	28.8	C	10	1053	19.6	B	10
Argyle St / Station St	11NL	987	North	Left	436	5.9	A	7	485	7.7	A	9	333	4.5	A	4	426	3.3	A	6
	11NT	989		Through	65	6.2	A	3	99	7.1	A	2	115	6.2	A	3	109	5.4	A	2
	11NR	1436		Right	0	0.0	A	3	0	0.0	A	2	8	0.0	A	3	0	0.0	A	2
	11EL	984	East	Left	624	7.2	A	13	412	8.9	A	11	450	4.8	A	6	393	3.0	A	3
	11ET	1435		Through	0	0.0	A	6	0	0.0	A	7	0	0.0	A	4	0	0.0	A	4
	11ER	985		Right	383	7.9	A	6	398	8.7	A	7	404	5.5	A	4	382	4.4	A	4
	11SL	1437	South	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	11ST	992		Through	51	8.5	A	6	100	8.0	A	6	147	8.9	A	6	100	8.0	A	5
	11SR	991		Right	462	7.4	A	6	533	9.2	A	6	525	9.1	A	6	443	8.1	A	5
	11WL	1438	West	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	11WT	1439		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	11WR	1440		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
				Total	2021	8.5	A	13	2025	9.2	A	11	1983	9.1	A	6	1853	8.1	A	6
Dalley St / Whian St	12NL	1041	North	Left	13	11.5	A	13	16	16.3	B	9	0	0.0	A	10	0	0.0	A	10
	12NT	1043		Through	236	18.4	B	15	189	19.2	B	11	192	18.1	B	12	171	25.9	B	13
	12NR	1042		Right	37	12.6	A	14	4	36.5	C	10	20	5.5	A	11	23	6.4	A	11
	12EL	1038	East	Left	2	2.4	A	0	1	1.1	A	0	10	1.9	A	1	0	0.0	A	2
	12ET	1040		Through	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	12ER	1039		Right	0	0.0	A	2	0	0.0	A	1	7	5.2	A	1	6	7.5	A	1
	12SL	1044	South	Left	17	3.3	A	2	2	9.5	A	1	83	1.2	A	1	3	4.1	A	0
	12ST	1046		Through	389	1.5	A	8	311	1.4	A	4	210	1.4	A	4	222	2.5	A	4
	12SR	1045		Right	0	0.0	A	1	18	2.2	A	1	34	1.8	A	2	45	4.9	A	3
	12WL	1047	West	Left	0	0.0	A	2	0	0.0	A	1	0	0.0	A	1	0	0.0	A	0
	12WT - upg	2876		Through	43	8.0	A	2	45	6.2	A	3	0	0.0	A	0	0	0.0	A	0
	12WR - up	2875		Right	0	0.0	A	0	14	8.6	A	1	11	2.3	A	1	9	8.3	A	2
				Total	737	10.4	B	15	600	36.5	C	11	567	18.1	B	12	479	25.9	B	13
Stuart St / Whian St	13NT	1055	North	Through	0	0.0	A	0	38	0.1	A	0	0	0.0	A	0	0	0.0	A	0
	13NR	1054		Right	42	0.8	A	0	33	0.6	A	0	2	0.6	A	0	0	0.0	A	0
	13SL	1056	South	Left	0	0.0	A	0	0	0.0	A	0	7	2.3	A	0	6	2.3	A	0
	13ST	1058		Through	11	1.2	A	0	0	0.0	A	0	13	0.6	A	0	0	0.0	A	0
	13WL	1050	West	Left	43	1.7	A	1	31	1.7	A	0	8	2.4	A	1	10	2.3	A	0
	13WR	1051		Right	13	3.1	A	1	30	2.1	A	1	0	0.0	A	0	0	0.0	A	0
				Total	109	3.1	A	1	132	2.1	A	1	39	2.4	A	1	16	2.3	A	0
Jubilee Ave / Fern St	14NL	1062	North	Left	3	1.5	A	0	2	1.2	A	0	0	0.0	A	0	0	0.0	A	0
	14NT	1064		Through	222	0.4	A	0	176	0.3	A	0	213	0.4	A	0	258	0.6	A	0
	14EL	1059	East	Left	523	8.2	A	23	354	3.2	A	9	388	4.9	A	10	356	5.4	A	9
	14ER	1060		Through	0	0.0	A	16	0	0.0	A	3	2	24.4	B	4	1	2.9	A	3
	14ST	1067	South	Through	409	13.8	A	8	331	8.5	A	5	328	12.2	A	5	263	3.8	A	5
	14SR	1066		Right	411	15.1	B	9	493	9.4	A	8	561	13.2	A	5	396	5.4	A	5
				Total	1568	15.1	B	23	1356	9.4	A	9	1492	24.4	B	10	1274	5.4	A	9
Stuart St / Fern St	15NL	933	North	Left	26	6.5	A	2	52	6.7	A	2	0	0.0	A	0	0	0.0	A	0
	15NT	935		Through	13	13.4	A	2	16	10.9	A	1	26	11.0	A	2	24	4.8	A	2
	15NR	934		Right	0	0.0	A	0	7	10.4	A	1	0	0.0	A	0	0	0.0	A	0
	15EL	936	East	Left	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	15ET	938		Through	484	3.9	A	0	325	3.2	A	0	378	3.7	A	0	349	3.6	A	0
	15ER	937		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	15SL	927	South	Left	0	0.0	A	0	0	0.0	A	0	17	2.3	A	0	8	3.2	A	0
	15ST	929		Through	0	0.0	A	0	0	0.0	A	0	20	11.2	A	2	6	2.9	A	1
	15SR	928		Right	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	15WL	930	West	Left	0	0.0	A	1	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
	15WT	932		Through	408	1.2	A	3	465	1.8	A	6	533	1.5	A	5	394	1.1	A	4
	15WR	931		Right	0	14.7	B	2	2	11.5	A	1	0	0.0	A	0	0	0.0	A	0
				Total	934	14.7	B	3	867	11.5	A	6	974	11.2	A	6	781	4.8	A	4

APPENDIX C

SAFE SYSTEM ASSESSMENT

Cardno
now
Stantec

Cardno now Stantec

Mullumbimby Traffic Investigations – Safe System Assessment

80022070

Report Date

6 September 2022

Prepared for:

Byron Shire Council

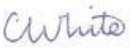
Prepared by:

Cardno now Stantec

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Revision	Description	Author		Quality Check		Independent Review	
1	Draft SSA	C. White	6/9/22	H. Calvey	6/9/22		6/9/22

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Prepared by  (signature)

Chris White

Reviewed by  (signature)

Hayden Calvey

Approved by  (signature)

Hayden Calvey

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

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MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Introduction

1.0 INTRODUCTION

1.1 OVERVIEW

Byron Shire Council (Council) is looking to consider road safety as part of the heavy vehicle route option assessment through Mullumbimby Town Centre.

Council has engaged Cardno now Stantec (Stantec) to undertake a Safe System Assessment (SSA) of various existing road segments and intersections along the proposed heavy vehicle routes to measure how well they align with Safe System principles. The SSA is to also examine the proposed design options to gauge how much impact they will have on road safety along the proposed heavy vehicle routes.

The SSA is prepared in accordance with Austroads Safe System Assessment Framework (AP-R509-16) with the aim to enable the project to meet TfNSW's Towards Zero goal.

1.2 SAFE SYSTEM ASSESSMENT PROCESS

A Safe System comprises of four essential components which together reflect a holistic view of road safety.

Figure 1 Pillars of the Safe System Framework

1.1

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Introduction

The basic principles of the Safe System are that:

- People are human and sometimes make mistakes – a simple mistake shouldn't cost anyone their life.
- Roads, roadsides and vehicles need to be designed to minimise crashes or reduce forces if a crash happens.
- Road safety is a shared responsibility – everyone needs to make safe decisions on and around the road to prioritise safety.

Safe Roads means that if a driver or rider makes a mistake, road infrastructure can significantly reduce the chance that it will result in a fatality or serious injury.

Safe Speeds relates to the speed at which vehicles are likely to travel on the road. Speed limits are set so vehicles travelling at the speed limit are able to safely respond to potential risks in the road environment. Ultimately it is a driver's speed that will determine the outcome.

Safe People is the road user behaviour and covers training, license and education, and making safe choices.

Safe Vehicles relates to the safety features of vehicles and smart systems that can help avoid crashes in the first place.

It should be noted that the angle of impact of a collision is also a factor that affects the severity of a crash. As far as is practically possible, infrastructure should be designed and travel speeds managed so that the impact speeds when a crash occurs are below the thresholds show in **Figure 2**.

Figure 2 Safe System Impact Speeds for Common Crash Types

CRASH TYPE	IMPACT SPEED
 Head on with another vehicle	70 km/h
 Side impact	50 km/h
 Side impact with tree	30 km/h
 Pedestrian & cyclists	30 km/h

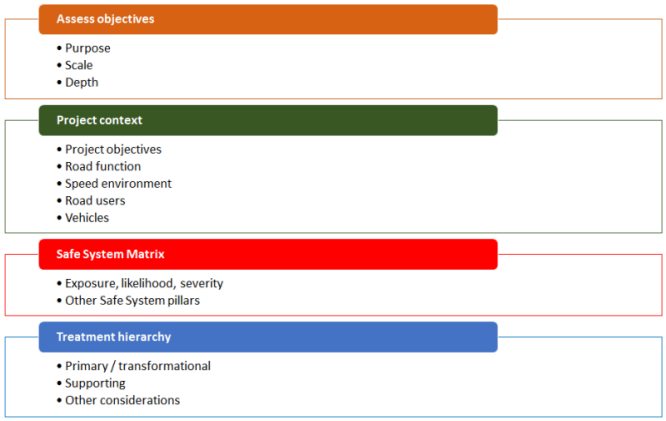
The Safe System Assessment is generally summarised in **Figure 3** as per Austroads.

1.2

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Introduction

Figure 3 Safe System Assessment Framework



1.3 OBJECTIVES

The objective of this assessment is to identify and compare how well the proposed heavy vehicle routes currently align with Safe System objectives, and to allow comparison with potential road infrastructure projects. This is the assessment of road segment lengths as well as individual intersections, looking at a specific road design and operational issues.

1.4 ASSESSMENT DETAILS

The relevant personnel and key milestone dates are shown in **Table 1** and **Table 2**.

Table 1 Relevant Personnel

Role	Detail	
Client	Byron Shire Council	
Client contact	Kirk Weallans	Project Engineer
Safe System Assessment team	Hayden Calvey	Traffic Engineering Team Leader
	Chris White	Traffic Engineer

Table 2 Key Milestone Dates

Activity	Date
Site visit	26-27 May 2022
Draft report	5 September 2022
Final report	TBA

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Project Context

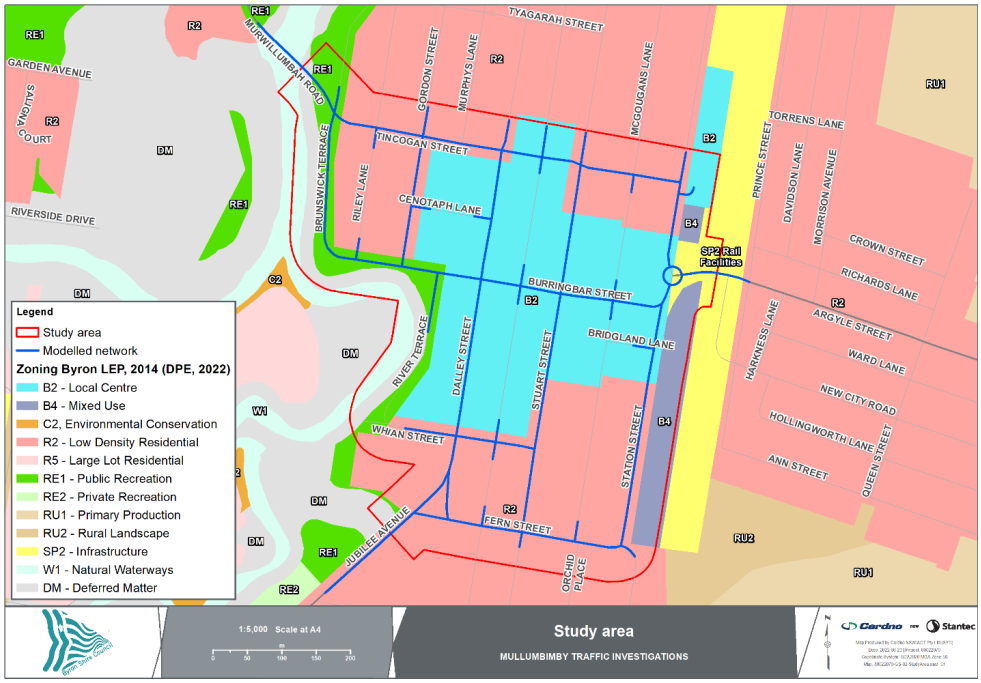
2.0 PROJECT CONTEXT

2.1 STUDY LOCATION

The study area is centred on the Mullumbimby town centre. The town centre consists of low-density residential developments, local centre commercial and retail facilities, and mixed-use land uses.

Figure 4 shows the study area for this Safe System Assessment.

Figure 4 Study Area



2.2 CRASH HISTORY

TfNSW provides details of all recorded accidents in NSW within the latest 5-year reporting period (2016 – 2020) on the NSW Centre for Road Safety website. **Figure 5** shows the accident history within the Study Area.

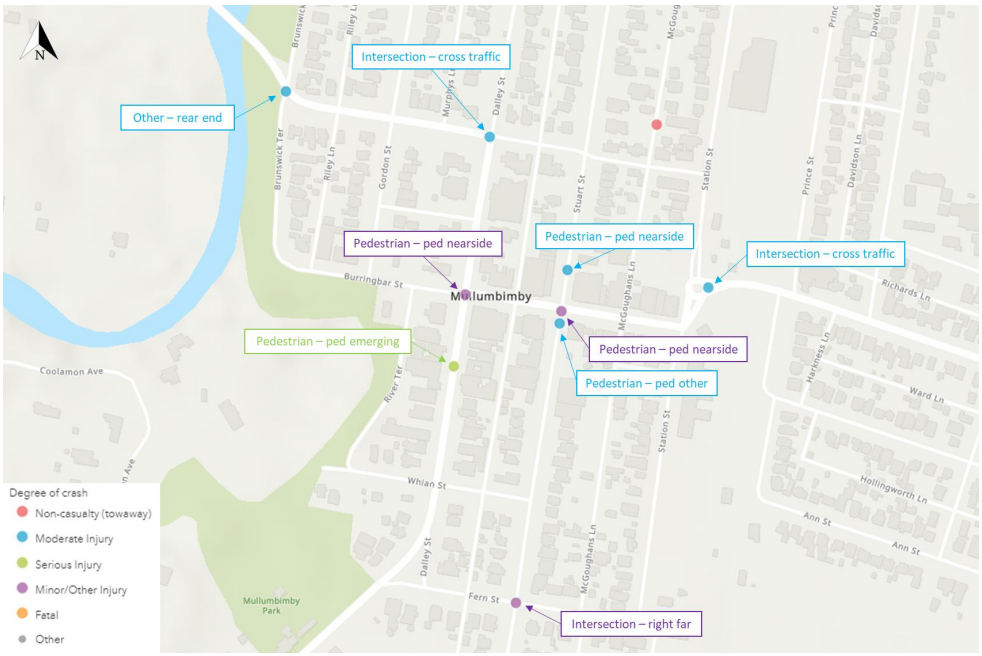
MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Project Context

There has been a total of 9 crashes over the latest 5-year reporting period. The types of crashes are categorised as follows:

- Pedestrian – 5
- Intersection – 3
- Other – 1
- Total – 9.

Figure 5 Historic Crash Locations (2016 – 2020)



2.3 SUMMARY

A list of project context considerations has been reproduced from Section 4.3 of the Austroads *Safe System Assessment Framework* (2016). A summary of this project's context is outlined below in **Table 3**.

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Project Context

Table 3 Project Context Summary

Considerations	Summary Comments
• What is the reason for the **project**? • Is there a specific crash type risk? • Is it addressing specific issues such as poor speed limit compliance, road access, congestion, future traffic growth, freight movement, amenity concerns from the community, maintenance/asset renewal, etc.	• To assess 4 potential heavy vehicle routes • Presence of heavy vehicles mostly impacts intersection and pedestrian-type crashes
• What is the **function** of the road? Consider location, roadside land use, area type, speed limit, intersection type, presence of parking, public transport services and vehicle flows. • What traffic features exist nearby (e.g. upstream and downstream)? • What alternative routes exist?	• Route 1 is route currently suited for heavy vehicles • Routes 2, 3 and 4 all go through local, residential streets
• What is the **speed** environment? • What is the current speed limit? • Has it changed recently? • Is it similar to other roads of this type? • How does it compare to Safe System speeds? • What is the acceptability of lowering the speed limit at this location?	• Recently introduced 30km/h speed limit in town centre • Aiming to create a pedestrian-friendly town centre with a heavy vehicle detour
• What **road users** are present? Consider the presence of elderly, school children and cyclists. • Also note what facilities are available to vulnerable road users (e.g. signalised crossings, bicycle lanes, school zone speed limits, etc.).	• More pedestrians in town centre • Many cycle lanes on all routes
• What is the **vehicle** composition? Consider the presence of heavy vehicles (and what type), motorcyclists and other vehicles using the roadway.	• Heavy vehicles predominantly use Route 1 • Motorcycle counts are unknown • Pedestrian activity is centred on Burringbar Street and Stuart Street

2.3

3.0 DESIGN CONSIDERATIONS

3.1 HEAVY VEHICLE ROUTE OPTIONS

Council has requested that the following 4 heavy vehicle route options be investigated and compared to determine how well each route aligns with the Safe System Framework.

Option 1

Option 1 proposes to restrict heavy vehicles to Dalley Street, Burringbar Street east of Dalley Street, and Tincogan Street west of Dalley Street. **Figure 6** shows the Option 1 heavy vehicle route.

Figure 6 Heavy Vehicle Route – Option 1

Option 2

Option 2 proposes to restrict heavy vehicles to Tincogan Street, Station Street and Fern Street. **Figure 7** shows the Option 2 heavy vehicle route.

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Design Considerations

Figure 7 Heavy Vehicle Route – Option 2

Option 3

Option 3 proposes to restrict the heavy vehicles to Stuart Street, Burringbar Street east of Stuart Street, Tincogan Street west of Stuart Street and Fern Street west of Stuart Street. **Figure 8** shows the Option 3 heavy vehicle route.

Figure 8 Heavy Vehicle Route – Option 3

3.2

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Design Considerations

Option 4

Option 4 proposes to restrict heavy vehicles to Burringbar Street, Brunswick Terrace and Dalley Street south of Burringbar Street. **Figure 9** shows the Option 4 heavy vehicle route.

Figure 9 Heavy Vehicle Route – Option 4

3.2 PROPOSED DESIGNS

In addition to the 4 heavy vehicle routes, Council is proposing to undertake the following proposed road infrastructure projects:

- Intersection of Tincogan Street and Dalley Street – pedestrian refuge islands, improved bicycle lanes, kerb extension islands, new footpath on south-eastern corner, and reorientation of intersection controls to match major traffic movements
- Intersection of Tincogan Street and Stuart Street – pedestrian refuge islands, improved bicycle lanes, kerb extension islands, new footpath on south-western corner, and reorientation of intersection controls to match major traffic movements
- Tincogan Street, between Dalley Street and Stuart Street – formalise 45-degree angled parking and install a new at-grade pedestrian crossing
- Station Street, between Burringbar Street and Fern Street – road resurfacing, pedestrian refuge island and warning signage
- Intersection of Fern Street and Stuart Street – pedestrian refuge islands
- Intersection of Fern Street and Station Street – road resurfacing, median rumble bars at 90-degree bend and warning signage.

3.3 ROAD GEOMETRY ISSUES WITH DESIGN VEHICLE

Using a 19m semi-trailer design vehicle, Council have identified issues with the existing road geometry in the following locations:

- Intersection of Tincogan Street and Brunswick Terrace – narrow road may cause side swipes between turning vehicles (intersection-type accident)
- Intersection of Tincogan Street and Station Street – tight horizontal turn may cause mounting of the inside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident)
- Intersection of Burringbar Street and Dalley Street – tight horizontal turn may cause mounting of the inside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident)
- Intersection of Burringbar Street and Stuart Street – tight horizontal turn may cause collisions between turning vehicles (intersection-type accident)
- Intersection of Fern Street and Dalley Street – narrow road width may cause mounting of the inside curve (pedestrian-type accident)
- Intersection of Fern Street and Station Street – tight horizontal turn may cause mounting of the outside curve (pedestrian-type accident) and/or collisions between turning vehicles (intersection-type accident).

4.0 ASSESSMENT OF HEAVY VEHICLE ROUTE OPTIONS

4.1 METHODOLOGY

The SSA has been prepared based on the following assessment and reporting steps:

- Define project need and scope
- Site Inspection
- Document Safe System Matrix Results
- Consideration of other Safe System pillars
- Identification of treatments to improve Safe System alignment.

4.2 ASSESSMENT MATRIX

In order to assess the existing conditions and proposed design options, and ensure that Safe System element are considered, or alternatively to measure the how well a project aligns with the Safe System principles, a matrix assessment is used.

The purpose of the Safe System matrix is to adopt a risk assessment approach focused on seven major crash types against the exposure to that crash risk, the likelihood of the crash occurring and the severity of the crash outcome if it were to occur.

The seven major crash types that reflect the main crash and road user types that contribute to fatalities and serious injuries are listed below:

- Run-off Road
- Head-on
- Intersection (vehicles from near or far side)
- Other (all vehicles in same direction, manoeuvring, overtaking, and miscellaneous crashes)
- Pedestrian
- Cyclist
- Motorcyclist.

The qualitative assessment is based on Austroads rating system provided in **Table 4** below.

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 4 Safe System Matrix Scoring System

Road User Exposure	Crash Likelihood	Crash Severity
0 = there is no exposure to a certain crash type. This might mean there is no side flow or intersecting roads, no cyclists, no pedestrians, or motorcyclists).	0 = there is only minimal chance that a given crash type can occur for an individual road user given the infrastructure in place. Only extreme behaviour or substantial vehicle failure could lead to a crash. This may mean, for example, that two traffic streams do not cross at grade, or that pedestrians do not cross the road.	0 = should a crash occur, there is only minimal chance that it will result in a fatality or serious injury to the relevant road user involved. This might mean that kinetic energies transferred during the crash are low enough not to cause a fatal or serious injury (FSI), or that excessive kinetic energies are effectively redirected/dissipated before being transferred to the road user. Users may refer to Safe System-critical impact speeds for different crash types, while considering impact angles, and types of roadside hazards/barriers present.
1 = volumes of vehicles that may be involved in a particular crash type are particularly low, and therefore exposure is low. For run-of-road, head-on, intersection and 'other' crash types, AADT is < 1 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are < 10 units per day.	1 = it is highly unlikely that a given crash type will occur.	1 = should a crash occur, it is highly unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies must be fairly low during a crash, or the majority is effectively dissipated before reaching the road user.
2 = volumes of vehicles that may be involved in a particular crash type are moderate, and therefore exposure is moderate. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 1 000 and 5 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 10–50 units per day.	2 = it is unlikely that a given crash type will occur.	2 = should a crash occur, it is unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, and the majority of the time they are effectively dissipated before reaching the road user.
3 = volumes of vehicles that may be involved in a particular crash type are high, and therefore exposure is high. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 5 000 and 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 50–100 units per day.	3 = it is likely that a given crash type will occur.	3 = should a crash occur, it is likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, but are not effectively dissipated and therefore may or may not result in an FSI.
4 = volumes of vehicles that may be involved in a particular crash type are very high, or the road is very long, and therefore exposure is very high. For run-of-road, head-on, intersection and 'other' crash types, AADT is > 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are > 100 units per day.	4 = the likelihood of individual road user errors leading to a crash is high given the infrastructure in place (e.g. high approach speed to a sharp curve, priority movement control, filtering right turn across several opposing lanes, high speed).	4 = should a crash occur, it is highly likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are high enough to cause an FSI crash, and it is unlikely that the forces will be dissipated before reaching the road user.

Source: Table 4.4 Safe System Assessment Framework (Austroads 2016)

4.2

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

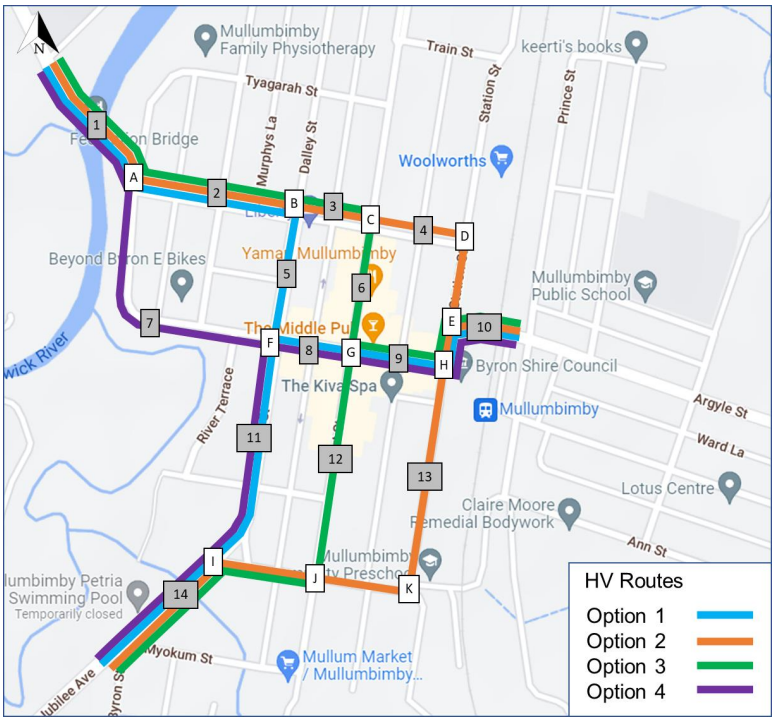
Assessment of Heavy Vehicle Route Options

4.3 SAFE SYSTEM MATRIX RESULTS

In order to analyse each of the route options in terms of road safety, the study roads have been separated into different road segments and intersections and analysed individually. This method will allow Council to analyse which road segments and intersections are positively or negatively impacting each route's Safe System score.

The 14 road segments and 11 intersections which have been assessed are shown in **Figure 10**.

Figure 10 Road Segments and Intersections



The detailed Safe System Matrix results for each road segment and intersection are listed below.

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 5 Existing Conditions Score – Segment 1

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	3/4	3/4
Likelihood	Factors that increase the likelihood include: • No edge line delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • Narrow bridge • Fencing and guard rails • Centre line delineation	Factors that increase the likelihood include: • Narrow road width Factors that decrease the likelihood include: • 85th percentile speed below design speed • Centre line delineation • No conflict points for opposing vehicles	Factors that increase the likelihood include: • No edge line delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • Centre line delineation • No bus stops • No angled street parking	Factors that decrease the likelihood include: • Off-road shared path • No roads to cross • No conflict between reversing vehicles and on-road cycleway	Factors that increase the likelihood include: • Average pavement quality • 1 slight horizontal curve Factors that decrease the likelihood include: • No road debris
	1/4	2/4	1/4	0/4	2/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) • Steep drop from bridge to river Factors that decrease the severity include: • Fencing and guard rails • No non-frangible roadside hazards (e.g. trees)	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • Fencing (non-frangible roadside hazard) Factors that decrease the severity include: • Low percentage of heavy vehicles
	3/4	2/4	2/4	3/4	3/4
Product	**9**	**12**	**6**	**0**	**18**
Sum					**45**

4.4

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 6 Existing Conditions Score – Segment 2

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	3/4	3/4
Likelihood	Factors that increase the likelihood include: • No fencing or guard rails • No delineation, RRPMs or guide posts Factors that decrease the likelihood include: • 85th percentile speed below design speed • Narrow road width	Factors that increase the likelihood include: • Narrow road width • 1 slight horizontal curve Factors that decrease the likelihood include: • 85th percentile speed below design speed • Minimal conflict points for opposing vehicles	Factors that increase the likelihood include: • No delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • No bus stops • Limited amount of angled street parking	Factors that decrease the likelihood include: • Off-road shared path • 1 road to cross, but low traffic volume • No conflict between reversing vehicles and on-road cycleway	Factors that increase the likelihood include: • Some road debris • 1 slight horizontal curve Factors that decrease the likelihood include: • Good pavement quality
	3/4	2/4	2/4	1/4	2/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) • No fencing or guard rails • Non-frangible roadside hazards (e.g. trees) Factors that decrease the severity include: • Narrow road width	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing Factors that decrease the severity include: • Slower vehicle speeds turning at intersection across cycle route	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • Non-frangible roadside hazards (e.g. trees) Factors that decrease the severity include: • Low percentage of heavy vehicles
	3/4	2/4	2/4	3/4	3/4
Product	**27**	**12**	**12**	**9**	**18**
Sum					**78**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 7 Existing Conditions Score – Segment 3

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	3/4	3/4
Likelihood	Factors that increase the likelihood include: • No fencing or guard rails • No delineation, RRPMs or guide posts Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Short, straight alignment	Factors that increase the likelihood include: • Average road width Factors that decrease the likelihood include: • 85th percentile speed below design speed • Minimal conflict points for opposing vehicles	Factors that increase the likelihood include: • No delineation • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed below design speed • No bus stops	Factors that decrease the likelihood include: • Off-road shared path • 1 road to cross, but low traffic volume • No conflict between reversing vehicles and on-road cycleway	Factors that increase the likelihood include: • Some road debris Factors that decrease the likelihood include: • Good pavement quality • No horizontal curves
	2/4	2/4	3/4	1/4	1/4
Severity	Factors that increase the severity include: • No fencing or guard rails Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h) • Short, straight alignment • No non-frangible roadside hazards (e.g. trees)	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing Factors that decrease the severity include: • Slower vehicle speeds turning at intersection across cycle route	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) Factors that decrease the severity include: • Low percentage of heavy vehicles • No non-frangible roadside hazards (e.g. trees)
	1/4	1/4	1/4	3/4	2/4
Product	**4**	**4**	**6**	**9**	**6**
Sum					**29**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 8 Existing Conditions Score – Segment 4

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • No fencing or guard rails • Some delineation missing Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Narrow road width	Factors that increase the likelihood include: • Narrow road width • Some delineation missing • Conflict point with high turning volumes (Woolworths) Factors that decrease the likelihood include: • 85th percentile speed below design speed	Factors that increase the likelihood include: • Some delineation missing Factors that decrease the likelihood include: • 85th percentile speed below design speed • Deceleration lane into Woolworths • No bus stops • No angled street parking	Factors that decrease the likelihood include: • Off-road shared path Factors that increase the severity include: • High turning traffic volume into Woolworths crosses over shared path • Refuge islands not wide enough for cyclists	Factors that increase the likelihood include: • Some road debris Factors that decrease the likelihood include: • Good pavement quality • No horizontal curves
	2/4	3/4	1/4	2/4	1/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) • No fencing or guard rails • Non-frangible roadside hazards (e.g. poles and private fences) Factors that decrease the severity include: • Narrow road width • Short, straight alignments	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming at the refuge island crossing for cyclists	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • Non-frangible roadside hazards (e.g. poles and private fences) Factors that decrease the severity include: • Low percentage of heavy vehicles
	2/4	2/4	2/4	3/4	3/4
Product	**12**	**18**	**6**	**12**	**9**
Sum					**57**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 9 Existing Conditions Score – Segment 5

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • Faded delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that increase the likelihood include: • Faded delineation Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Wide travel lanes • Minimal conflict points for opposing vehicles	Factors that increase the likelihood include: • 1 bus stop • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed below design speed	Factors that increase the likelihood include: • Faded delineation of cycle lane • Conflict between reversing vehicles and on-road cycleway Factors that decrease the likelihood include: • 1 road to cross, but low traffic volume	Factors that increase the likelihood include: • Poor pavement quality • Some road debris Factors that decrease the likelihood include: • No horizontal curves
	2/4	1/4	3/4	3/4	3/4
Severity	Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h) • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing Factors that decrease the severity include: • Slower vehicle speeds when reversing from parking	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) Factors that decrease the severity include: • Low percentage of heavy vehicles • Buffer between travel lanes and non-frangible roadside hazards
	1/4	1/4	1/4	2/4	2/4
Product	**4**	**2**	**6**	**12**	**18**
Sum					**42**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 10 Existing Conditions Score – Segment 6

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • Poor delineation at northern end • Long, straight segment encourages speeding Factors that decrease the likelihood include: • 85th percentile speed below design speed	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Centre linemarking • Wide travel lanes • No conflict points for opposing vehicles	Factors that increase the likelihood include: • 1 bus stop • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed below design speed	Factors that increase the likelihood include: • Cycle lanes disappear at northern end • Conflict between reversing vehicles and on-road cyclists Factors that decrease the likelihood include: • No roads to cross	Factors that increase the likelihood include: • Poor pavement quality (especially northern end) • High amount of road debris at northern end Factors that decrease the likelihood include: • No horizontal curves
	3/4	1/4	3/4	3/4	3/4
Severity	Factors that increase the likelihood include: • Long, straight segment encourages speeding • Some non-frangible roadside hazards (e.g. trees) Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h)	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) Factors that decrease the severity include: • Slower vehicle speeds when reversing from parking • 30km/h speed zone for half the segment	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) Factors that decrease the severity include: • Low percentage of heavy vehicles • 30km/h speed zone for half the segment
	2/4	1/4	1/4	2/4	2/4
Product	**12**	**2**	**6**	**12**	**18**
Sum					**50**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 11 Existing Conditions Score – Segment 7

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • 1 tight horizontal curve • Limited warning signage • No fencing or guard rails • No delineation, RRPMs or guide posts Factors that decrease the likelihood include: • 85th percentile speed below design speed	Factors that increase the likelihood include: • 1 tight horizontal curve • No median or centre linemarking Factors that decrease the likelihood include: • 85th percentile speed below design speed • Minimal conflict points for opposing vehicles	Factors that increase the likelihood include: • No delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • No bus stops • Limited amount of angled street parking	Factors that increase the likelihood include: • 1 road to cross with medium traffic volume Factors that decrease the likelihood include: • Off-road shared path • No conflict between reversing vehicles and on-road cycleway	Factors that increase the likelihood include: • Poor pavement quality • High amount of road debris • 1 tight horizontal curve
	4/4	2/4	2/4	2/4	3/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) • No fencing or guard rails • Multiple non-frangible roadside hazards (e.g. trees)	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing Factors that decrease the severity include: • Slower vehicle speeds turning at intersection across cycle route	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • Multiple non-frangible roadside hazards (e.g. trees) Factors that decrease the severity include: • Low percentage of heavy vehicles
	3/4	2/4	2/4	3/4	3/4
Product	**24**	**8**	**8**	**12**	**27**
Sum					**79**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 12 Existing Conditions Score – Segment 8

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	3/4	3/4
Likelihood	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Centre linemarking • Minimal conflict points for opposing vehicles • Wide travel lanes	Factors that increase the likelihood include: • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • No bus stops	Factors that increase the likelihood include: • Conflict between reversing vehicles and on-road cyclists • No separation distance between cycle lane and travel lane Factors that decrease the likelihood include: • 1 road to cross, but low traffic volume • On-road cycle lane	Factors that increase the likelihood include: • Some areas of deteriorated pavement Factors that decrease the likelihood include: • No road debris • No horizontal curves
	1/4	1/4	2/4	3/4	1/4
Severity	Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h) • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that decrease the severity include: • Slower vehicle speeds when reversing from parking • 30km/h speed zone	Factors that increase the severity include: • Average percentage of heavy vehicles Factors that decrease the severity include: • 30km/h speed zone • Buffer between travel lanes and non-frangible roadside hazards
	1/4	1/4	1/4	1/4	2/4
Product	**3**	**3**	**6**	**9**	**6**
Sum					**27**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 13 Existing Conditions Score – Segment 9

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	3/4	3/4
Likelihood	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Centre linemarking • Minimal conflict points for opposing vehicles • Wide travel lanes	Factors that increase the likelihood include: • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • No bus stops	Factors that increase the likelihood include: • Conflict between reversing vehicles and on-road cyclists • No separation distance between cycle lane and travel lane Factors that decrease the likelihood include: • 1 road to cross, but low traffic volume • On-road cycle lane	Factors that increase the likelihood include: • Some areas of deteriorated pavement Factors that decrease the likelihood include: • No road debris • No horizontal curves
	1/4	1/4	2/4	3/4	1/4
Severity	Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h) • Built-up environment encourages slower speed • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that decrease the severity include: • Slower vehicle speeds when reversing from parking • 30km/h speed zone	Factors that increase the severity include: • Average percentage of heavy vehicles Factors that decrease the severity include: • 30km/h speed zone • Buffer between travel lanes and non-frangible roadside hazards
	1/4	1/4	1/4	1/4	2/4
Product	**3**	**3**	**6**	**9**	**6**
Sum					**27**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 14 Existing Conditions Score – Segment 10

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is over 10,000vpd	AADT is over 10,000vpd	AADT is over 10,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	4/4	4/4	4/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • 2 slight horizontal curves • Poor delineation • No warning signage Factors that decrease the likelihood include: • 85th percentile speed below design speed • Short road segment • Some wooden posts / barriers	Factors that increase the likelihood include: • 2 slight horizontal curves Factors that decrease the likelihood include: • 85th percentile speed below design speed • Median islands • No conflict points for opposing vehicles	Factors that increase the likelihood include: • Increased chance of rear ends at roundabout • No deceleration lanes • Poor delineation Factors that decrease the likelihood include: • 85th percentile speed below design speed • No bus stops • No angled street parking	Factors that increase the likelihood include: • No cycle path / cycle lane	Factors that increase the likelihood include: • Some road debris • 2 slight horizontal curves Factors that decrease the likelihood include: • Good pavement quality
	2/4	1/4	2/4	3/4	2/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) Factors that decrease the severity include: • Some wooden posts / barriers • Limited number of non-frangible roadside hazards (e.g. trees)	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed • Slower vehicle speeds on approach to intersections	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) Factors that decrease the severity include: • Slower vehicle speeds in short segments between intersections	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • High percentage of heavy vehicles Factors that decrease the severity include: • Limited number of non-frangible roadside hazards (e.g. trees)
	2/4	2/4	1/4	2/4	2/4
Product	**16**	**8**	**8**	**12**	**12**
Sum					**56**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 15 Existing Conditions Score – Segment 11

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • 1 slight horizontal curve • No warning signage • No edge delineation or RRPM's on curve Factors that decrease the likelihood include: • 85th percentile speed below design speed • Good delineation for majority of segment	Factors that increase the likelihood include: • Narrow travel lanes • 1 slight horizontal curve Factors that decrease the likelihood include: • 85th percentile speed below design speed • Minimal conflict points for opposing vehicles	Factors that increase the likelihood include: • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed below design speed • Good delineation • No bus stops	Factors that increase the likelihood include: • Conflict between reversing vehicles and on-road cyclists • No separation distance between cycle lane and travel lane • Poor transition from off-road to on-road cycle way	Factors that increase the likelihood include: • Some areas of deteriorated pavement • 1 slight horizontal curve Factors that decrease the likelihood include: • No road debris
	2/4	2/4	2/4	4/4	2/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for ROR accidents (40km/h) • No fencing or guard rails • Non-frangible roadside hazards on curve (e.g. trees and poles) Factors that decrease the severity include: • Narrow travel lanes	Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing	Factors that increase the severity include: • 85th percentile speed above survival speed for motorcyclist accidents (30km/h) • Non-frangible roadside hazards on curve (e.g. trees and poles) Factors that decrease the severity include: • Low percentage of heavy vehicles
	3/4	2/4	2/4	4/4	3/4
Product	**18**	**12**	**12**	**32**	**18**
Sum					**92**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 16 Existing Conditions Score – Segment 12

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	2/4	3/4
Likelihood	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • Built-up environment encourages slower speed • Some wooden posts / barriers	Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Centre linemarking • Minimal conflict points for opposing vehicles • Wide travel lanes	Factors that increase the likelihood include: • Frequently used angled street parking Factors that decrease the likelihood include: • 85th percentile speed well below design speed • Good delineation • No bus stops	Factors that increase the likelihood include: • Conflict between reversing vehicles and on-road cyclists • No separation distance between cycle lane and travel lane Factors that decrease the likelihood include: • Visible green cyclist lane at intersection	Factors that decrease the likelihood include: • Good pavement quality • No road debris • No horizontal curves
	1/4	1/4	2/4	3/4	1/4
Severity	Factors that decrease the severity include: • 85th percentile speed below survival speed for ROR accidents (40km/h) • Some wooden posts / barriers • Buffer between travel lanes and non-frangible roadside hazards	Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that decrease the severity include: • 85th percentile speed well below design speed	Factors that increase the severity include: • 85th percentile speed above survival speed for cyclist accidents (30km/h) Factors that decrease the severity include: • Slower vehicle speeds when reversing from parking • 30km/h speed zone	Factors that decrease the severity include: • 30km/h speed zone • Low percentage of heavy vehicles • Buffer between travel lanes and non-frangible roadside hazards
	1/4	1/4	1/4	2/4	1/4
Product	**2**	**2**	**4**	**12**	**3**
Sum					**23**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 17 Existing Conditions Score – Segment 13

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	AADT is between 1,000 – 5,000vpd	Estimated to be 10 – 50 movements per day	Estimated to be 50 – 100 movements per day
	2/4	2/4	2/4	2/4	3/4
Likelihood	Factors that increase the likelihood include: • 85th percentile speed above design speed • Long, straight segments encourage speeding • 1 tight horizontal curve • No warning signs • No fencing or guard rails • Poor delineation	Factors that increase the likelihood include: • 85th percentile speed above design speed • 1 tight horizontal curve • Conflict point with high turning volumes (carpark) Factors that decrease the likelihood include: • Centre linemarking on curve	Factors that increase the likelihood include: • 85th percentile speed above design speed • No deceleration lanes • Poor delineation • Frequently used angled street parking Factors that decrease the likelihood include: • No bus stops	Factors that increase the likelihood include: • No cycle path / cycle lane	Factors that increase the likelihood include: • High amount of road debris • 1 tight horizontal curve Factors that decrease the likelihood include: • Good pavement quality
	4/4	3/4	3/4	3/4	3/4
Severity	Factors that increase the severity include: • 85th percentile speed well above survival speed for ROR accidents (40km/h) • Long, straight segments encourage speeding • No fencing or guard rails • Non-frangible roadside hazards (e.g. trees, poles)	Factors that increase the severity include: • 85th percentile speed above survival speed for intersection accidents (50km/h) Factors that decrease the severity include: • Slower vehicle speeds when turning into carpark	Factors that increase the severity include: • 85th percentile speed above design speed	Factors that increase the severity include: • 85th percentile speed well above survival speed for cyclist accidents (30km/h) • No traffic calming or pedestrian crossing	Factors that increase the severity include: • 85th percentile speed well above survival speed for motorcyclist accidents (30km/h) • Non-frangible roadside hazards (e.g. trees, poles) Factors that decrease the severity include: • Low percentage of heavy vehicles
	4/4	3/4	3/4	4/4	3/4
Product	**32**	**18**	**18**	**24**	**27**
Sum					**119**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 18 Existing Conditions Score – Segment 14

	Run-off road (ROR)	Head-on (HO)	Other (O)	Cyclist (C)	Motorcyclist (MC)
Exposure	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	AADT is between 5,000 – 10,000vpd	Estimated to be 50 – 100 movements per day	Estimated to be 50 – 100 movements per day
	3/4	3/4	3/4	3/4	3/4
Likelihood	Factors that increase the likelihood include: • 85th percentile speed above design speed • Long, straight segment encourages speeding • No edge delineation Factors that decrease the likelihood include: • Guard rail over creek • Verge / shoulder	Factors that increase the likelihood include: • 85th percentile speed above design speed • 1 conflict point with turning vehicles (pool) • 3m travel lane over creek Factors that decrease the likelihood include: • Centre linemarking	Factors that increase the likelihood include: • 85th percentile speed above design speed • No deceleration lanes • Poor delineation • Frequently used angled street parking Factors that decrease the likelihood include: • No bus stops • No angled street parking	Factors that decrease the likelihood include: • Off-road shared path • 1 road to cross, but low traffic volume	Factors that decrease the likelihood include: • Good pavement quality • No road debris • No horizontal curves
	3/4	2/4	2/4	1/4	1/4
Severity	Factors that increase the severity include: • 85th percentile speed well above survival speed for ROR accidents (40km/h) • Long, straight segment encourages speeding • A few non-frangible roadside hazards (e.g. trees, poles) Factors that decrease the severity include: • Guard rail over creek	Factors that increase the severity include: • 85th percentile speed above survival speed for intersection accidents (50km/h)	Factors that increase the severity include: • 85th percentile speed above design speed	Factors that increase the likelihood include: • No traffic calming or pedestrian crossing Factors that decrease the severity include: • Slower vehicle speeds turning at intersection across cycle route	Factors that increase the severity include: • 85th percentile speed well above survival speed for motorcyclist accidents (30km/h) • A few non-frangible roadside hazards (e.g. trees, poles) Factors that decrease the severity include: • Low percentage of heavy vehicles
	3/4	3/4	3/4	2/4	3/4
Product	**27**	**18**	**18**	**6**	**9**
Sum					**78**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 19 Existing Conditions Score – Intersection A

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	>100 movements per day
	4/4	4/4
Likelihood	Factors that increase the likelihood include: • Faded linemarking Factors that decrease the likelihood include: • Low traffic volume from minor road/s • Adequate sight distance	Factors that increase the likelihood include: • No crossing facilities Factors that decrease the likelihood include: • Some footpaths provided • Adequate sight distance for drivers to pedestrians • Lighting installed
	2/4	2/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed well above survival speed for pedestrian accidents (30km/h) • No crossing facility or traffic calming to reduce vehicle speed
	2/4	4/4
Product	**16**	**32**
Sum		**48**

Table 20 Existing Conditions Score – Intersection B

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	>100 movements per day
	4/4	4/4
Likelihood	Factors that increase the likelihood include: • High traffic volume from minor road/s • 12 possible intersection movements Factors that decrease the likelihood include: • Adequate sight distance • Good visibility approaching intersection	Factors that increase the likelihood include: • Insignificant refuge island • Large crossing distance • Less than adequate sight distance for drivers to pedestrians Factors that decrease the likelihood include: • Footpaths provided on most legs • Lighting installed
	3/4	3/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed above survival speed for pedestrian accidents (30km/h) • No crossing facility or traffic calming to reduce vehicle speed
	1/4	3/4
Product	**12**	**36**
Sum		**48**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 21 Existing Conditions Score – Intersection C

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is between 5,000 – 10,000vpd	>100 movements per day
	3/4	4/4
Likelihood	Factors that increase the likelihood include: • High traffic volume from minor road/s • Poor intersection alignment, hard for drivers to comprehend • Poor sight distance Factors that decrease the likelihood include: • Minimal traffic coming from north approach (i.e. reduces conflict points)	Factors that increase the likelihood include: • No crossing facilities • Less than adequate sight distance for drivers to pedestrians • Only 1 light installed Factors that decrease the likelihood include: • Footpaths provided on most legs • Short crossing distances
	4/4	3/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed above survival speed for pedestrian accidents (30km/h) • No crossing facility or traffic calming to reduce vehicle speed
	1/4	3/4
Product	**12**	**36**
Sum		**48**

Table 22 Existing Conditions Score – Intersection D

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is between 5,000 – 10,000vpd	>100 movements per day
	3/4	4/4
Likelihood	Factors that increase the likelihood include: • Faded linemarking Factors that decrease the likelihood include: • Only 2 main intersection movements • Adequate sight distance	Factors that increase the likelihood include: • No traffic calming Factors that decrease the likelihood include: • Footpaths provided on most legs • 1 refuge island • Short crossing distances • Adequate sight distance for drivers to pedestrians
	2/4	2/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed well above survival speed for pedestrian accidents (30km/h) • No traffic calming to reduce vehicle speed
	2/4	4/4
Product	**12**	**32**
Sum		**44**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 23 Existing Conditions Score – Intersection E

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	Between 10 – 50 movements per day
	4/4	2/4
Likelihood	Factors that increase the likelihood include: • Very high traffic volume through intersection Factors that decrease the likelihood include: • Good visibility approaching intersection • Adequate sight distance	Factors that increase the likelihood include: • Unsafe refuge with large crossing distance on eastern approach Factors that decrease the likelihood include: • Footpaths provided on all legs • Adequate sight distance for pedestrians to vehicles
	3/4	3/4
Severity	Factors that increase the severity include: • High percentage of heavy vehicles Factors that decrease the severity include: • 85th percentile speed below survival speed for intersection accidents (50km/h) • Slower speeds travelling through roundabout	Factors that increase the severity include: • 85th percentile speed well above survival speed for pedestrian accidents (30km/h) • No crossing facility or traffic calming to reduce vehicle speed Factors that decrease the severity include: • Roundabout as a traffic calming device
	1/4	3/4
Product	**12**	**18**
Sum		**30**

Table 24 Existing Conditions Score – Intersection F

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	>100 movements per day
	4/4	4/4
Likelihood	Factors that increase the likelihood include: • Medium traffic volume from minor road/s • 12 possible intersection movements • Dense vegetation restricts sight distance Factors that decrease the likelihood include: • Good visibility approaching intersection	Factors that increase the likelihood include: • 1 at-grade crossing • Crossings located at intersections not midblock • Large crossing distance • Very poor sight distance for drivers to pedestrians Factors that decrease the likelihood include: • Footpaths provided on all legs • 2 pedestrian crossings (1 raised)
	3/4	4/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed above survival speed for pedestrian accidents (30km/h) Factors that decrease the severity include: • 2 pedestrian crossings (1 raised)
	1/4	2/4
Product	**12**	**32**
Sum		**44**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 25 Existing Conditions Score – Intersection G

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	>100 movements per day
	4/4	4/4
Likelihood	Factors that increase the likelihood include: • Medium traffic volume from minor road/s • 12 possible intersection movements • Vegetation blocking signage • Faded linemarking Factors that decrease the likelihood include: • Adequate sight distance	Factors that increase the likelihood include: • Crossings not raised • Crossings located at intersections not midblock • Large crossing distance • Very poor sight distance for drivers to pedestrians Factors that decrease the likelihood include: • Footpaths provided on all legs • 2 pedestrian crossings
	2/4	4/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that increase the severity include: • 85th percentile speed above survival speed for pedestrian accidents (30km/h) Factors that decrease the severity include: • 2 pedestrian crossings • Lane narrowing • 30km/h speed limit
	1/4	1/4
Product	**8**	**16**
Sum		**24**

Table 26 Existing Conditions Score – Intersection H

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	>100 movements per day
	4/4	4/4
Likelihood	Factors that increase the likelihood include: • Slightly faded linemarking Factors that decrease the likelihood include: • Low traffic volume from minor road/s • Only 6 possible intersection movements • Good visibility approaching intersection • Adequate sight distance	Factors that increase the likelihood include: • Crossings not raised • Crossings located at intersections not midblock • Large crossing distance Factors that decrease the likelihood include: • Footpaths provided on all legs • 2 pedestrian crossings • Adequate sight distance for drivers to pedestrians
	1/4	2/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • 85th percentile speed well below survival speed for intersection accidents (50km/h)	Factors that increase the severity include: • 85th percentile speed above survival speed for pedestrian accidents (30km/h) Factors that decrease the severity include: • 2 pedestrian crossings • 30km/h speed limit
	1/4	1/4
Product	**4**	**8**
Sum		**12**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 27 Existing Conditions Score – Intersection I

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is over 10,000vpd	Between 10 – 50 movements per day
	4/4	2/4
Likelihood	Factors that increase the likelihood include: • Medium traffic volume from minor road/s • No linemarking • Only 1 sign visible Factors that decrease the likelihood include: • Only 6 possible intersection movements • Adequate sight distance	Factors that increase the likelihood include: • Only some footpaths provided • No crossing facilities • Very little lighting
	2/4	3/4
Severity	Factors that increase the severity include: • 85th percentile speed above survival speed for intersection accidents (50km/h) • Give Way intersection control Factors that decrease the severity include: • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed well above survival speed for pedestrian accidents (30km/h) • No crossing facility or traffic calming to reduce vehicle speed
	3/4	4/4
Product	**24**	**24**
Sum		**48**

Table 28 Existing Conditions Score – Intersection J

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is between 1,000 – 5,000vpd	Between 50 – 100 movements per day
	2/4	2/4
Likelihood	Factors that increase the likelihood include: • 12 possible intersection movements • Missing Give Way line Factors that decrease the likelihood include: • Low traffic volume from minor road/s • Adequate sight distance • Good visibility approaching intersection	Factors that increase the likelihood include: • Only some footpaths provided • 2 insignificant refuge islands • No traffic calming Factors that decrease the likelihood include: • Adequate sight distance for pedestrians to vehicles
	2/4	3/4
Severity	Factors that increase the severity include: • 85th percentile speed well above survival speed for intersection accidents (50km/h) • Give Way intersection control Factors that decrease the severity include: • Low percentage of heavy vehicles	Factors that increase the severity include: • 85th percentile speed well above survival speed for pedestrian accidents (30km/h) • 2 insignificant refuge islands • No traffic calming
	3/4	4/4
Product	**12**	**24**
Sum		**36**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 29 Existing Conditions Score – Intersection K

	Intersection (INT)	Pedestrian (PED)
Exposure	AADT is between 1,000 – 5,000vpd	Between 10 – 50 movements per day
	2/4	1/4
Likelihood	Factors that decrease the likelihood include: • Low traffic volume from minor road/s (cul-de-sac) • Only 6 possible intersection movements • Adequate delineation and signage • Adequate sight distance	Factors that increase the likelihood include: • No footpaths provided • No crossing facilities
	1/4	3/4
Severity	Factors that increase the severity include: • Give Way intersection control Factors that decrease the severity include: • Curve turning speed below survival speed for intersection accidents (50km/h) • Low percentage of heavy vehicles	Factors that decrease the severity include: • Curve turning speed below survival speed for pedestrian accidents (30km/h)
	1/4	2/4
Product	**2**	**6**
Sum		**8**

4.4 ASSESSMENT SUMMARY

4.4.1 Existing Conditions

A summary of the Safe System assessments of the existing road segments and intersections is provided below.

Table 30 Assessment of Road Segments (starting from least aligned with Safe System objectives)

Road Segment	ROR	HO	O	C	MC	Total
13	32	18	18	24	27	**119/320**
11	18	12	12	32	18	**92/320**
7	24	8	8	12	27	**79/320**
14	27	18	18	6	9	**78/320**
2	27	12	12	9	18	**78/320**
4	12	18	6	12	9	**57/320**
10	16	8	8	12	12	**56/320**
6	12	2	6	12	18	**50/320**
1	9	12	6	0	18	**45/320**
5	4	2	6	12	18	**42/320**
3	4	4	6	9	6	**29/320**
8	3	3	6	9	6	**27/320**
9	3	3	6	9	6	**27/320**
12	2	2	4	12	3	**23/320**

Table 31 Assessment of Intersections (starting from least aligned with Safe System objectives)

Intersection	INT	PED	Total
A	16	32	**48/128**
B	12	36	**48/128**
C	12	36	**48/128**
I	24	24	**48/128**
D	12	32	**44/128**
F	12	32	**44/128**
J	12	24	**36/128**
E	12	18	**30/128**
G	8	16	**24/128**
H	4	8	**12/128**
K	2	6	**8/128**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Based on an average of the road segment scores and intersection scores on each of the 4 proposed heavy vehicle routes, the following total Safe System scores have been deduced for the existing conditions.

Table 32 Route Summary

Route	Road Segments	Average Segment Score	Intersections	Average Intersection Score	Total
1	1, 2, 5, 8, 9, 10, 11, 14	**56/320**	A, B, E, F, G, H, I	**36/128**	**92/448**
2	1, 2, 3, 4, 10, 13, 14	**66/320**	A, B, C, D, E, H, I, J, K	**36/128**	**102/448**
3	1, 2, 3, 6, 9, 10, 12, 14	**48/320**	A, B, C, E, G, H, I, J	**37/128**	**85/448**
4	1, 7, 8, 9, 10, 11, 14	**58/320**	A, E, F, G, H, I	**34/128**	**92/448**

Under the existing conditions, Route 2 was found to have the least alignment with the Safe System objectives, followed by routes 4 and 1. Route 3 was found to have the most alignment with Safe System objectives. In broad terms, reasons for this include the recently introduced 30km/h speed limit, lower 85th percentile speeds, good pavement quality, good delineation, less horizontal curves and a relatively low number of non-frangible roadside hazards.

4.4.2 Proposed Heavy Vehicle Routes

For each of the proposed heavy vehicle routes, the road segments and intersections most impacted by an increase in heavy vehicles have been re-assessed in terms of their safety and alignment with Safe System principles.

The following factors have been considered due to the higher percentage of heavy vehicles:

- Increased severity of run-off road accidents, head-on accidents, and other accidents (i.e., now more likely to result in a fatality or serious injury due to greater chance of higher force in crashes)
- Increased likelihood and severity of cyclist accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)
- Increased likelihood and severity of motorcyclist accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)
- Increased likelihood and severity of pedestrian accidents (i.e., now more likely to occur, and more likely to result in a fatality or serious injury)

Route 1

The critical road segments impacted by a higher percentage of heavy vehicles on Route 1 are Segments 5, 8 and 9. The critical intersections impacted by a higher percentage of heavy vehicles on Route 1 are Intersections F, G and H. The re-assessment of these road segments and intersections are shown below, where existing condition scores are denoted by strikethrough text (~~example~~), and future updated scores are denoted by bold text (**example**).

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 33 Assessment of Future Road Segments based on Route 1 as the Heavy Vehicle Route

Road Segment	ROR	HO	O	C	MC	Total
13	32	18	18	24	27	**119/320**
11	18	12	12	32	18	**92/320**
7	24	8	8	12	27	**79/320**
14	27	18	18	6	9	**78/320**
2	27	12	12	9	18	**78/320**
4	12	18	6	12	9	**57/320**
10	16	8	8	12	12	**56/320**
6	12	2	6	12	18	**50/320**
1	9	12	6	0	18	**45/320**
5	~~4~~	~~2~~	~~6~~	~~12~~	~~18~~	~~**42/320**~~
	12	**6**	**18**	**32**	**27**	**95/320**
3	4	4	6	9	6	**29/320**
8	~~3~~	~~3~~	~~6~~	~~9~~	~~6~~	~~**27/320**~~
	6	**6**	**12**	**48**	**18**	**90/320**
9	~~3~~	~~3~~	~~6~~	~~9~~	~~6~~	~~**27/320**~~
	6	**6**	**12**	**48**	**18**	**90/320**
12	2	2	4	12	3	**23/320**

Table 34 Assessment of Future Intersections based on Route 1 as the Heavy Vehicle Route

Intersection	INT	PED	Total
A	16	32	**48/128**
B	12	36	**48/128**
C	12	36	**48/128**
I	24	24	**48/128**
D	12	32	**44/128**
F	~~12~~	~~32~~	~~**44/128**~~
	12	**48**	**60/128**
J	12	24	**36/128**
E	12	18	**30/128**
G	~~8~~	~~16~~	~~**24/128**~~
	8	**48**	**56/128**
H	4	~~8~~	~~**12/128**~~
	4	**36**	**40/128**
K	2	6	**8/128**

4.26

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

In considering the increase in heavy vehicles on Route 1, the updated average segment score is 78/320 and the average intersection score is 47/128, leading to a total updated Safe System score of **125/448**.

To allow Route 1 to be selected as the heavy vehicle route, it is likely that Council would need to consider the following actions:

- Review the proposed intersection design at Tincogan Street and Dalley Street to allow for the swept paths of a 19m semi-trailer
- Alter the existing intersection of Burringbar Street / Dalley Street to cater for 19m semi-trailer swept paths
- Reconsider the locations of marked pedestrian crossings and on-street bicycle lanes
- Reconsider the 30km/h speed zone and 'Movement and Place' function of Burringbar Street.

Route 2

The critical road segments impacted by a higher percentage of heavy vehicles on Route 2 are Segments 3, 4 and 13. The critical intersections impacted by a higher percentage of heavy vehicles on Route 2 are Intersections D, H and K. The re-assessment of these road segments and intersections are shown below, where existing condition scores are denoted by strikethrough text (~~example~~), and future updated scores are denoted by bold text (**example**).

Table 35 Assessment of Future Road Segments based on Route 2 as the Heavy Vehicle Route

Road Segment	ROR	HO	O	C	MC	Total
13	~~32~~	~~18~~	~~18~~	~~24~~	~~27~~	~~**119/320**~~
	32	**18**	**18**	**32**	**27**	**127/320**
11	18	12	12	32	18	**92/320**
7	24	8	8	12	27	**79/320**
14	27	18	18	6	9	**78/320**
2	27	12	12	9	18	**78/320**
4	~~12~~	~~18~~	~~6~~	~~12~~	~~9~~	~~**57/320**~~
	12	**18**	**6**	**12**	**18**	**66/320**
10	16	8	8	12	12	**56/320**
6	12	2	6	12	18	**50/320**
1	9	12	6	0	18	**45/320**
5	4	2	6	12	18	**42/320**
3	~~4~~	~~4~~	~~6~~	~~9~~	~~6~~	~~**29/320**~~
	12	**12**	**18**	**12**	**18**	**72/320**
8	3	3	6	9	6	**27/320**
9	3	3	6	9	6	**27/320**
12	2	2	4	12	3	**23/320**

4.27

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 36 Assessment of Future Intersections based on Route 2 as the Heavy Vehicle Route

Intersection	INT	PED	Total
A	16	32	**48/128**
B	12	36	**48/128**
C	12	36	**48/128**
I	24	24	**48/128**
D	~~12~~	~~32~~	~~**44/128**~~
	12	**48**	**60/128**
F	12	32	**44/128**
J	12	24	**36/128**
E	12	18	**30/128**
G	8	16	**24/128**
H	~~**4**~~	~~**8**~~	~~**12/128**~~
	4	**36**	**40/128**
K	~~2~~	~~6~~	~~**8/128**~~
	2	**9**	**11/128**

In considering the increase in heavy vehicles on Route 2, the updated average segment score is 75/320 and the average intersection score is 41/128, leading to a total updated Safe System score of **116/448**.

To allow Route 2 to be selected as the heavy vehicle route, it is likely that Council would need to consider the following actions:

- Review the need for the proposed pedestrian crossing on Tincogan Street (a Safe System objective is to remove exposure between pedestrians and heavy vehicles)
- Review the need for the proposed refuge island on Station Street South (a Safe System objective is to remove exposure between pedestrians and heavy vehicles)
- Potential land acquisition at the intersection of Tincogan Street / Station Street to allow for the swept paths of a 19m semi-trailer
- Widen the intersection of Fern Street / Station Street to cater for 19m semi-trailer swept paths
- Reconsider the need for a marked pedestrian crossing in Station Street just south of Burringbar Street
- Tincogan Street to have the major road priority through Dalley Street and Stuart Street.

Route 3

The critical road segments impacted by a higher percentage of heavy vehicles on Route 3 are Segments 3, 6, 9 and 12. The critical intersections impacted by a higher percentage of heavy vehicles on Route 3 are Intersections G, H and J. The re-assessment of these road segments and intersections are shown below, where existing condition scores are denoted by strikethrough text (~~example~~), and future updated scores are denoted by bold text (**example**).

4.28

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Table 37 Assessment of Future Road Segments based on Route 3 as the Heavy Vehicle Route

Road Segment	ROR	HO	O	C	MC	Total
13	32	18	18	24	27	**119/320**
11	18	12	12	32	18	**92/320**
7	24	8	8	12	27	**79/320**
14	27	18	18	6	9	**78/320**
2	27	12	12	9	18	**78/320**
4	12	18	6	12	9	**57/320**
10	16	8	8	12	12	**56/320**
6	~~12~~	~~2~~	~~6~~	~~12~~	~~18~~	~~**50/320**~~
	12	**4**	**12**	**32**	**27**	**87/320**
1	9	12	6	0	18	**45/320**
5	4	2	6	12	18	**42/320**
3	~~4~~	~~4~~	~~6~~	~~9~~	~~6~~	~~**29/320**~~
	12	**12**	**18**	**12**	**18**	**72/320**
8	3	3	6	9	6	**27/320**
9	~~3~~	~~3~~	~~6~~	~~9~~	~~6~~	~~**27/320**~~
	6	**6**	**12**	**48**	**18**	**90/320**
12	~~2~~	~~2~~	~~4~~	~~12~~	~~3~~	~~**23/320**~~
	4	**4**	**8**	**32**	**18**	**66/320**

Table 38 Assessment of Future Intersections based on Route 3 as the Heavy Vehicle Route

Intersection	INT	PED	Total
A	16	32	**48/128**
B	12	36	**48/128**
C	12	36	**48/128**
I	24	24	**48/128**
D	12	32	**44/128**
F	12	32	**44/128**
J	~~12~~	~~24~~	~~**36/128**~~
	18	**24**	**42/128**
E	12	18	**30/128**
G	~~8~~	~~16~~	~~**24/128**~~
	8	**48**	**56/128**
H	~~4~~	~~8~~	~~**12/128**~~
	4	**36**	**40/128**

4.29

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

K	2	6	**8/128**

In considering the increase in heavy vehicles on Route 3, the updated average segment score is 72/320 and the average intersection score is 45/128, leading to a total updated Safe System score of **117/448**.

To allow Route 3 to be selected as the heavy vehicle route, it is likely that Council would need to consider the following actions:

- Review the proposed intersection design at Tincogan Street and Stuart Street to allow for the swept paths of a 19m semi-trailer
- Review the need for the proposed pedestrian crossing on Tincogan Street (a Safe System objective is to remove exposure between pedestrians and heavy vehicles)
- Review the proposed intersection design at Fern Street and Stuart Street to allow for the swept paths of a 19m semi-trailer
- Alter the existing intersection of Burringbar Street / Stuart Street to cater for 19m semi-trailer swept path
- Reconsider the locations of marked pedestrian crossings and on-street bicycle lanes
- Reconsider the 30km/h speed zone and 'Movement and Place' function of Burringbar Street and Stuart Street
- Tincogan Street to have the major road priority through Dalley Street.

Route 4

The critical road segments impacted by a higher percentage of heavy vehicles on Route 4 are Segments 7, 8 and 9. The critical intersections impacted by a higher percentage of heavy vehicles on Route 4 are Intersections F, G and H. The re-assessment of these road segments and intersections are shown below, where existing condition scores are denoted by strikethrough text (~~example~~), and future updated scores are denoted by bold text (**example**).

Table 39 Assessment of Future Road Segments based on Route 4 as the Heavy Vehicle Route

Road Segment	ROR	HO	O	C	MC	Total
13	32	18	18	24	27	**119/320**
11	18	12	12	32	18	**92/320**
7	~~24~~	~~8~~	~~8~~	~~12~~	~~27~~	~~**79/320**~~
	24	**8**	**8**	**16**	**27**	**83/320**
14	27	18	18	6	9	**78/320**
2	27	12	12	9	18	**78/320**
4	12	18	6	12	9	**57/320**
10	16	8	8	12	12	**56/320**
6	12	2	6	12	18	**50/320**
1	9	12	6	0	18	**45/320**

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

5	4	2	6	12	18	**42/320**
3	4	4	6	9	6	**29/320**
8	~~3~~	~~3~~	~~6~~	~~9~~	~~6~~	~~**27/320**~~
	6	**6**	**12**	**48**	**18**	**90/320**
9	~~3~~	~~3~~	~~6~~	~~9~~	~~6~~	~~**27/320**~~
	6	**6**	**12**	**48**	**18**	**90/320**
12	2	2	4	12	3	**23/320**

Table 40 Assessment of Future Intersections based on Route 4 as the Heavy Vehicle Route

Intersection	INT	PED	Total
A	16	32	**48/128**
B	12	36	**48/128**
C	12	36	**48/128**
I	24	24	**48/128**
D	12	32	**44/128**
F	~~12~~	~~32~~	~~**44/128**~~
	12	**48**	**60/128**
J	12	24	**36/128**
E	12	18	**30/128**
G	~~8~~	~~16~~	~~**24/128**~~
	8	**48**	**56/128**
H	~~4~~	~~8~~	~~**12/128**~~
	4	**36**	**40/128**
K	2	6	**8/128**

In considering the increase in heavy vehicles on Route 4, the updated average segment score is 76/320 and the average intersection score is 47/128, leading to a total updated Safe System score of **123/448**.

To allow Route 4 to be selected as the heavy vehicle route, it is likely that Council would need to consider the following actions:

- Alter the existing intersection of Tincogan Street / Brunswick Terrace to cater for 19m semi-trailer swept paths
- Alter the existing intersection of Burringbar Street / Dalley Street to cater for 19m semi-trailer swept paths
- Alter the 90-degree horizontal curve on Brunswick Terrace to cater for 19m semi-trailer swept paths
- Widen the road width, pavement resurfacing and linemarking in Brunswick Terrace & Burringbar Street
- Reconsider the locations of marked pedestrian crossings and on-street bicycle lanes
- Reconsider the 30km/h speed zone and ‘Movement and Place’ function of Burringbar Street.

4.31

MULLUMBIMBY TRAFFIC INVESTIGATIONS – SAFE SYSTEM ASSESSMENT

Assessment of Heavy Vehicle Route Options

Heavy Vehicle Route Summary

A summary of the updated Safe System scores is provided below based on each route becoming the heavy vehicle route. The existing condition scores are denoted by strikethrough text (~~example~~), and the updated scores are denoted by bold text (**example**).

Table 41 Heavy Vehicle Route Summary

Route	Road Segments	Average Segment Score	Intersections	Average Intersection Score	Total
1	1, 2, 5, 8, 9, 10, 11, 14	~~56/320~~	A, B, E, F, G, H, I	~~36/128~~	~~92/448~~
		78/320		**47/128**	**125/448**
2	1, 2, 3, 4, 10, 13, 14	~~66/320~~	A, B, C, D, E, H, I, J, K	~~36/128~~	~~102/448~~
		75/320		**41/128**	**116/448**
3	1, 2, 3, 6, 9, 10, 12, 14	~~48/320~~	A, B, C, E, G, H, I, J	~~37/128~~	~~85/448~~
		72/320		**45/128**	**117/448**
4	1, 7, 8, 9, 10, 11, 14	~~58/320~~	A, E, F, G, H, I	~~34/128~~	~~92/448~~
		76/320		**47/128**	**123/448**

The results show that Route 2 is the favoured heavy vehicle route. This route is supported as it redirects heavy vehicles away from the pedestrian and cyclist-friendly town centre (i.e., Burringbar Street and Stuart Street).

5.0 CONCLUSION

This Safe System Assessment has shown that Route 3 currently shows the best alignment with Safe System objectives, in considering the exposure, likelihood and severity of different accident types, as well as the safety of pedestrians, cyclists and motorcyclists. However, when the increase in heavy vehicles is considered, Route 2 is the favoured heavy vehicle route due to the separation of heavy vehicles from places of high pedestrian and cyclist activity centred around Burringbar Street.

All potential heavy vehicle routes have key considerations that would likely need to be addressed before the heavy vehicle route could be formalised, ranging from intersection upgrades to reviews of particular road functions in terms of 'Movement and Place'.

The formalisation of any of the proposed heavy vehicle routes will add an element of risk to the safety of pedestrians, cyclists and motorcyclists. Eliminating heavy vehicle exposure to pedestrians, cyclists and motorcyclists is the best way to align with Safe System principles. However, the heavy vehicle route must be able to cater for the intersection swept paths of the largest design vehicle, or else the risk of intersection-type accidents is significantly increased.

APPENDIX D

PAVEMENT CONDITIONS ASSESSMENT

Cardno now Stantec

1.1 Pavement Conditions

Pavement condition was assessed in accordance with the videos, site visit notes and Google maps views. In some locations Google maps images were outdated. At these roads, site visit notes, photos and videos were considered.

The terminology used to describe defects and potential treatments is consistent with that used in Austroads Guide to Pavement Technology Part 5 Pavement Evaluation and Treatment Design (AGPT05-19).

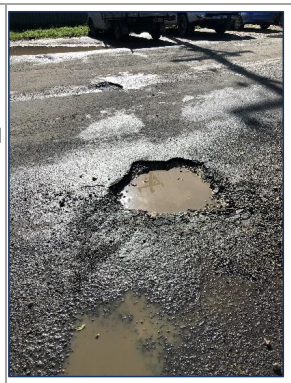
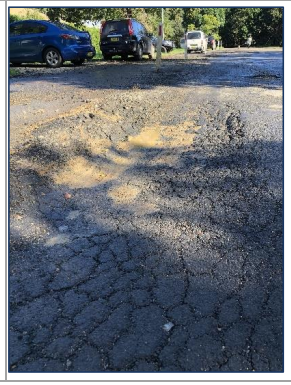
The road alignments assessed are presented in Figure 1-1.

Details of the pavement assessments are presented in Table 1-1.

Figure 1-1 Pavement assessment – Assessed streets

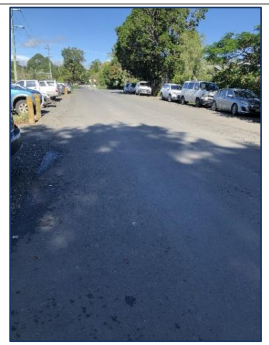
Table 1-1 Pavement Assessments

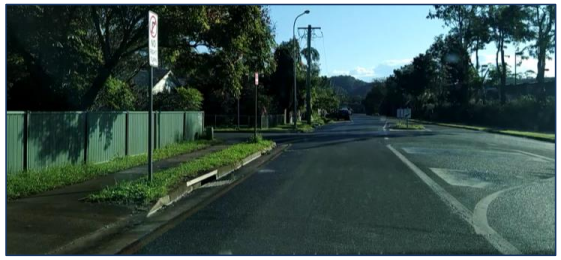
Road	Condition	Comment	Photo	Recommendations
Tincogan St - West	Good	Some longitudinal cracking Crocodile cracking and ravelling on the pavement edges No kerb and gutter on the pavement edges.	 	Longitudinal cracks should be sealed to ensure no water ingress into the existing pavement. Upon review of pavement design and as built drawings, consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage of overall road alignment, shoulder sealing and repair of edge breaks and crocodile cracking.
Tincogan St - East	Good	Edge Break was observed at Stuart Street intersection Some longitudinal cracking was observed No kerb and gutter present for majority of section.		Longitudinal cracks should be sealed to ensure no water ingress into the existing pavement. Upon review of pavement design and as built drawings, consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage of overall road alignment, shoulder sealing and repair of edge breaks.

Brunswick Terrace	Poor	Multiple potholes, various cracking including some minor crocodile cracking, edge break, deformed surface.		Mill and reinstate pothole and crocodile cracking locations. Visible meandering cracks should be sealed. Consideration should be given to installation of kerb and gutter and subsoil drainage to improve the drainage on over all road alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine structural rehabilitation requirements.
River Terrace	Very Poor	Severe successive Potholes (>1m wide), uneven road surface, extensive crocodile cracking and shoving, and transverse cracking		It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine suitable pavement rehabilitation or reconstruction options.

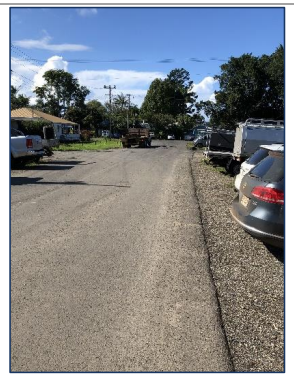
Dalley Street – North	Fair	Some crocodile cracking and potholes (remediated) visible. Block cracking observed. Crocodile cracking, meandering cracking was observed at intersections: Dalley St & Burringbar St,	  	Mill and reinstate pothole and crocodile cracking locations. Visible cracks should be sealed. Consideration should be given to subsoil drainage (if not present) to improve the drainage on over all road alignment. Extensive crocodile cracking was observed on several locations. Consideration should be given to structural rehabilitation of these sections of the alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine pavement rehabilitation / resurfacing options.

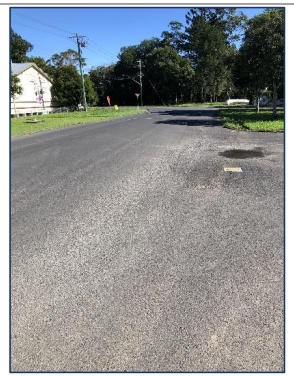
				
Dalley Street – South	Fair	Observed to be in good condition in general Crocodile cracking, block cracking and longitudinal cracking observed at Whian Street intersection.		Visible transverse and longitudinal cracks should be sealed. Consideration should be given to subsoil drainage (if not present) to improve the drainage on over all road alignment. Extensive crocodile cracking was observed on several locations. Consideration should be given to structural rehabilitation of these sections of the alignment. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine pavement rehabilitation / resurfacing options
Burringbar St East and West	Fair	Some crocodile cracking and longitudinal cracking observed. Some minor transverse cracking observed. Textured surface.		Mill and reinstate crocodile cracking locations. Visible cracks should be sealed. Review pavement history to determine surfacing age and need for resurfacing.

				
Stuart St	Good	Minor longitudinal cracking and minor stripping of asphalt was observed. Top layer of asphalt beginning to ravel in some sections. Rubbish and vegetation on road.	 	Sealing of longitudinal cracks and continued monitoring of Stuart Street can be undertaken. Review pavement history to determine surfacing age and need for resurfacing. Mill and reinstate asphalt wearing course to remediate the ravelling of asphalt.

Station St (North of Roundabout)	Very Good	Crocodile cracking observed at the entry and exit of roundabout. Recently repaved, smooth pavement. Minor longitudinal cracking observed.	  	Mill and reinstate crocodile cracking locations. Visible cracks should be sealed. Asphalt thickness to be designed for up to 20 year traffic loading.

Station St (South of Roundabout)	Poor	Some remediated potholes, patching, crocodile cracking and ravelling was observed. No kerb and gutter was observed.	   	It is recommended to structurally rehabilitate one lane along Station street. Where crocodile cracking is observed on the right hand lane, mill and reinstation of pavement should be undertaken. It is recommended to undertake a detailed pavement investigation including intrusive investigation to determine rehabilitation design options.

Whian St	Very Good	Some longitudinal cracking (minor). Even surface, dirty markings from truck. No kerb and gutter were observed.	 	Consideration should be given to installation of kerb and gutter and subsoil drainage, and sealing of shoulders to improve the drainage of overall road alignment. Visible cracks should be sealed. Review pavement history to determine surfacing age and need for resurfacing.

Fern St	Good	Depression at one location was observed. Rare small longitudinal cracking was observed. Dirt wheel tracks being embedded into asphalt. No kerb and gutter.	  	Consideration should be given to installation of kerb and gutter, subsoil drainage and sealing of shoulders to improve the drainage of overall road alignment. Visible cracks should be sealed.

Report No. 6.8 Station Street, Bangalow - Accessible Parking Space

File No: I2022/1637

5 The purpose of this report is to obtain Local Traffic Committee endorsement for the provision of an accessible parking space in Station Street, Bangalow.

The location for the space was identified by a local community group and is situated adjacent the Bangalow RSL club. There is limited opportunity in the centre of town to provide an accessible parking space due to various geometric issues.

10 This space will be provided in conjunction with a footpath link from the existing ramp to the path to the south (2m minimum).

Figure 1: Signs plan accessible parking space Station St, Bangalow

Figure 2: Locality map

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5 **RECOMMENDATION:**

That the Local traffic Committee support the provision for an accessible parking space adjacent 19 Station Street, Bangalow.