traffic + transport

Transport Assessment

West Orange Residential Planning Proposal

for

Landorange Partnership

Document Control

Project No: 0380

Project: West Orange Residential Planning Proposal

Client: Landorange Partnership

File Reference: P0380r1v5 West Orange Residential Planning Proposal Transport Assessment

Revision History

Revision	Date	Details	Approved by
v1	17/03/2023	Draft 1	A. Reisch
v2	17/04/2023	Final 1	A. Reisch
v3	14/11/2023	Final 2	A. Reisch
v4	15/11/2023	Final 3	A. Reisch
v5	17/11/2023	Final 4	A. Reisch

Table of Contents

1 Introduction

1.1 Overview

arc traffic + transport has been engaged by Landorange Partnership to prepare a Transport Assessment (**TA**) relating to a proposed residential subdivision (the **Proposal**) on land at 277 Cargo Road, Orange (the **Site**). The Proposal provides:

- Approximately 72 low density residential lots;
- New internal road and pedestrian infrastructure; and
- A new access intersection to Cargo Road, and connections to existing local roads to the east of the Site.

Full details of the Proposal are provided in the broader **Planning Proposal** documentation to be submitted to City of Orange Council (**Council**) and in turn the NSW Department of Planning & Environment (**DP&E**) to be assessed through the Gateway process.

It is noted from the outset that the Site sits within a broader parcel of land that is referred to as the Witton Place Candidate Area (**WPCA**) in the Orange Local Housing Strategy 2022 (the **Housing Strategy**). The WPCA is also anticipated to be rezoned (further to appropriate assessment and approvals) for low density residential lots; it is estimated that an additional 105 lots could be provided in the WPCA, for a total of approximately 177 lots.

While the TA focuses on the Site itself, the development of the broader WPCA has necessarily been considered, particularly in regard to future trip generation and the operation of key intersections to Cargo Road.

1.2 Transport for NSW and Council Requests for Additional Information

arc traffic + transport prepared an earlier version of the TA dated 17/04/2023 which was submitted with the Planning Proposal to Council, who in turn referred it to Transport for NSW (**TfNSW**) for review, further to which they provided correspondence to Council requesting additional information in regard to some of the issues addressed in the TA. This correspondence, dated 1/11/2023 (the **TfNSW RFI**) relates to the following transport issues:

- The distribution of future Site and WPCA trips to the intersection which will be available at Cargo Road, including a new intersection (**Road 1**) and the existing Cargo Road & Witton Place intersection, and specifically the assignment of Site (and WPCA) trips at these intersections;
- Confirmation of the number of new intersections to Cargo Road from the Site/WPCA;
- Confirmation of the Site's trip generation;
- The provision of appropriate sight distance at the proposed intersection of Cargo Road & Road 1; and

- The design of the intersection of Cargo Road & Road 1 with reference to Austroads warrants.

These issues were specifically addressed in a revised TA 15/11/2023. However, correspondence was subsequently received from Council in 16/11/2023 (**Council RFI**) requesting further clarification of a reference in Section 2.2.3 to the Site generating 5 vehicle trips per hour (**vph**); and a further revised distribution scenario to the Road 1 and Witton Place intersections with Cargo Road from that identified in the TfNSW RFI.

While a revised distribution profile in accordance with the Council RFI has been assessed, from the outset arc traffic + transport wishes to address the reference to 5vph in Section 2.2.3. Both the TfNSW RFI and Council RFI appear to have interpreted these 5vph as being the future trip generation of the Site (further to the Proposal); this is not correct. Rather, Section 2.2.3 relates to the **existing characteristics** of the Site which – based on small number of existing Site dwellings – is estimated to **currently generate approximately 5vph**.

Moreover of course, and as noted in the TfNSW RFI, the assessment of the **future characteristics** of the Site and WPCA provided in Section 5 appropriate considers the much higher generation of the Site further to the Proposal, based on what the TfNSW RFI identifies as *fair and reasonable* [trip generation] *estimates.*

We trust that this information has appropriately resolved this misunderstanding.

1.3 Transport Assessment Tasks

The TA provides an assessment of the relevant access and traffic characteristics of the Proposal; this has included consideration of the following:

- Existing and future base traffic conditions in the local road network providing for the Site;
- Existing and future public and active transport services and infrastructure;
- The future vehicle trip generation and distribution of the Site (and WPCA), and the potential impact of those trips on the local road network and key intersections;
- Pedestrian and cycle connectivity within the Site and to external active transport infrastructure;
- The provision of bus capable roads, and potential bus routes, within and through the Site;
- The proposed intersection of the Site and Cargo Road with reference to the applicable road design guidelines; and
- The proposed internal road network with reference to the applicable road design guidelines.

1.4 Reference Documents

1.4.1 Planning Controls and Strategies

As discussed, the Site lies within the Orange Local Government Area (**LGA**); key Council planning and strategic documents referenced in the preparation of this TA include:

- Orange Development Control 2004 (the **DCP**);

- Orange Local Environmental Plan 2011 (the **LEP**);
- Orange Local Strategic Planning Statement, 2020 (the **LSPS**);
- Orange Local Housing Strategy, 2022 (the **Housing Strategy**);
- Orange Sustainable Settlement Strategy, 2004 (**Settlement Strategy 2004**);
- Orange Sustainable Settlement Strategy, 2010 (**Settlement Strategy 2010**);
- Orange Community Strategic Plan, 2021 (the **Strategic Plan**);
- Orange Active Travel Plan, 2016 (the **Active Plan**); and
- Orange FutureCity Planning & Design Framework, 2020 (**FutureCity Framework**).

1.4.2 Traffic and Transport Guidelines

This TA also references general traffic and transport guidelines, including:

- Guide to Traffic Generating Developments 2002, Roads & Traffic Authority (**RTA Guide**);
- Guide to Traffic Generating Developments – Updated Traffic Surveys 2013, Roads & Maritime (**RMS Guide**);
- Transport for NSW (**TfNSW**) Guidelines for Public Transport Capable Infrastructure in Greenfield Sites, 2018 (**Bus Guidelines**);
- Austroads Guide to Road Design Part 3: Geometric Design (**Austroads GRD Part 3**);
- Austroads Guide to Road Design Part 4: Intersections & Crossings General (**Austroads GRD Part 4**);
- Austroads Guide to Road Design Part 4A: Unsignalised & Signalised Intersections (**Austroads GRD Part 4A**);
- Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossing Management (**Austroads GTM Part 6**);
- Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments; and
- Transport for NSW (**TfNSW**) Guide to Transport Impact Assessments.

1.5 Consultation

arc traffic + transport has had the opportunity to discuss the Proposal with both Council and TfNSW officers, particularly in regard to existing and future local conditions and the appropriate scope of work provided in this TA.

Council officers have also provided information in regard to other developments in the vicinity of the Site with the potential to generate traffic to the key roads and intersections providing access for the Site; and data from Council's Strategic Traffic Model (the **Orange STM**) which provides forecasts of future traffic volumes.

arc traffic + transport wishes to acknowledge the assistance and insights provided by these officers, including the additional issues identified in the TfNSW RFI and Council RFI.

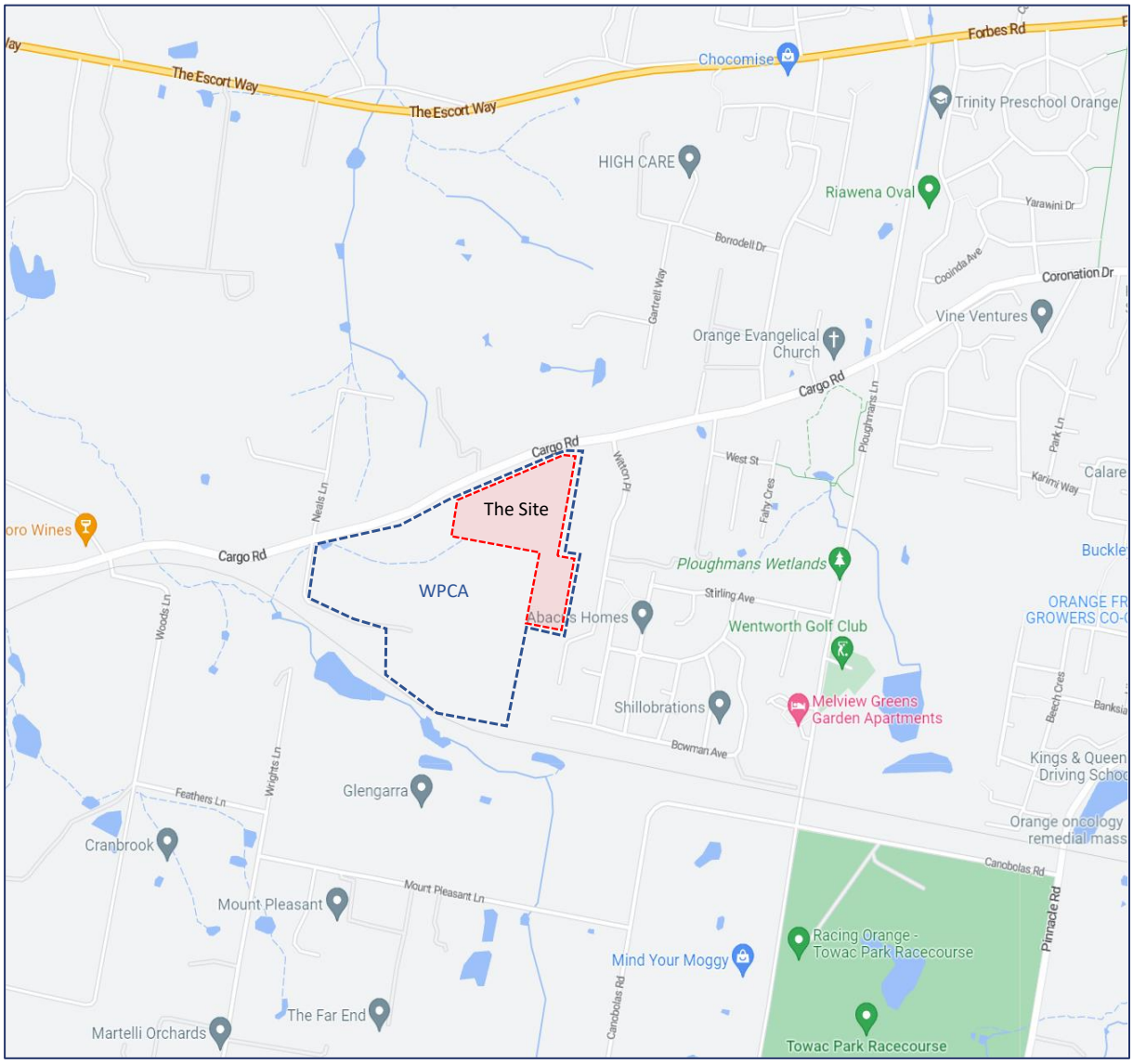
2 Existing Conditions

2.1 Site Location

The Site is officially referenced as Lot A in Deposited Plan 408148, with a street address of 277 Cargo Road, Orange. The Site is generally bordered by Cargo Road to the north, the railway corridor to the south, Witton Place (and existing residential areas) to the east, and pastureland and rural residential properties to the west. As discussed, the Site forms the upper part of the WPCA.

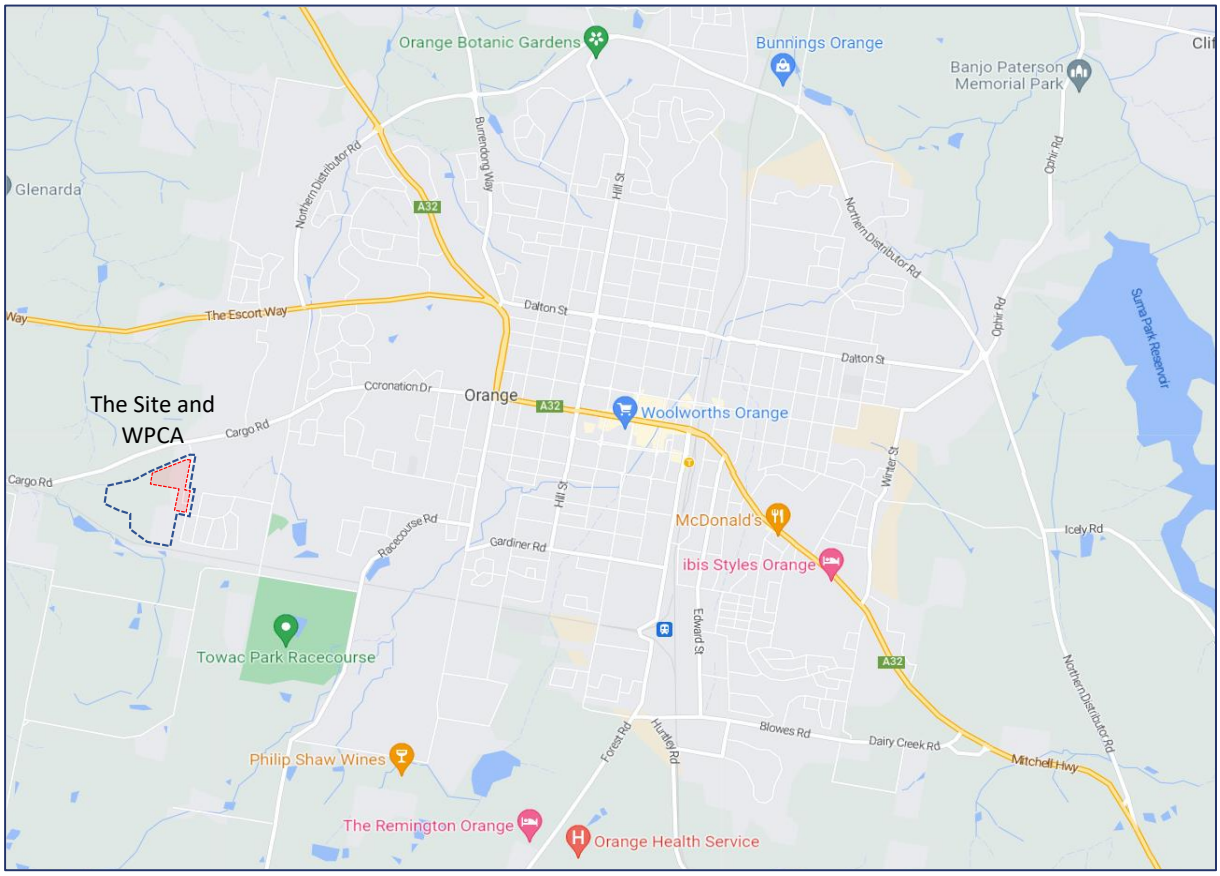
The Site has an area of approximately 11.02 hectares, and is shown in its local context in Figure 1, and broader context within the Orange LGA in Figure 2.

Figure 1: Site Location Local Context



Source: Google

Figure 2: Site Location Sub-Regional Context



Source: Google

2.2 Current Site Characteristics

2.2.1 Site Use

The Site is currently occupied by a number of rural residential properties and pastureland.

2.2.2 Site Access

WPCA access is currently provided via minor rural driveways to Cargo Road, Witton Place and Neals Lane. It is noted from the outset that – in accordance with the Housing Strategy – vehicle access to the Site (and WPCA) will not be provided via Neals Lane (see also Section 3.1), while in the first instance (i.e. further to the development of the Site only) all access will be via Cargo Road.

2.2.3 Trip Generation

With reference to the regional residential trip rates provide in the RMS Guide – being 0.78 and 0.71 trips per dwelling in the AM and PM peak hours respectively - the residential dwellings on the Site would generate no more than 5vph in the peak periods, stressing again that this is the current trip generation of the existing Site dwellings, not a forecast of the future trip generation of the Site further to the Proposal. This level of trip generation would have no impact on the operation of the local road network.

3 Planning Strategies and Controls

3.1 Orange Local Housing Strategy

3.1.1 Overview

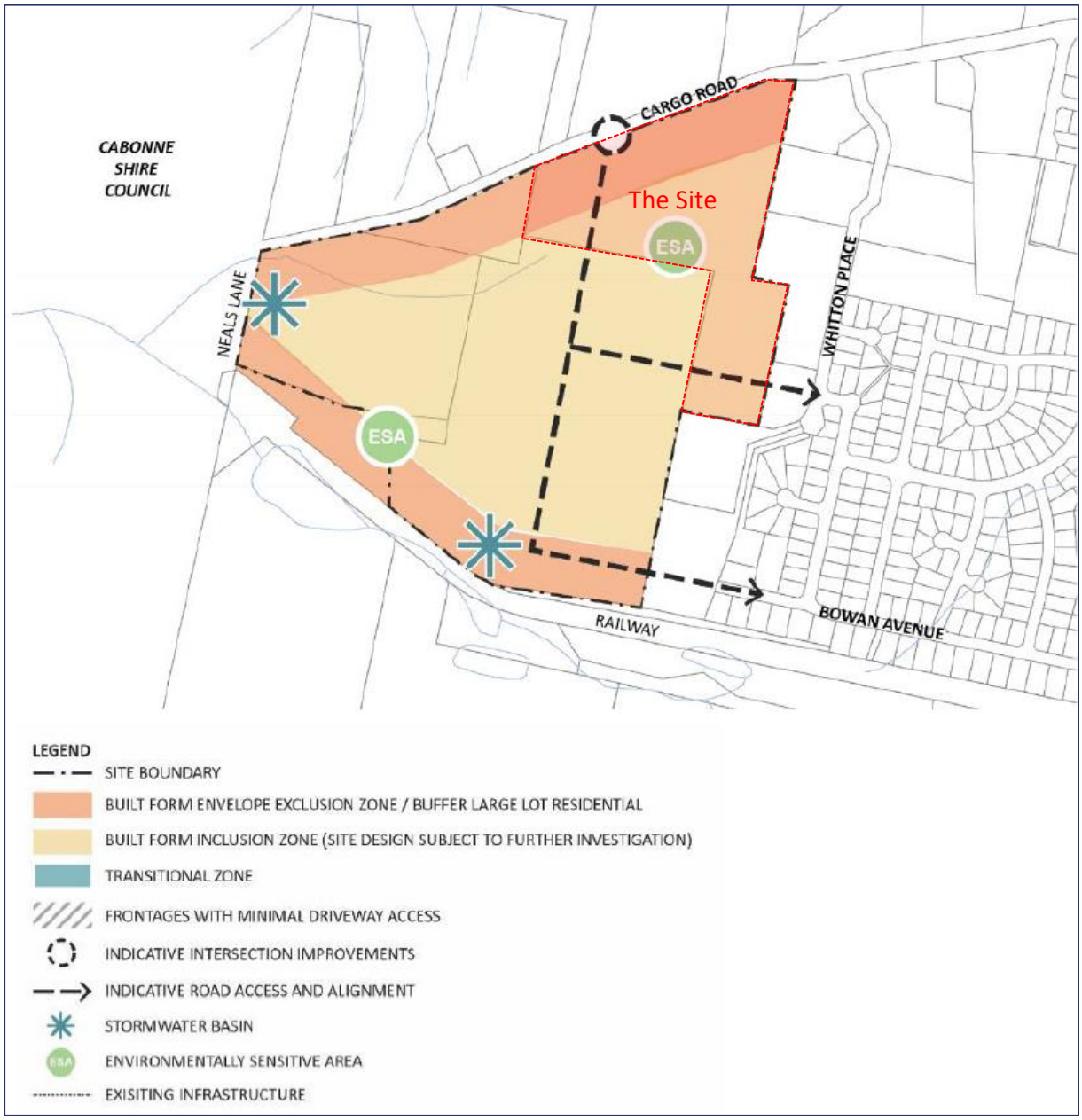
The Housing Strategy was finalised in July 2022, and provides guidance for Council and the private sector in regard to the ongoing delivery of residential dwellings across the LGA, generally matching the need for new dwellings as the population increases with essential consideration of housing diversity; the need to provide infrastructure to new urban release areas; and the need to properly account for environmental constraints.

3.1.2 The Witton Place Candidate Area

The Site lies within what the Housing Strategy identifies as the WPCA, which is generally bordered by Cargo Road to the north, the railway to the south, Witton Place to the east and Neals Lane and rural residential properties to the west.

The WPCA is shown in the figure to Section 8.4.1.2 of the Housing Strategy, which is reproduced below.

Figure 3: Witton Place Candidate Area



Source: Housing Strategy

3.1.3 Housing Strategy Preliminary Assessment of the Witton Place Candidate Area

In the preliminary assessment of the suitability of the WPCA for new residential development, the Housing Strategy examined a range of key considerations for any new development, including items such as heritage, stormwater drainage, biodiversity and the interface with adjoining developments.

With regard to transport, the Housing Strategy specifically determined that a *Traffic Impact Assessment* would be required to accompany any future application so as to ensure that sites within the WPCA could be provided with appropriate internal and interface road network access.

In addition, the Housing Strategy identifies the key considerations/assessment tasks for any such assessment; these include:

- *Minimal access off Cargo Road will be permitted*
- *Any connection to Neals Lane is to be limited to pedestrian / cyclist use only and not allow direct vehicular access to Neals Lane*
- *Internal road networks to extend off Whitton* [sic] *Place to the east and Bowmans Avenue to the south east*
- *Impacts on Whitton Place, Bowmans Avenue and Cargo Road resulting from the increase in traffic volumes*

In addition, the Housing Strategy identifies key traffic and transport infrastructure anticipated to be incorporated into a future WPCA [site-specific] DCP, providing the following in regard to *Transport and Movement Hierarchy/Roads*:

- *Design to avoid road connections westwards to Neals Lane, pedestrian and cyclist linkage only.*
- *Direct access to Cargo Road (maximum two intersections), design and location of intersections to be informed by traffic study.*
- *New intersection off Whitton* [sic] *Place / Taloumbi Place*
  - *Note Lot 1 DP 1217170 is situated between the URA and western end of Taloumbi Place. The strategy supports extending Taloumbi Place through this lot to form a connection to the URA proper. Alternatively the southern end of Lot 6 DP 1045677 could be considered where it aligns with Wirringulla Place.*
- *Additional eastern connection to Bowman Avenue*
  - *Note: Lot 10 DP 1045677 is situated between the URA and the western extent of Bowman Avenue. The strategy supports extending Bowman Avenue through this lot to form a connection to the URA proper*.
- *Upgrade of Cargo Road along the extent of release area frontage, design to be informed by traffic study*
- *Upgrade of Witton Place, design to be informed by traffic study*
- *Upgrade Witton Place / Cargo Road intersection and Neals Lane Intersection, design to be informed by traffic study*
- *Extension of Bowman Avenue to provide connectivity to Witton release area, traffic study to model anticipated traffic volumes through Bowman Avenue to Ploughmans Lane*

In accordance with the Housing Strategy, these considerations/assessment tasks have all been detailed in this TA.

3.2 Additional Council Plans and Strategies

3.2.1 Orange Community Strategic Plan 2018-2028

The Community Plan provides a 10-year vision for the LGA and a series of supporting long-term strategic goals, outcomes, activities and measures. With specific regard to housing, the vision includes a healthy, safe, inclusive and vibrant community balancing the need for growth with due consideration of natural, cultural and historical considerations. The plan also focuses on providing the community with positive choices for investment, employment and study.

3.2.2 Orange Local Strategic Planning Statement 2020

The LSPS contains planning priorities and actions for a 20 year vision for the Orange LGA outlining how growth and change will be managed into the future. Planning priorities specifically relevant to the Proposal include:

- Supporting the development of new homes in residential release areas in West Orange, and increasing the range of housing options in existing urban areas.
- Locating new growth areas with appropriate access to essential services; and
- Ensuring that building design and construction is of a high quality, and maintains residential amenity.

With specific regard to transport, the LSPS provides the following:

> *Traditionally developments are designed to cater for private vehicles with parking requirements being the main focus. Alternative modes of transport include walking, cycling, public transport and ride-share services, all of which are more ecologically sustainable and reduce emissions.*
>
> *Additionally active transport has health benefits and is more readily available to people with limited incomes.*
>
> *Increased density, in appropriate locations, results in a greater local population that may sustain shops and services within a walking distance catchment, negating the need for private transport.*
>
> *Additionally private vehicle ownership forms a significant component of most household budgets. Studies overseas have shown that cyclists spend more money per capita in their local economies, increasing the amount of money in local circulation compared to motorists (given that at least the capital cost of the vehicle leaves the local economy).*
>
> *Council will therefore seek to promote alternative active modes of transport by reviewing development controls so that the built form of the city becomes more accessible over time.*

Pedestrian and cyclist facilities will be elevated in status to match that of other modes of transport and access requirements of all residents, including those with physical or cultural impairment, are given proper consideration.

Further, and again with specific reference to the Proposal, some of the key action items detailed in the LSPS include:

- Requiring new residential subdivisions to include footpaths and pedestrian friendly layouts by minimising path gradients and maximising permeability with mid-block connections.
- Continuous reviews and (where appropriate) updates to Council's broader cycling and pedestrian strategies; and
- Investigating and promoting innovative transport solutions to service schools and other public and community facilities.

3.2.3 Orange FutureCity – Planning and Design Framework

The FutureCity Framework sets out the broad vision and aims for the future of the City to be delivered over the long term through major projects and initiatives, as well as detailed directions to provide more certainty for developers and the broader community.

With specific reference to the Proposal, the FutureCity Framework aims to promote diversity of housing stock, and to create vibrant community environments. These objectives include attracting more people into the City by broadening residential typology choice and reducing the reliance on car usage in favour of promoting active (and public) transport modes.

Notwithstanding that the Site lies outside of the City, the provision of high quality residential dwellings (within the Site and WPCA) allows the City itself to provide a more diverse range of dwelling types, including more high and medium density dwellings - so that a full range of dwelling types will be available to future residents across the City and broader LGA.

3.2.4 Orange Development Control Plan 2004

The DCP provides development controls relating to residential, commercial, industrial and associated infrastructure development. There are also a number of site specific chapters to be considered in the assessment of development applications lodged with Council for particular locations, noting that in developing the Proposal particular consideration has been given to chapters of the DCP relating to new residential subdivision.

Notwithstanding, and as discussed in the Housing Strategy, it is anticipated that a new Site/WPCA-specific DCP (or additional chapter to the existing DCP) will be prepared to govern the development of these new growth areas.

4 Existing Local Conditions

4.1 Key Roads

4.1.1 Cargo Road

Cargo Road is a classified road that runs south-west from central Orange to Cargo and then south to Canowindra. In the vicinity of the Site, it provides 1 traffic lane in each direction and sealed and unsealed verges, and has a posted speed limit of 60km/h (in the vicinity of Witton Place) that then transitions to 80km/h east of Neals Lane.

It is noted that Cargo Road was upgraded in 2019 along the frontage of the Site.

4.1.2 Coronation Drive

Coronation Drive is a classified road that forms an eastern extension of Cargo Road between Ploughmans Lane and the roundabout intersection with Woodward Street & Summer Street (both of which form part of Mitchell Highway). Coronation Drive provides 1 wide traffic lane in each direction, on-street parking and bus stops in kerbside lanes, and has a posted speed limit of 60km/h.

4.1.3 Witton Place

Witton Place is a local road that runs north-south between Cargo Road and a terminus north of Bowman Avenue. It provides 1 traffic lane in each direction, on-street parking and bus stops in kerbside lanes, and has a posted speed limit of 50km/h.

4.1.4 Taloumbi Place

Taloumbi Place is a local road that runs east and then south from Witton Place to Bowman Avenue, and provides access to other local roads providing access for the small residential precinct east of Witton Place. It provides 1 traffic lane in each direction, on-street parking and bus stops in kerbside lanes, and has a posted speed limit of 50km/h.

4.1.5 Neals Lane

Neals Lane is a minor access lane that runs south from Cargo Road, and provides access for a small number of rural residential properties. While Neals Lane nominally provides access to the WPCA, in accordance with the Housing Strategy no vehicle access will be provided between the WPCA and Neals Lane.

4.1.6 Other Local Roads

There are a number of local roads within the residential precinct east of the WPCA that provide access to the sub-regional network via Ploughmans Lane, with routes (from Witton Place) including Bowmans Avenue, Isaac Drive and Sterling Avenue. These local roads all provide 1 traffic lane in each direction and on-street parking.

arc traffic + transport notes that while the Housing Strategy requires an assessment of the future operation of Bowmans Avenue, there is little if any potential for trips generated by the Site (and WPCA) to use local routes to the east (including the local roads identified above) as they do not provide a more efficient route for the overwhelming majority of trips other than perhaps to the small number of destinations in Ploughmans Lane south of Cargo Road.

Rather, the future routes available from the Site (and WPCA) to Cargo Road directly or via Witton Place would be significantly more efficient to almost all destinations in Orange via the intersection of Coronation Drive & Woodward Street & Summer Street.

More details in regard to the potential trip generation of the Site and WPCA to these local roads is provided in Section 5.9.

4.2 Key Intersections

4.2.1 Cargo Road & Witton Place

This intersection operates under priority (Give Way) control, with priority to Cargo Road. It provides relatively significant auxiliary lane infrastructure given the very moderate traffic volumes in Witton Place, including:

- A Channelised Right (**CHR**) treatment, Cargo Road to Witton Road;
- An Auxiliary Left (**AUL**) treatment, Cargo Road to Witton Place; and
- A Basic Left (**BAL**) treatment, Witton Place to Cargo Road.

Based on our discussions with TfNSW, it is understood that the intersection was upgraded to provide this more extensive turn lane infrastructure as a function of sight distances to the intersection, noting that the traffic volumes currently generated to/from Witton Place would be unlikely to warrant (with reference to Austroads GTM Part 6) these higher order treatments.

A more detailed assessment of this intersection is provided in later sections of this TA.

4.2.2 Cargo Road & Neals Lane

This intersection operates under priority (Give Way) control, with priority to Cargo Road. It provides no significant auxiliary lane infrastructure, with the Neals Lane approaches (north and south) providing only simple BAL treatments.

Noting the Housing Strategy's requirement for a more detailed assessment of this intersection further to the development of the WPCA, it is the opinion of arc traffic + transport that the intersection would generally be unaffected by future development as a function of:

- The relatively minor traffic volumes in Cargo Road (see also Section 4.3);
- The very minor traffic volumes in Neals Lane both north and south of Cargo Road; and

- As discussed in Section 3.1.3, the Housing Strategy does not provide for WPCA vehicle access via Neals Lane, and as such there is little potential for traffic volumes in Neals Lane south of Cargo Road to increase.

4.2.3 Local Intersections

All local intersections in the residential areas east of Witton Place operate under basic Give Way control, or as 1 lane roundabouts. As previously discussed, the Site and WPCA are unlikely to generate any significant number of trips to these local intersections, which regardless provide significant spare capacity given the very minor traffic volumes that they accommodate.

4.3 Existing Traffic Volumes

4.3.1 Traffic Surveys

arc traffic + transport engaged Traffic Information Specialists to undertaken peak period intersection and classified (tube) counter surveys at key locations in the local road network to better inform the TA. The surveys were conducted in March 2023, and include:

- Peak period traffic volumes at the intersections of Cargo Road & Witton Place; and
- Classified counter (24/7) surveys in Cargo Place east of Witton Place, and in Witton Place south of Cargo Road.

The full survey data set is provided in Appendix A.

4.3.2 Existing Traffic Volumes

The peak hour traffic volumes at the intersection of Cargo Place & Witton Place and Witton Place & Taloumbi Place are shown in Figure 4, while Table 1 and Table 2 provide a summary of average daily traffic volumes in Cargo Road and Witton Place respectively.

Figure 4: 2023 Peak Hour Traffic Volumes

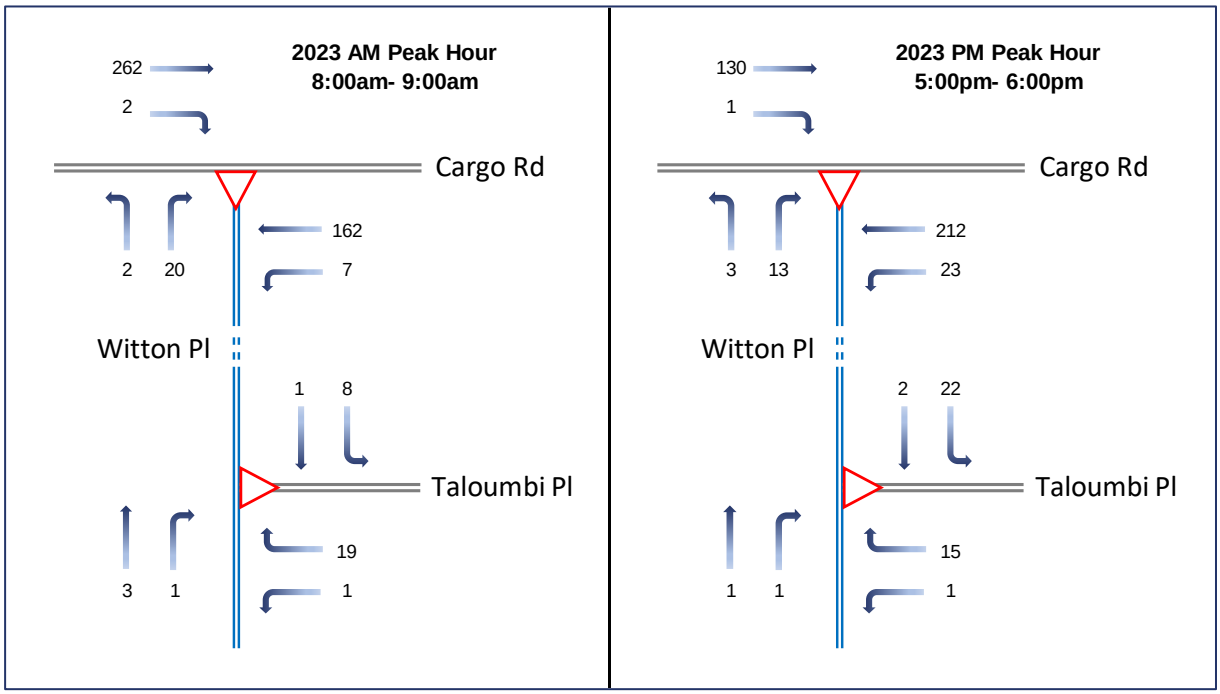


Table 1:Cargo Road Average Daily Traffic Volumes

Time	Mon		Tue		Wed		Thu		Fri		Sat		Sun		7 Day Total	
	6-Mar		7-Mar		1-Mar		2-Mar		3-Mar		4-Mar		5-Mar			
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
0:00	2	3	4	5	3	5	3	7	2	5	5	1	9	7	28	33
1:00	1	0	1	2	0	0	2	0	2	1	5	1	0	2	11	6
2:00	3	2	2	1	1	2	1	1	1	1	1	4	2	0	11	11
3:00	4	1	2	4	2	1	0	2	2	3	0	1	0	1	10	13
4:00	8	15	7	11	8	14	6	10	9	10	1	4	4	3	43	67
5:00	20	49	29	46	35	44	20	37	20	37	12	13	6	7	142	233
6:00	78	74	76	85	68	82	71	73	75	75	37	26	21	27	426	442
7:00	85	134	119	154	152	136	102	155	104	107	84	68	42	31	688	785
8:00	125	276	150	282	157	264	151	260	170	255	93	107	99	57	945	1501
9:00	124	150	120	134	115	140	114	141	150	163	174	172	157	112	954	1012
10:00	111	101	104	106	105	117	110	137	147	133	190	205	202	140	969	939
11:00	112	121	113	110	126	133	114	107	135	140	218	184	241	176	1059	971
12:00	126	105	113	112	120	114	110	117	118	112	208	186	222	206	1017	952
13:00	92	104	120	131	130	98	132	128	154	116	226	164	201	186	1055	927
14:00	131	100	115	136	131	129	125	124	169	169	192	189	165	183	1028	1030
15:00	167	169	179	185	185	183	209	206	212	180	160	200	156	176	1268	1299
16:00	210	154	207	160	178	158	212	173	211	160	115	168	136	180	1269	1153
17:00	200	126	226	108	233	148	274	133	197	155	95	150	95	164	1320	984
18:00	126	89	147	92	119	94	136	108	124	103	58	97	68	114	778	697
19:00	67	64	76	69	76	106	84	109	73	64	46	47	55	58	477	517
20:00	47	30	37	28	50	44	29	42	42	50	34	30	35	39	274	263
21:00	19	6	29	20	35	19	27	25	42	31	29	26	13	20	194	147
22:00	9	7	13	13	7	5	5	19	23	25	18	16	8	9	83	94
23:00	10	4	6	18	6	8	7	10	13	31	20	16	5	4	67	91
07-19	1609	1629	1713	1710	1751	1714	1789	1789	1891	1793	1813	1890	1784	1725	12350	12250
06-22	1820	1803	1931	1912	1980	1965	2000	2038	2123	2013	1959	2019	1908	1869	13721	13619
06-00	1839	1814	1950	1943	1993	1978	2012	2067	2159	2069	1997	2051	1921	1882	13871	13804
00-00	1877	1884	1995	2012	2042	2044	2044	2124	2195	2126	2021	2075	1942	1902	14116	14167

Source: TIS Surveys

Table 2: Witton Place Average Daily Traffic Volumes

Time	Mon		Tue		Wed		Thu		Fri		Sat		Sun		7 Day Total	
	6-Mar		7-Mar		1-Mar		2-Mar		3-Mar		4-Mar		5-Mar			
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
0:00	0	0	0	1	0	0	0	1	0	0	0	1	0	2	0	5
1:00	0	0	0	0	0	0	0	1	0	0	0	0	2	1	2	2
2:00	0	0	0	0	0	0	1	0	0	0	1	2	1	2	3	4
3:00	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	2
4:00	3	0	3	0	2	1	2	0	3	0	1	0	1	1	15	2
5:00	5	0	2	0	7	0	3	0	6	1	3	0	5	1	31	2
6:00	9	3	10	4	7	3	10	2	8	4	1	0	0	1	45	17
7:00	10	9	21	9	16	11	16	11	11	9	4	3	4	2	82	54
8:00	24	6	19	8	22	8	29	9	26	9	11	5	14	3	145	48
9:00	11	12	8	11	13	10	9	9	12	7	13	11	14	7	80	67
10:00	7	4	12	7	12	6	6	9	15	14	22	13	15	25	89	78
11:00	5	10	5	8	10	9	12	15	11	6	20	13	8	8	71	69
12:00	7	13	5	6	14	11	10	12	14	18	16	18	15	21	81	99
13:00	11	6	5	9	11	9	12	12	15	17	12	17	9	15	75	85
14:00	6	8	11	10	12	13	12	8	13	14	14	21	13	10	81	84
15:00	13	18	12	17	5	19	10	24	21	20	3	10	10	12	74	120
16:00	4	14	9	26	15	24	20	20	15	11	6	10	8	12	77	117
17:00	7	23	10	20	10	20	15	25	10	29	9	18	11	15	72	150
18:00	5	11	8	19	6	24	8	17	12	14	6	10	8	12	53	107
19:00	9	13	5	6	8	14	10	20	9	18	7	8	4	3	52	82
20:00	3	4	4	4	3	5	4	7	2	5	5	5	5	5	26	35
21:00	1	4	0	3	1	3	1	3	3	6	2	1	1	3	9	23
22:00	2	2	1	1	1	3	0	1	2	3	0	2	0	0	6	12
23:00	0	0	0	2	0	0	0	0	0	3	2	3	1	0	3	8
07-19	110	134	125	150	146	164	159	171	175	168	136	149	129	142	980	1078
06-22	132	158	144	167	165	189	184	203	197	201	151	163	139	154	1112	1235
06-00	134	160	145	170	166	192	184	204	199	207	153	168	140	154	1121	1255
00-00	142	160	150	171	175	193	191	206	208	208	158	173	149	161	1173	1272

Source: TIS Surveys

4.4 Existing Intersection Operations

4.4.1 SIDRA

The operation of the key intersections has been assessed using the SIDRA intersection model. SIDRA provides a number of outputs by which to measure the performance of an intersection, including:

- **Degree of Saturation:** Degree of Saturation is defined as the ratio of demand (arrival) flow to capacity. Degrees of Saturation above 1.0 represent over-saturated conditions (demand flows exceed capacity) and degrees of saturation below 1.0 represent under-saturated conditions (demand flows are below capacity)
- **Average Vehicle Delay:** Average Vehicle Delay represents the difference between interrupted and uninterrupted travel times through an intersection, and is measured in seconds per vehicle in this assessment. Delays include queued vehicles accelerating and decelerating from/to the intersection stop, as well as general delays to all vehicles travelling through the intersection.
- **Level of Service:** Level of Service is a basic performance parameter assigned to an intersection based on average delay; we note that we have assessed the intersections using the RTA parameters which use only delay in the calculation of Level of Service.

  For priority controlled intersections, Level of Service is based on the worst minor approach movement delay.

Table 3 provides a summary of the SIDRA recommended criteria for the assessment of intersections.

Table 3: SIDRA Level of Service Criteria

Level of Service	Average Delay (seconds per vehicle)	Traffic Signals & Roundabouts	Stop & Give Way
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

Source: SIDRA Systems

4.4.2 Existing Intersection Operations

The results of the SIDRA analysis of the existing operation of the intersection of Cargo Road & Witton Place are summarised in Table 4, and detailed SIDRA Movement reports are provided in Appendix B.

Table 4: 2023 Intersection Operations

Base 2023	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	0.5	0.7	8.3	7.4	0.146	0.118
Witton Place & Taloumbi Place	A	A	4.0	4.3	4.6	4.6	0.016	0.014

With reference to Table 4, all of the key intersections operate at a good Level of Service, with minimal delays and significant spare capacity, simply as a factor of good intersection infrastructure and minimal traffic volumes.

4.5 Environmental Capacity

The RTA Guide provides guidance in the determination of appropriate traffic volumes for local roads such as Witton Place and Taloumbi Place that considers their *environmental capacity*, which essentially relates to the amenity of a road based on broader use of the road and adjacent dwellings/sites. In this regard, Table 4.6 of the RTA Guide is reproduced below.

Table 5: RTA Guide Environmental Capacity Performance Standards

Road class	Road type	Maximum Speed (km/hr)	Maximum peak hour volume (veh/hr)
Local	Access way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Source: RTA Guide

With reference to the traffic survey data, peak hour traffic volumes in both Witton Place and Taloumbi Place represent only a small percentage of the *environmental goal* volumes for a *Local Street*.

4.6 Future Base Traffic Volumes

4.6.1 Overview

So as to provide an appropriate assessment of future base conditions, arc traffic + transport has developed Base 2033 traffic volumes in Cargo Road in the vicinity of the Site so as to determine what road network upgrades might be required to accommodate those Base 2033 volumes, and then any additional upgrades that might be required to accommodate the traffic volumes generated by the Site and WPCA.

Sections below provide more detail in regard to the development of the Base 2033 traffic volumes, and an assessment of road network operations under Base 2033 conditions.

4.6.2 Orange Strategic Traffic Model

Given that the only real potential for additional traffic volumes to impact the local road network would be in the immediate vicinity of the Site along Cargo Road, the traffic assessment has focused on potential traffic growth in Cargo Road along the Site frontage (where a new access intersection is proposed) and in Cargo Road through the intersection with Witton Place.

Forecasts for this growth have been determined with reference to the Orange STM, data from which has been provided by Council for the 2018 and 2028 base years. The 2018 volumes were calibrated using surveys across the Orange road network, while the 2028 volumes include additional development that has been identified by Council as being completed prior to 2028.

4.6.3 Cargo Road Annual Average Traffic Growth

In Cargo Road, the Orange STM data indicate very moderate average growth between 2018 and 2028 in the AM peak period, and indeed a reduction in traffic volumes in the PM peak. In this regard:

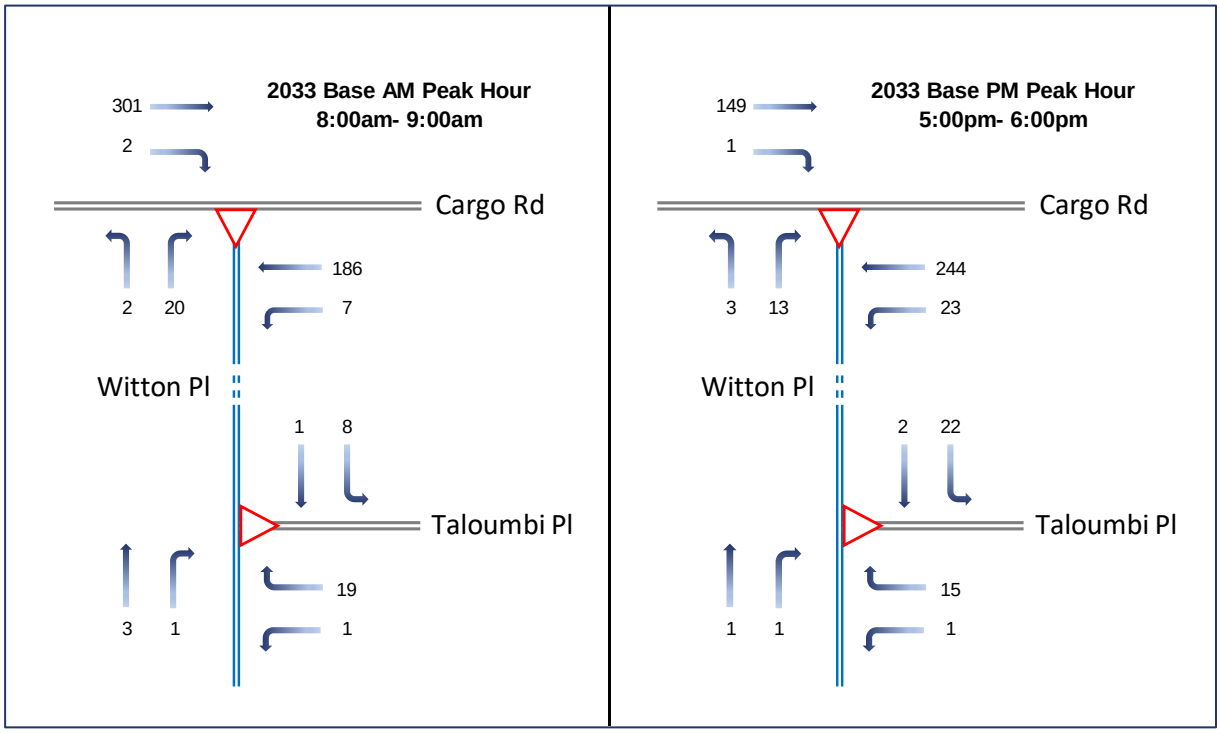
- Traffic volumes in Cargo Road increased by approximately 0.8% per annum in the AM peak; and
- Traffic volumes in Cargo Road decreased by approximately 2.8% per annum in the PM peak.

There is little information available as to why the traffic volumes would decrease to this extent in the PM peak; regardless though, to provide an appropriate level of sensitivity in the assessment of future conditions, arc traffic + transport has factored the surveyed traffic volumes in both peak periods by 1.5% per annum through 2033 so as to effectively reflect worst case conditions.

4.6.4 Base 2033 Traffic Volumes

Further to the above, the Base 2033 peak hour traffic volumes are shown in Figure 5.

Figure 5: Base 2033 Peak Hour Base Traffic Volumes



4.6.5 Base 2033 Intersection Operations

The SIDRA model has been used to determine the operation of the intersection of Cargo Road & Witton Place; the results of this analysis are summarised in Table 6, and detailed SIDRA Movement reports are again provided in Appendix B.

Table 6: Base 2033 Intersection Operations

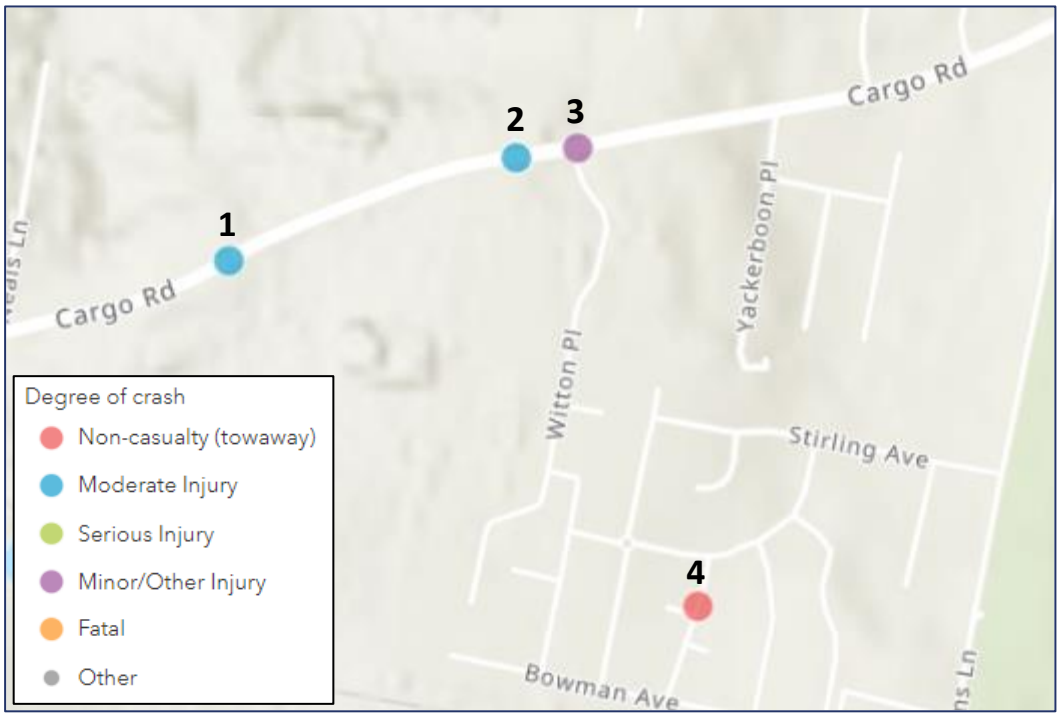
Base 2023	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	0.5	0.7	8.3	7.4	0.146	0.118

With reference to Table 6, the intersection of Cargo Road & Witton Place continues to operate at a good Level of Service under Base 2033 conditions.

4.7 Crash Data

Crash data is available from TfNSW's Centre for Road Safety, and provides information about crashes in the vicinity of the Site between 2017 and 2021 inclusive; a summary of crash locations is provided in Figure 6, while Table 7 provides additional details in regard to each crash.

Figure 6: Crash Locations 2017 - 2021



Source: TfNSW

Table 7: Crash Details 2017 - 2021

Location	Year	Crash Severity	RUM Code	RUM Description	Conditions
1	2017	Moderate	71	Off Road L Object	Dawn
2	2019	Moderate	71	Off Road L Object	Daylight
3	2017	Minor	13	Right Near	Daylight
4	2021	No Injury	71	Off Road L Object	Darkness

Source: TfNSW

With reference to the crash data, there does not appear to be any speeding or fatigue characteristics identified in these crashes, nor indication that the road/intersection design at each location provides an unsafe environment. As such, it is anticipated that most of these crashes were simply the result of human error.

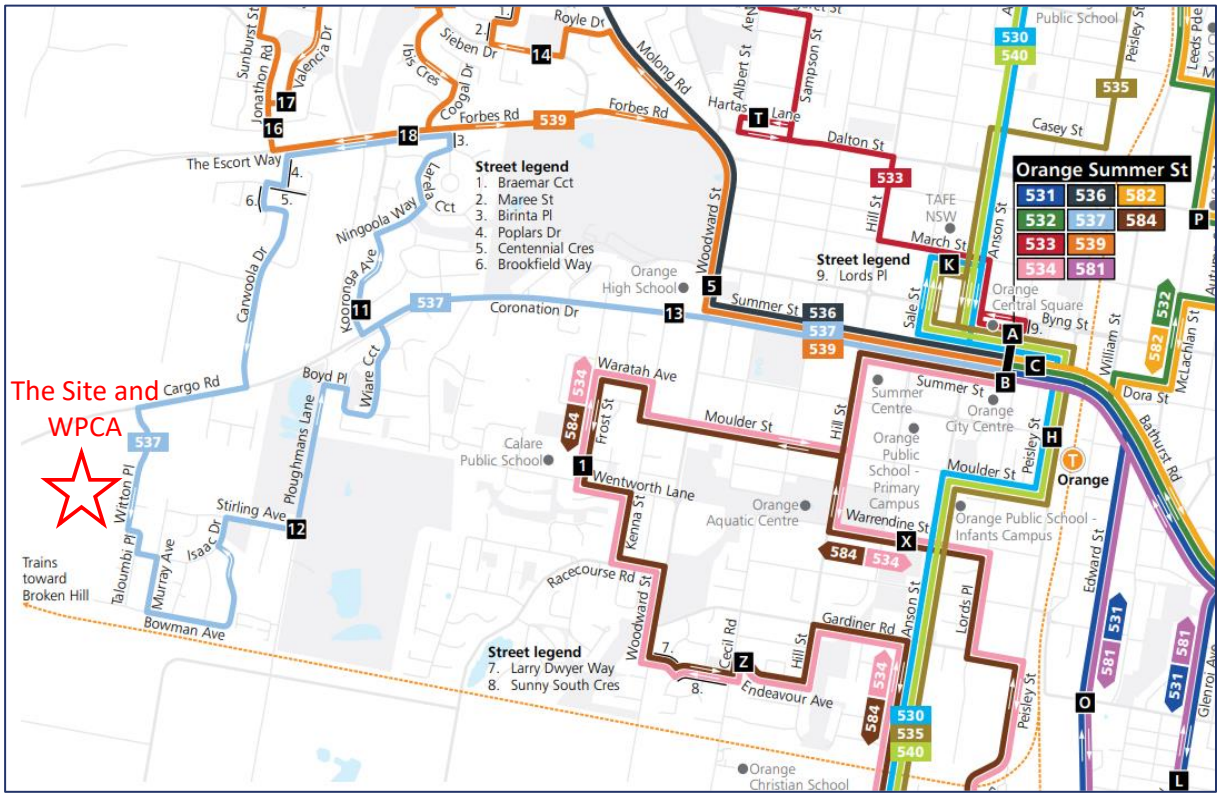
4.8 Public Transport Services

4.8.1 Existing Bus Services

Bus services in Orange have increased in recent years as a specific priority of TfNSW and Council to ensure that more transport options are available to residents across the LGA; bus services are currently operated by Orange Buslines.

Route 537 is a loop (one-way) service that operates between the City Centre and West Orange at a 2-hour headway on weekdays and Saturdays, with a bus stop located on the eastern side of Witton Place immediate south of Cargo Road. Route 537 is shown in Figure 7.

Figure 7: Bus Route 537



Source: Orange Buslines

4.8.2 Future Bus Services

At this time, no additional bus services are proposed that would provide additional public transport accessibility for the Site and WPCA. Notwithstanding, bus services have been expanding across the LGA, with TfNSW announcing an additional 200 daily services in September 2022, particularly to and through the City Centre, and links to key destinations such as Orange Hospital.

The challenge of providing additional bus services is acknowledged in Section 7.7. of FutureCity, particularly given the relatively low density of the outer suburbs (and indeed anywhere outside of the City core) and the dispersed nature of destinations. Notwithstanding, FutureCity acknowledges that there is a demand for public transport, and moreover additional services are required to provide an equitable transport environment.

While FutureCity acknowledges that new strategies will need to be developed to achieve more positive public transport outcomes, it identifies the potential for on-demand services and the better uses of [largely school] buses during of peak periods. These are certainly strategies that can be examined further by Council and TfNSW as residential development continues within the broader City.

4.9 Active Transport

4.9.1 Existing Active Transport Infrastructure

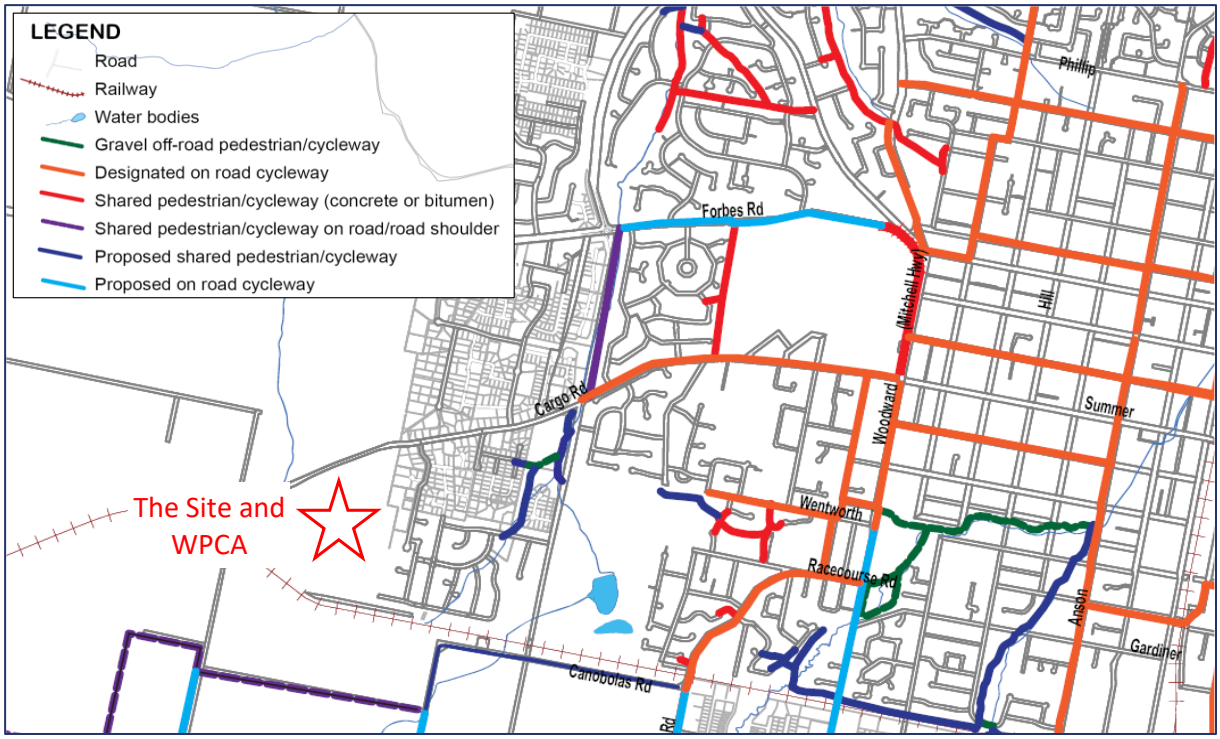
The majority of local roads in the vicinity (east) of the Site do not provide any active transport infrastructure. However, as part of the upgrade of Cargo Road, Council installed a shared path on the southern side of the road that extends from Witton Place east to the Ploughmans Wetlands (which provide numerous pedestrian and cycle paths) and then through the intersection with Ploughmans Lane, where a pedestrian refuge provides access to a pedestrian path that runs along the northern side of Cargo Road through to the City Centre.

A marked on-road cycleway is also provided on both sides of the road in Cargo Road and Coronation Drive through to Woodward Street

4.9.2 Future Active Transport Infrastructure

Existing and future active transport infrastructure is shown in Figure 11 of the Active Plan, which is reproduced below, noting that the Active Plan does not show the recently constructed shared path in Cargo Road as discussed above.

Figure 8: Orange Active Travel Plan Existing and Proposed Infrastructure



Source: Active Travel Plan

Regardless, the Proposal will provide for connections from the internal active transport network within the Site to the adjacent active transport infrastructure in Cargo Road, and to the active transport networks to be provided across the WPCA (see also Section 0).

5 The Proposal

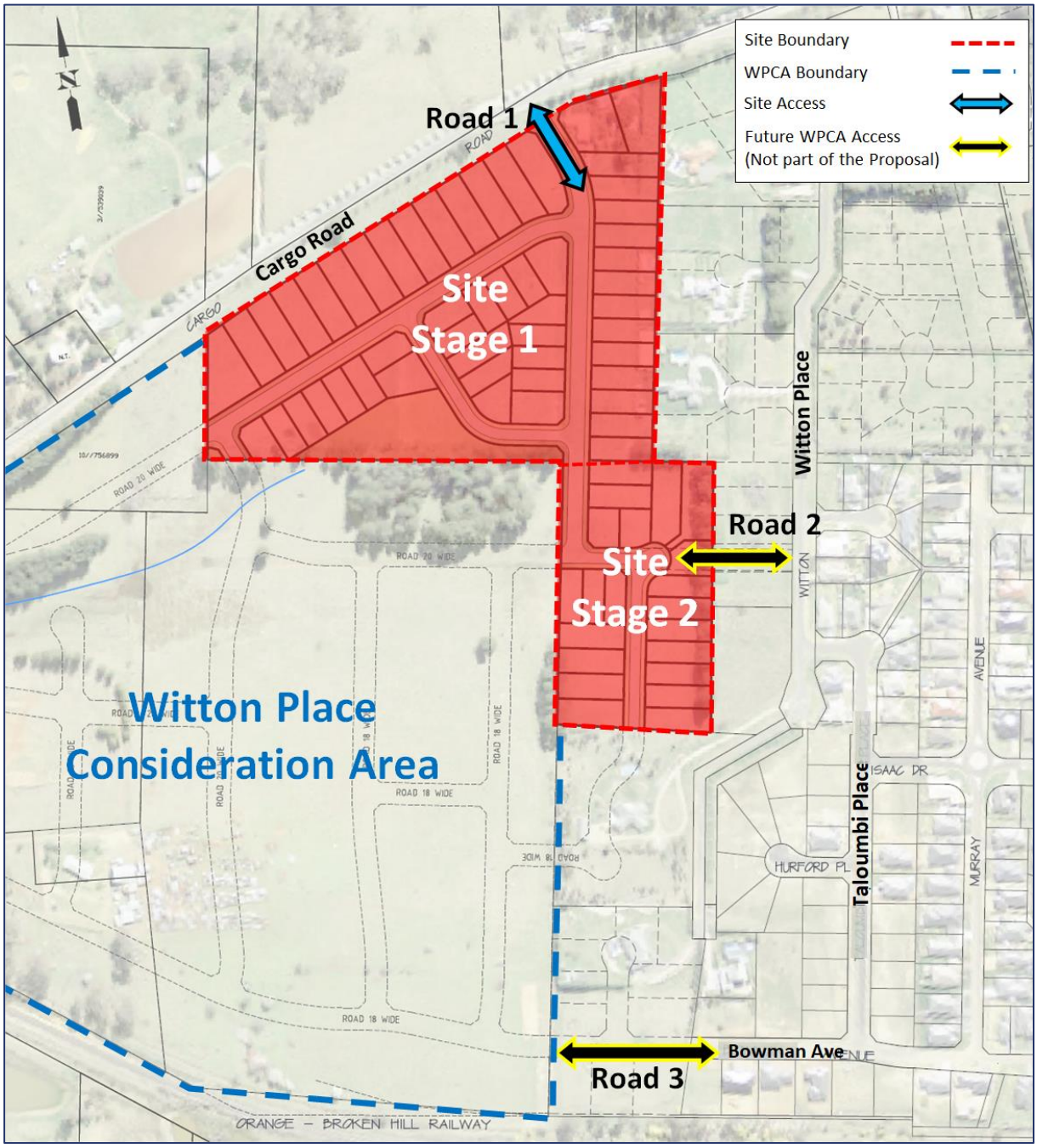
5.1 Overview

As discussed in the Introduction, the Proposal provides for the development of a residential subdivision on the Site; the Proposal would provide for approximately 72 residential lots. It is anticipated that the Site will be developed in 2 stages, with Stage 1 including the lots in the north part of the Site – as well as the new access road to Cargo Road (see also Section 5.2.2); and Stage 2 being the lots in the southern part of the Site west of Witton Place.

Given that the Site lies within the broader WPCA, a Concept Plan has been prepared by Heath Consulting Engineers that includes not only the Site but also the eastern part of the WPCA, which is particularly important so as to show future access not only for the Site but for the whole WPCA. It is noted that while the Concept Plan shows the proposed layout of the Site in detail, the design of roads/lots in the WPCA would be subject to future assessment by others.

The Concept Plan is shown in Figure 9, and additional detailed plans are provided in the broader Planning Proposal submission.

Figure 9: Planning Proposal Concept Plan



Source: Heath Consulting Engineers and arc traffic + transport

5.2 Access

5.2.1 Overview

The Proposal provides for new access roads to the adjacent road network in accordance with the indicative road access and alignment provisions shown in Section 8.4.1.2 of the Housing Strategy (previously reproduced in Figure 3). Further details in regard to these new road are provided in sections below.

5.2.2 Access to Cargo Road

In accordance with the Housing Strategy, 1 additional access road (termed **Road 1** for ease of reference) will be provided to Cargo Road, which is centrally located along the northern Site frontage, approximately 180m west of Witton Place. The intersection of Cargo Road & Road 1 will provide for all movements to and from the Site (and WPCA).

With reference to the TfNSW RFI, it is reiterated that a second (new) intersection to Cargo Road is not proposed; rather, the discussion in Section 10 below (cited in the TfNSW RFI) relates only to the design of internal roads, not a proposed second collector road intersecting with Cargo Road.

The design of the Cargo Road & Road 1 intersection has been determined further to an assessment of the trip generation (and distribution) of Road 1, and the through traffic volumes and speeds in Cargo Road, and is examined in further detail in Section 5.7.

5.2.3 Access to Witton Place

In accordance with the Housing Strategy, a new road (term **Road 2** for ease of reference) would connect east to Witton Place, anticipated to be opposite or south of Taloumbi Place. It is noted that a small (separate) landholding lies between the Site and Witton Place, and as such the timing and design of Road 2 cannot be determined at this time; moreover, this new road does not form part of the Proposal.

Importantly, Stage 2 of the Proposal does not rely on access being available via Witton Road, but rather access could be provided via an extension of the existing roads in Stage 1 south into Stage 2.

5.2.4 Access to Bowman Avenue

In accordance with the Housing Strategy, a new road (termed **Road 3** for ease of reference) would be constructed as a western extension of Bowman Avenue into the WPCA. As with the Witton Place connection, a small (separate) landholding lies between the WPCA and the existing portion of Bowman Avenue, and as such the timing and design of Road 3 cannot be determined at this time; again therefore, Road 3 does not form part of the Proposal.

5.2.5 Access to Neals Lane

In accordance with the Housing Strategy, no vehicle access would be provided between the WPCS and Neals Lane.

5.3 Public & Active Transport

5.3.1 Bus Accessibility

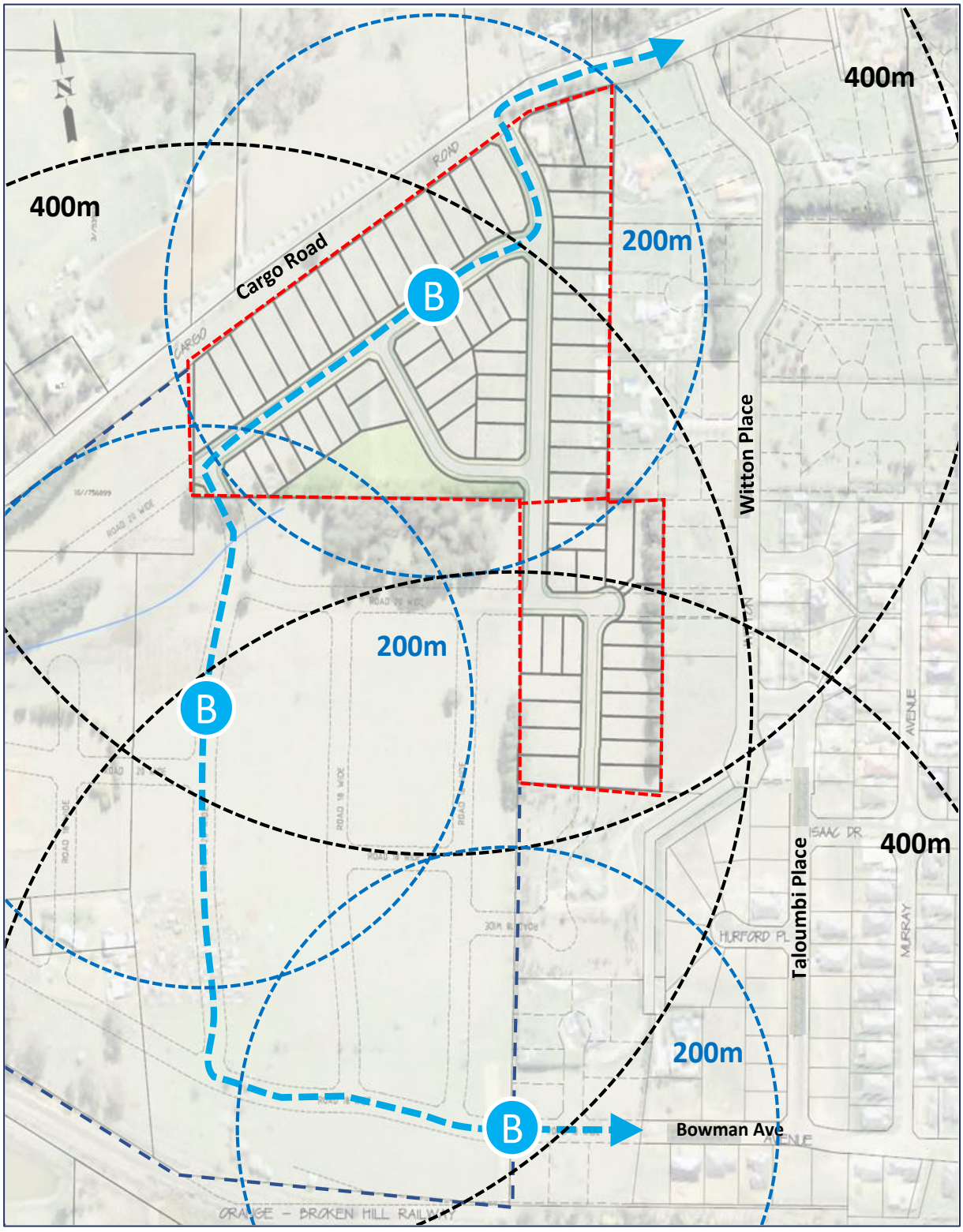
With reference to Section 5.10 below, key internal roads have been designed to the higher urban collector profile so as to provide for future bus accessibility.

In this regard, a review of the design of the local roads east of the Site that are used by buses indicates an 11.0m carriageway in accordance with the urban collector profile. With buses operating in a loop through this area, and moreover only travelling in one direction, this implies the design accommodates:

- 2 x 3.0m travel lanes;
- 1 x 3.0m kerbside parking/bus stop lane; and
- 1 x 2.0m parking lane.

With regard to the travel route, Figure 10 shows a potential route whereby all dwellings lie within 400m of a bus stop, and indeed most dwelling would lie within 200m of a bus stop. This route could then use Road 3 to return to Bowman Avenue, i.e. along the existing Route 537 route. It is likely that this route would be one-way in the first instance (i.e. like route 537) but the potential exists for a two-way route in the future based on growth across West Orange.

Figure 10: Potential Bus Route



5.3.2 Active Transport

As discussed in Section 5.7 below, the proposed road profiles are in accordance with the Subdivision Guidelines for all roads within the Site, which means that footpaths will be provided in all roads as a minimum, while wider paths (essentially operating as shared paths) would also be provided on at least one side of collector (20m wide) roads.

The upgrade of Cargo Road adjacent to the Site will also be constructed to the same profile as the recent upgraded sections of Cargo Road to the east, and as such provide a shared path along the southern side of Cargo Road directly adjacent to the Site. There is excellent potential for future residents to use this infrastructure given that (for example) a cycle ride to the City Centre is approximately 10 minutes.

As outlined in the Housing Strategy, access to Neals Lane would be restricted to active transport modes only; however - and as discussed in Section 5.2.5 - the timing and design of any new active transport infrastructure to Neals Lane will need to be determined as part of future planning for the WPCA, and necessarily consider any adjacent landowners.

At this time, few roads in the existing residential area to the east of the Site provide any pedestrian infrastructure, but there is a relatively extensive path network (including shared paths) through riparian corridors which lead to local recreational facilities. However, it is anticipated the majority of active transport trips will take advantage of the shared paths and on-street cycleways in Cargo Road.

5.4 Trip Generation Rates

The trip generation of the Site and WPCA can be determined with reference to the RMS Guide trip rates for regional dwelling houses which – as discussed in Section 2.2.3 – are 0.78 and 0.71 trips per dwelling in the AM and PM peak hours respectively. Application of these trip rates indicates that:

- The Site would generate 57 vph and 52 vph in the AM and PM peaks respectively;
- The WPCA would generate 82 vph and 75 vph in the AM and PM peaks respectively; and
- The Site and WPCS combined would generate 139 vph and 126 vph in the AM and PM peaks respectively.

As discussed in the TfNSW RFI, these trip generation rates are considered to be *fair and reasonable estimates* of future trip generation, and it is again noted that the reference to 5vph citied in the TfNSW related to the trip generation of the existing Site, not the Site further to the Proposal.

5.5 Trip Distribution

5.5.1 Directional Distribution

As shown in the traffic surveys, it is anticipated that almost all trips generated by the Site and WPCA would be to/from Cargo Road, and in turn a majority would be to/from the east based on the key origins and destinations in Orange and across the LGA.

In turn, 85% of trips have been assigned to/from the east, and 15% of trips assigned to/from the west; it is noted that the TfNSW RFI supports this distribution.

5.5.2 Trip Assignment to Cargo Road Intersections

Further to the full development of the WPCA (including the Site), arc traffic + transport originally estimated that approximately 40% of trips would utilise the intersection of Cargo Road & Road 1, and 60% of trips would utilise the intersection of Cargo Road & Witton Place. This assignment was based on the likely internal road network (within the WPCA) providing more efficient access to Cargo Road via Witton Place for the higher number of dwelling in the central and southern parts of the WPCA. For ease of reference, we have referred to this original assignment as **Assignment 1**.

As discussed, the TfNSW RFI recommended that a different distribution profile to these intersections be assessed, being 60% of trips to/from Cargo Road & Road 1, and 40% of trips to/from Cargo Road & Witton Place. This distribution – referred to as **Assignment 2** – has now been assessed.

The Council RFI has also requested an assessment of a third distribution profile – **Assignment 3** – that provides for 70% of trips to/from Cargo Road & Road 1, and 30% of trips to/from Cargo Road & Witton Place; again, we have now also provided an assessment of this distribution profile.

Finally, so as to provide a worst case assessment of right turn movements from the west (Cargo Road to Road 1) for the warrants assessment provided in Section 5.7.1, all trips to/from the west have been assigned to the Cargo Road & Road 1 intersection.

5.5.3 Trip Assignment to Bowman Avenue

Few if any trips are anticipated to be generated through the adjacent residential area to the east of the Site simply as a function of there being few key origins and destinations provided with more efficient access via these local routes. This in turn indicates that Bowman Avenue – and moreover a western extension of Bowman Avenue – would be seldom used given the circuitous route through the residential area to the east of the Site to Ploughmans Lane and then to Cargo Road.

5.5.4 Arrival and Departure Distribution

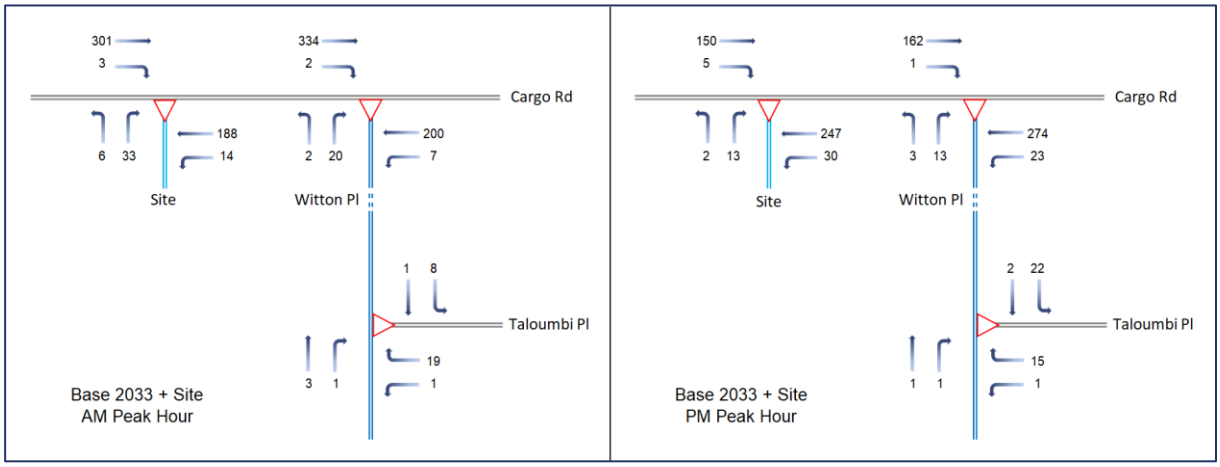
In line with our past assessments of regional residential estates, and with reference to both the traffic surveys and the Orange STMP data, it is anticipated that approximately 30% of trips would be arrival trips and 70% of trips would be departure trips in the AM peak, with the opposite distribution in the PM peak. We note that the TfNSW RFI does not provide any commentary in regard to this arrival and departure distribution profile.

5.6 Future Traffic Volumes

5.6.1 Base 2033 + Site

With reference to sections above, future traffic volumes at the key intersections under a Base 2033 + Site scenario are shown in Figure 11, noting that until such time as the broader WPCA (and other small landholding) was developed, Site access would be provided by the Cargo Road & Road 1 intersection only.

Figure 11: Base 2033 + Site Traffic Volumes



5.6.2 Base 2033 + Site + WPCA

With reference to sections above, future traffic volumes at the key intersections under a Base 2033 + Site + WPCA consider that road network access would be available via Road 1, Road 2 and Road 3 to the adjacent road network.

The figures below provide a summary of future traffic volumes at the key intersections based on the distribution profiles discussed in Section 5.2.2, being:

- **Assignment 1:** 40% to Cargo Road & Road 1, 60% to Cargo Road & Witton Place;
- **Assignment 2:** 60% to Cargo Road & Road 1, 40% to Cargo Road & Witton Place; and
- **Assignment 3:** 70% to Cargo Road & Road 1, 30% to Cargo Road & Witton Place.

Figure 12: Base 2033 + Site + WPCA Assignment 1

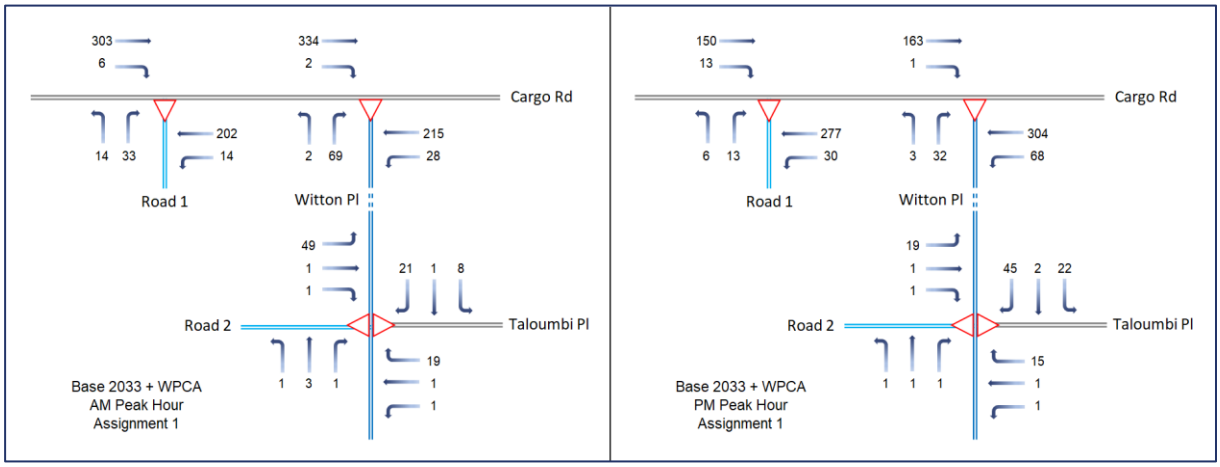


Figure 13: Base 2033 + Site + WPCA Assignment 2

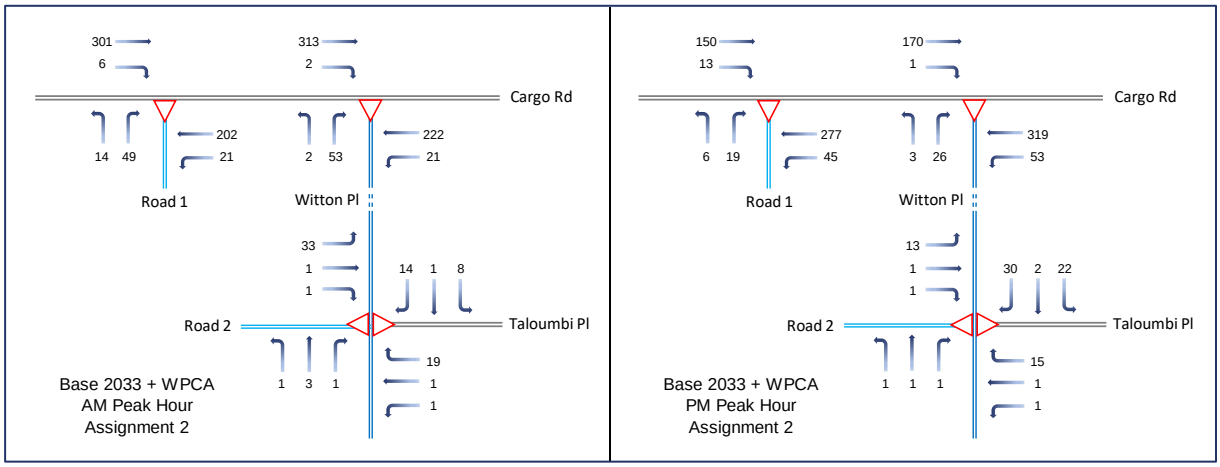
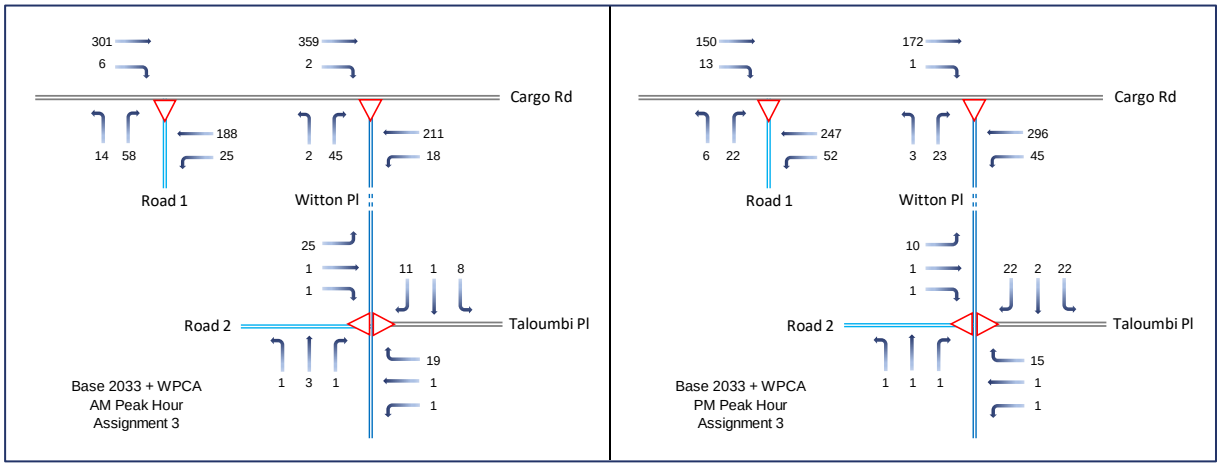


Figure 14: Base 2033 + Site + WPCA Assignment 3



5.7 Intersection Design: Cargo Road & Road 1

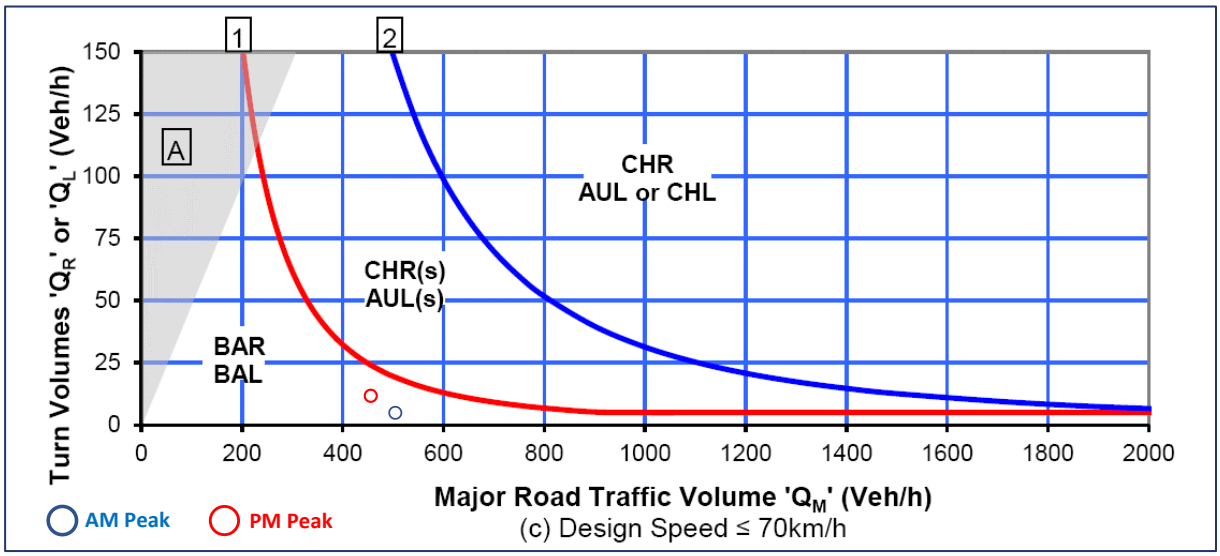
5.7.1 Design Warrants

Warrants for the design of new intersections in urban areas are discussed in Section 3.3.6 of Austroads GTM Part 6, and reference the traffic volumes in the major road (Cargo Road) and the minor road (Road 1), and the design speed of the major road so as to determine the appropriate intersection treatment.

Figure 3.25 of Austroads GTM Part 6 – which provides warrants for roads with a design speed up to 70km/h - is reproduced below. This also shows the future right turn traffic volumes to Road 1 from Cargo Road during the AM and PM peaks further to the Assignment 3 distribution profile, which assigns the same number of trips to the right turn movement, Cargo Road to Road 1, as the other assignments, but has the highest left turn volume, Cargo Road to Road 1, noting that this is considered an opposing traffic volume (to the right turn movement, Cargo Road to Road 1).

It is noted that based on the warrants, only Basic Left (**BAL**) treatments are required for all left turn movements under both distribution scenarios.

Figure 15: Austroads GTM Part 6 Intersection Design Warrants AM Peak Hour



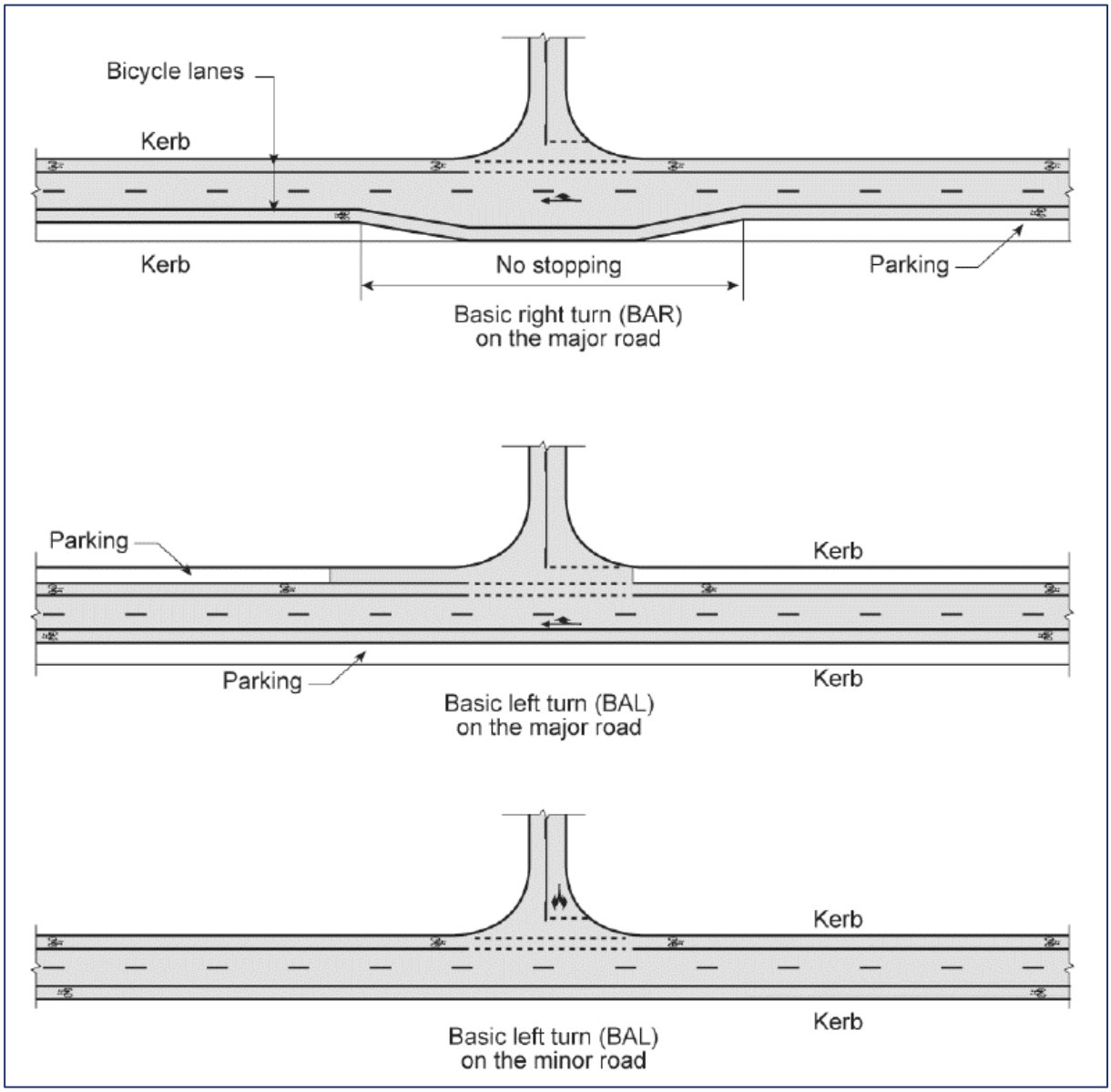
Source: Austroads GTM Part 6

With reference to Figure 15, the Intersection of Cargo Road & Road 1 would require:

- A BAL turn treatment for the left turn from Cargo Road to Road 1;
- A Basic Right (**BAR**) turn treatment for the right turn from Cargo Road to Road 1; and
- A BAL turn treatment for the left turn from Road 1 to Cargo Road.

The general design of these treatments is shown in Figure A.2 of Austroads GRD Part 4, which is reproduced below.

Figure 16: Austroads Basic Turn Treatments



Source: Austroads GRD Part 4

It is noted that these treatment designs are essentially the same as those provided at intersections of other local roads with Cargo Road, including Yackerboon Place, Ploughmans Lane and Kooranga Avenue.

With regard to the design of the intersection, the TfNSW RFI states the following:

> *…if you put all traffic onto Road 1, the development would be at the tipping scale of a full length CHR and AUL. Given access to Witton Place is provided, an AUL(s) and CHR(s) would suffice. I note the plan provided showed an AUL(s)/AUR type intersection. Austroads and TfNSW no longer support AURs which have been replaced by CHR(s).*

Given the low volumes of right turn traffic performing this movement (as previously noted and provided in the TIA), my view is that a BAR would suffice for this intersection, but would be happy to support Council, should they wish, to require a CHR(s) at this location to be consistent with the existing road environment (Witton has a CHR(s)).

While TfNSW agrees that a BAR treatment is appropriate, it is noted again that the Austroads GRD Part 4 warrants show that either Site trips to the intersection or traffic volumes in Cargo Road would still need relatively significant increases to reach the Channelised Right (**CHR**) treatment using the distribution profile recommended in the TfNSW RFI.

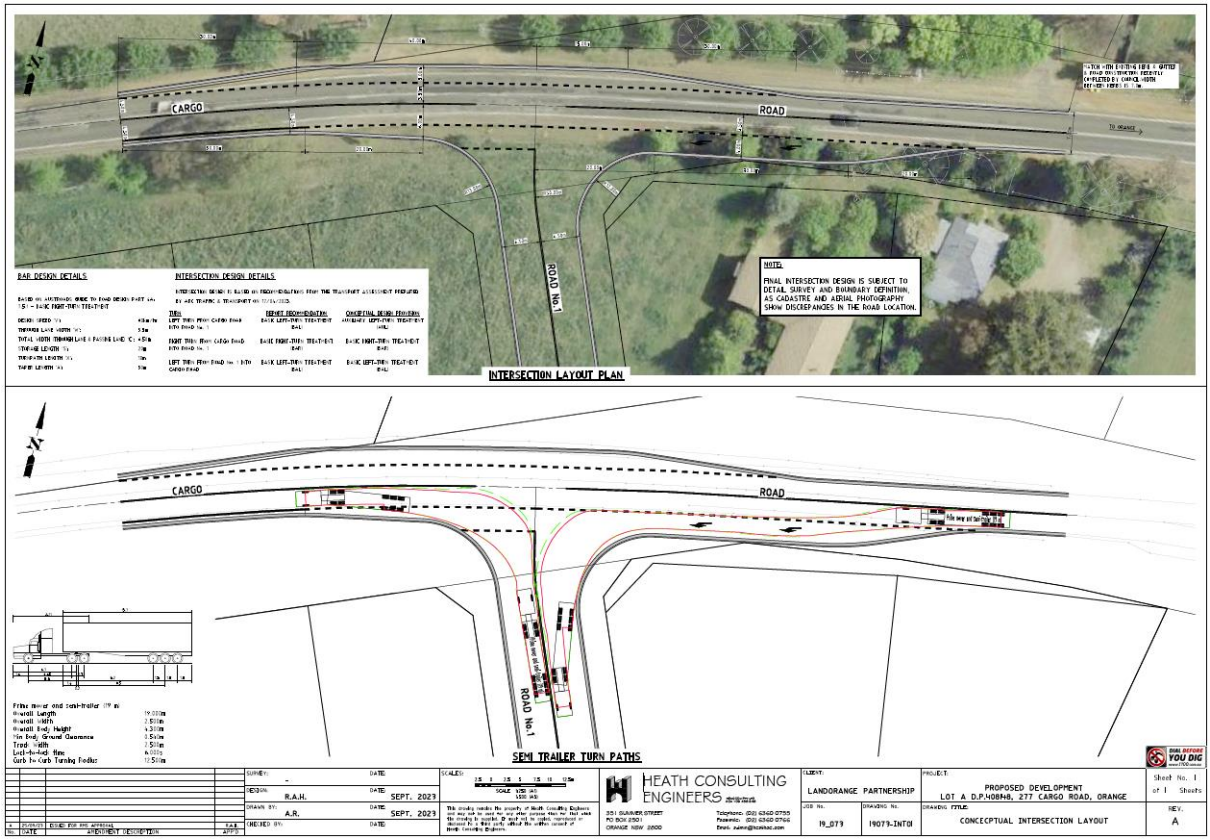
Moreover, TfNSW's identification of future traffic volumes being at the tipping scale for a CHR is only based on an assignment of all trips to the intersection of Cargo Road & Road 1, which will simply not occur given the more efficient route via Road 2, Witton Place and the intersection of Cargo Road & Witton Road for a significant number of dwellings in the central and southern part of the WPCA.

As such, arc traffic + transport would agree with TfNSW that the provision of a BAR treatment for the movement Cargo Roaf to Road 1 is appropriate.

5.7.2 Intersection Design

Further to a determination of BAL and BAR treatments as being warranted, a detailed design of the intersection has been prepared by Heath Consulting Engineers, and is shown below, noting that plans will also be submitted to Council and TfNSW for full approval prior to construction.

Figure 17: Cargo Road & Road 1 Concept Design



Source: Heath Consulting Engineers

5.7.3 Sight Distance

Sight distance requirement can be determined with reference to Section 5 of the GRD Part 3, which provides details of required sight distance under different road conditions and different vehicle speeds. As noted in the TfNSW RFI, it is preferable for new intersections to not only provide Safe Stopping Distance (**SSD**) but the higher order Safe Intersection Sight Distance (**SISD**), which requires additional sight distance to provide greater awareness of turning vehicles prior to a potential conflict point.

In regard to Road 1, the TfNSW RFI notes that SISD of 151m would be required in both directions for a design speed limit of 70km/h, notwithstanding minor revision to account for grade changes. It is also noted that the current speed limit in Cargo Road is 60km/h (i.e. 10km/h lower than the design speed) and moreover that Council have indicated a likely reduction in the Cargo Road speed limit to 50km/h past the Site and other new residential developments in Cargo Road.

As such, 151m will more likely represent a SISD requirement for a speed 20km/h higher than the future posted speed limit.

Regardless, an assessment of the available sight distance was undertaken by Heath Consulting Engineers in November 2023 based on the sight distance assessment guidelines identified in Section 5 of GRD Part 3, which determined that SISD of at least 151m was available to both the east and west of Road 1.

A copy of the Heath Consulting Engineers sight distance assessment is provided in Appendix C, and we note that the Council RFI confirms the findings of the assessment.

5.8 Future WPCA Intersections

5.8.1 Intersection of Cargo Road & Witton Place

As discussed in Section 4.2.1, the intersection of Cargo Road & Witton Place already provides significantly auxiliary turn treatments; this existing intersection design has been used in the first instance for the assessment of the intersection (SIDRA) under all future scenarios, noting that the additional traffic volumes at the intersection do not (in and of themselves) warrant higher order treatments than those currently provided.

5.8.2 Intersection of Witton Place & Taloumbi Place & WPCA

As discussed in Section 5.2.3, the Housing Strategy indicates that future access from the WPCA could be provided via Witton Place further to a new road connecting to Witton Place opposite or south of Taloumbi Place. In the first instance – and as a worst case - the assessment of this intersection using SIDRA considers a 4 way intersection of Witton Place & Taloumbi Place & Road 2 operating under priority (Give Way) control, with priority to Witton Place.

5.9 Future Traffic Operations

5.9.1 Intersection Operations: Base 2033 + Site

SIDRA has been utilised to determine the future operation of the key intersections further to the additional Site trips, referencing the future traffic volumes detailed in Section 5.6.1, and the intersection designs detailed in Section 5.7.

Further to the SIDRA analysis, Table 8 provides a summary of the resulting future intersection operations under the Base 2033 + Site scenario (noting that traffic volumes at the intersection of Witton Place & Taloumbi Place would not change). SIDRA Movement Summary reports are again provided in Appendix B.

Table 8: Base 2033 + Site Intersection Operations

Base 2033 + Site	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	0.5	0.6	9.8	8.5	0.186	0.153
Cargo Road & Road 1	A	A	0.7	0.6	6.7	6.4	0.149	0.155

With reference to Table 8, the key intersections will operate at a Level of Service A in both peak periods further to the development of the Site in accordance with the Proposal.

5.9.2 Intersection Operations: Base 2033 + Site + WPCA

SIDRA has been utilised to determine the future operation of the key intersections further to the additional Site and WPCA trips, referencing the future traffic volumes detailed in Section 0, and the intersection designs detailed in Section 5.7. Analysis is provided of each of Assignment 1, Assignment 2 and Assignment 3 in Table 9, Table 10 and Table 11 respectively, and SIDRA Movement Summary reports are provided in Appendix B.

Table 9: Base 2033 + Site + WPCA Intersection Operations Assignment 1

Base 2033 + Site	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	1.5	1.3	10.0	9.4	0.166	0.169
Cargo Road & Road 1	A	A	0.7	0.7	7.1	6.6	0.173	0.172
Witton Place & Taloumbi Place	A	A	4.4	4.5	4.9	4.9	0.033	0.040

Table 10: Base 2033 + Site + WPCA Intersection Operations Assignment 2

Base 2033 + Site	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	1.0	1.0	7.2	9.5	0.172	0.178
Cargo Road & Road 1	A	A	1.0	0.9	6.9	6.7	0.158	0.180
Witton Place & Taloumbi Place	A	A	4.4	4.4	4.7	4.8	0.023	0.031

Table 11: Base 2033 + Site + WPCA Intersection Operations Assignment 3

Base 2033 + Site	Level of Service		Average Delay (s)		Worst Delay (s)		Degree of Saturation	
	AM	PM	AM	PM	AM	PM	AM	PM
Cargo Road & Witton Place	A	A	1.0	0.9	10.8	9.1	0.200	0.165
Cargo Road & Road 1	A	A	1.1	1.1	7.1	6.5	0.172	0.167
Witton Place & Taloumbi Place	A	A	4.3	4.4	4.6	4.8	0.020	0.027

With reference to the tables above, the key intersections will operate at a Level of Service A in both peak periods under each of the different assignments, and with reference to the SIDRA Movement reports provided in Appendix B, there is virtually no queuing on any approaches to these intersections, and significant spare capacity in all approaches.

As such, the intersection design of both Cargo Road & Road 1, and Witton Place & Taloumbi Place & Road 2 as discussed in Section 5.2.2 and Section 5.2.3 respectively, will more than appropriately provide for future traffic conditions.

5.9.3 Environmental Capacity

With regard to environmental capacity, Witton Place and Taloumbi Place will continue to accommodate traffic volumes significantly lower than the environmental cap for a *Local Street*, as will all roads within the Site and WPCA (see also Section 5.10).

5.10 Internal Roads

Within the Site, the proposed road network is based on the design profiles provided in the Subdivision Code appropriate to the internal hierarchy of roads within residential estates. In this regard, Table 2.1 of the Subdivision Code provides guidance on the determination of different road classes, as summarised in Table 12.

Table 12: Road Classification

Classification	Dwellings Served	Frontage Access	Design Speed
Urban Distributor	> 200	No	60km/h - 80km/h
Urban Collector	200	Yes	60km/h - 80km/h
Urban Local Access	50	Yes	50km/h
Urban Cul-de-Sac	> 8	Yes	40km/h
Urban Cul-de-Sac	< 8	Yes	40km/h

Source: Subdivision Code

Further to a determination of the class of road, Table 2.3.4.1 of the Subdivision Code provides the standard road profile for each class, as summarised in Table 13.

Table 13: Subdivision Code Road Profiles

Class of Road	Reserve (m)	Verge (m)	Carriageway (m)	Footpath (m)
Urban Distributor	22.0	2 x 4.5	13.0	2 x 1.5
Urban Collector	20.0	2 x 4.5	11.0	2 x 1.2
Urban Local Access	18.0	2 x 4.5	9.0	2 x 1.2
Urban Cul-de-Sac	18.0	2 x 4.5	9.0	1 x 1.2

Source: Subdivision Code

Based on the traffic volumes generated within the Site, it is anticipated that one of the north-south roads through the WPCA would be designed to the Urban Collector profile, while all other roads would provide access for fewer than 50 dwellings, and as such could be designed to the Urban Local Access or Urban Cul-de-Sac profiles.

As discussed in regard to the TfNSW RFI, only one new access road to Cargo Road (Road 1) is proposed.

The design of all roads will be determined as part of a future Development Application, and will also be subject to a swept path analysis to ensure that a waste collection vehicle can appropriately navigate all internal and interface intersections. Notwithstanding, it is generally the case that adherence to the Subdivision Code means that intersections can appropriately provide for such vehicles by default.

6 Conclusions

Further to our assessment of the Proposal, arc traffic + transport has determined the following:

- The Proposal is in accordance with the Housing Strategy, which specifically identifies the Site and WPCA for short-term low density residential development.
- Access to the Site will be provided via Cargo Road directly in accordance with the Housing Strategy; while it is anticipated that road connections to both Witton Place and Bowman Avenue will be provided further to the full development of the WPCA, the Site does not rely on these future connections, as all access can be provided via Cargo Road.
- With specific reference to the TfNSW RFI, only a single new connection is proposed between the Site/WPCA and Cargo Road at Road 1.
- In accordance with the Housing Strategy, no vehicle access will be provided between the WPCA and Neals Lane.
- There is good potential for local bus services to extend out to new residential areas in the short term, and a potential bus route running north-south through the Site and WPCA would provide access to bus stops within 400m of all dwellings.
- Active transport infrastructure will be provided within the Site based on the Subdivision Code road profile requirements, and a shared path will be provided along the Site frontage to Cargo Road, linking to the recently constructed shared path to the east of Witton Place.
- Under future Base 2033 conditions, the road network continues to operate at good Level of Service simply as a function of what are relatively moderate traffic volumes, particularly in Cargo Road.
- Further to the introduction of the additional Site trips, the local road network continues to operate at a good Level of Service, with minimal delays and queues at key intersections that also retain significant spare capacity; this is the case based on each of the different distribution assignments.
- Under both distribution profiles, the intersection of Cargo Road & Road 1 meets the warrants for the provision of BAL and BAR treatments only, and as noted in the TfNSW RFI these are considered to be appropriate treatments, particularly given the additional access available via the Cargo Road & Witton Place intersection.
- Sight distance at the intersection of Cargo Road & Road 1 has been assessed by Heath Consulting Engineers, and found to meet Austroads requirements for a 70km/h design speed in Cargo Road. It is anticipated that Council will in the future reduced the speed limit in Cargo Road past the Site which means that the sight distance requirements at Road 1 will be exceeded.
- Total traffic volumes in all local roads remain well below their environmental caps.

- All internal roads will be constructed in accordance with the Subdivision Code's road profile requirements, and swept path analysis of the largest vehicle travelling through internal intersections will be undertaken as part of future DAs.

In summary, arc traffic + transport has determined that the Planning Proposal is fully supportable further to access, traffic and transport considerations.

Appendix A: Traffic Surveys

Cargo Road & Witton Place 2023 Hourly Traffic Volumes

Location	-	Duration	7:00 - 9:00
	Cargo Road		16:00 - 18:00
	Witton Place		
	Cargo Road	Day/Date	Wednesday, 8 March 2023
Suburb	ORANGE	Weather	-

All Vehicles Time Per Hour	NORTH -										EAST Cargo Road											
	L			T			R			TOTAL	L			T			R			TOTAL	TOTAL		TOTAL
	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	
7:00 - 8:00											7	0	7	90	11	101				108	249	12	261
7:15 - 8:15											7	1	8	94	16	110				118	281	18	299
7:30 - 8:30											6	1	7	99	17	116				123	336	23	359
7:45 - 8:45											7	1	8	117	15	132				140	396	22	418
8:00 - 9:00											6	1	7	147	15	162				169	432	23	455
Period End																							
16:00 - 17:00											17	2	19	161	3	164				183	360	12	372
16:15 - 17:15											16	2	18	159	5	164				182	327	16	343
16:30 - 17:30											19	1	20	180	6	186				206	333	14	347
16:45 - 17:45											25	0	25	196	6	202				227	360	14	364
17:00 - 18:00											22	1	23	205	7	212				235	364	18	382
Period End																							

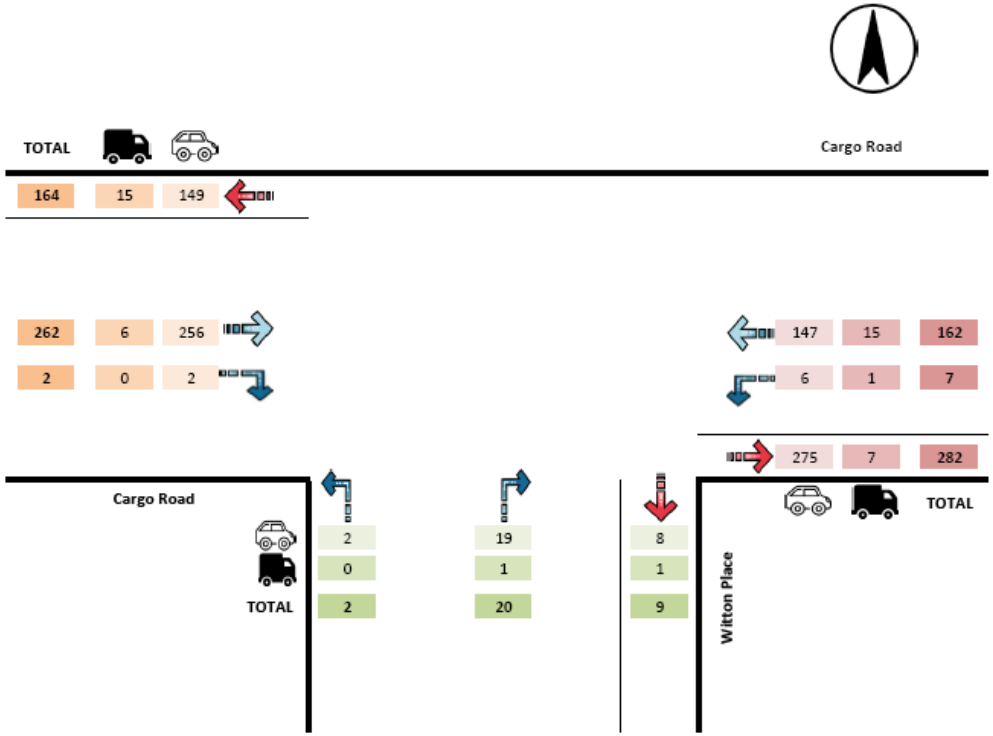
All Vehicles Time Per Hour	SOUTH Witton Place										WEST Cargo Road											
	L			T			R			TOTAL	L			T			R			TOTAL	TOTAL		TOTAL
	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	
7:00 - 8:00	2	0	2				14	1	15	17				136	0	136	0	0	0	136	249	12	261
7:15 - 8:15	1	0	1				13	1	14	15				166	0	166	0	0	0	166	281	18	299
7:30 - 8:30	1	0	1				16	1	17	18				214	4	218	0	0	0	218	336	23	359
7:45 - 8:45	3	0	3				19	1	20	23				248	5	253	2	0	2	255	396	22	418
8:00 - 9:00	2	0	2				19	1	20	22				256	6	262	2	0	2	264	432	23	455
Period End																							
16:00 - 17:00	0	0	0				9	0	9	9				169	6	175	4	1	5	180	360	12	372
16:15 - 17:15	0	0	0				13	0	13	13				135	9	144	4	0	4	148	327	16	343
16:30 - 17:30	1	0	1				14	0	14	15				117	7	124	2	0	2	126	333	14	347
16:45 - 17:45	2	0	2				12	0	12	14				114	8	122	1	0	1	123	350	14	364
17:00 - 18:00	3	0	3				13	0	13	16				120	10	130	1	0	1	131	364	18	382
Period End																							

Cargo Road & Witton Place 2023 AM Peak Hour Volumes

Location	-	Duration	7:00 - 9:00
	Cargo Road		16:00 - 18:00
	Witton Place		-
	Cargo Road	Day/Date	Wednesday, 8 March 2023
Suburb	ORANGE	Weather	-

DATA SELECTION	
Select Time:	PEAK

TIME RANGE		
PEAK	-	AM
PEAK		
8:00	-	9:00

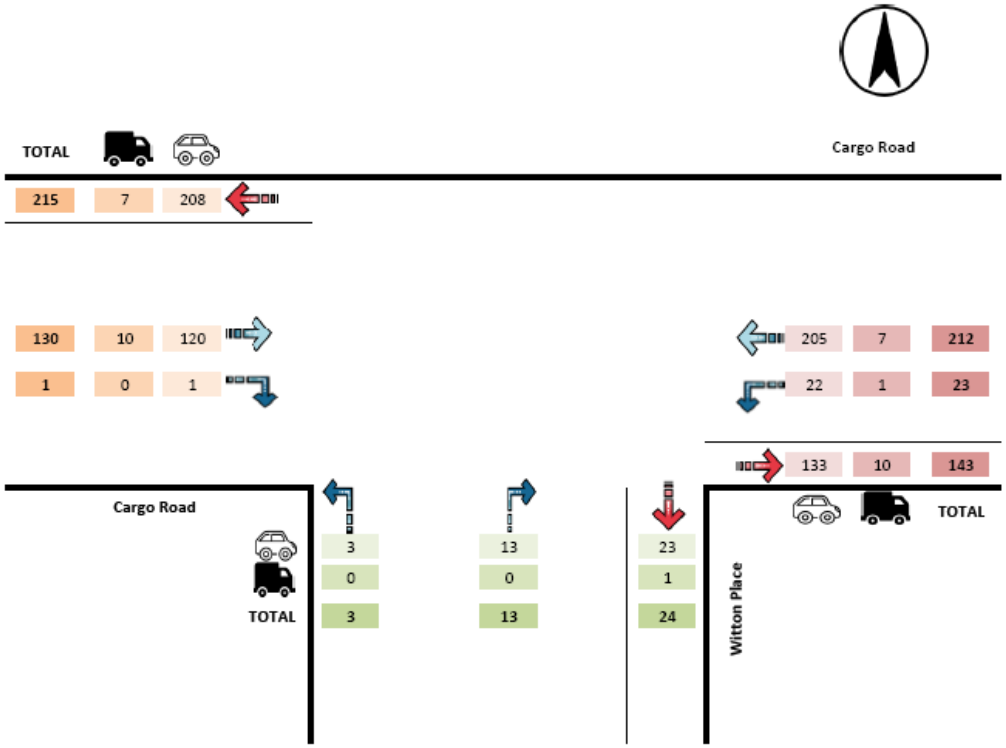


Cargo Road & Witton Place 2023 PM Peak Hour Volumes

Location	-	Duration	7:00 - 9:00
	Cargo Road		16:00 - 18:00
	Witton Place		-
	Cargo Road	Day/Date	Wednesday, 8 March 2023
Suburb	ORANGE	Weather	-

DATA SELECTION	
Select Time:	PEAK

TIME RANGE		
PEAK	-	PM
PEAK		
17:00	-	18:00



Appendix B: SIDRA Movement Reports

2023 AM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ Site: 1 [Cargo Road & Witton Place 2023 AM Peak (Site Folder: General)]

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.038	5.2	LOS A	0.1	1.0	0.48	0.66	0.48	47.5
3	R2	20	1.0	21	1.0	0.038	8.3	LOS A	0.1	1.0	0.48	0.66	0.48	47.4
Approach		22	1.0	23	1.0	0.038	8.0	LOS A	0.1	1.0	0.48	0.66	0.48	47.4
East: Cargo Road														
4	L2	7	1.0	7	1.0	0.004	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	162	5.0	171	5.0	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		169	4.8	178	4.8	0.090	0.3	NA	0.0	0.0	0.00	0.02	0.00	59.7
West: Cargo Road														
11	T1	262	5.0	276	5.0	0.146	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.1	LOS A	0.0	0.0	0.28	0.54	0.28	48.8
Approach		264	5.0	278	5.0	0.146	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles		455	4.7	479	4.7	0.146	0.5	NA	0.1	1.0	0.02	0.04	0.02	59.0

2023 PM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ Site: 1 [Cargo Road & Witton Place 2023 PM Peak (Site Folder: General)]

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.024	5.5	LOS A	0.1	0.6	0.43	0.60	0.43	48.2
3	R2	13	1.0	14	1.0	0.024	7.4	LOS A	0.1	0.6	0.43	0.60	0.43	48.0
Approach		16	1.0	17	1.0	0.024	7.0	LOS A	0.1	0.6	0.43	0.60	0.43	48.0
East: Cargo Road														
4	L2	23	1.0	24	1.0	0.013	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	212	5.0	223	5.0	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		235	4.6	247	4.6	0.118	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.3
West: Cargo Road														
11	T1	130	5.0	137	5.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	6.4	LOS A	0.0	0.0	0.33	0.54	0.33	48.7
Approach		131	5.0	138	5.0	0.072	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		382	4.6	402	4.6	0.118	0.7	NA	0.1	0.6	0.02	0.06	0.02	58.9

2023 AM Peak Hour Witton Place & Taloumbi Place

MOVEMENT SUMMARY

▽ Site: 2 [Witton Place & Taloumbi Place 2023 AM Peak (Site Folder: General)]

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
2	T1	3	0.0	3	0.0	0.002	0.0	LOS A	0.0	0.0	0.03	0.14	0.03	49.2
3	R2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.03	0.14	0.03	48.2
Approach		4	0.0	4	0.0	0.002	1.2	NA	0.0	0.0	0.03	0.14	0.03	48.9
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.016	4.6	LOS A	0.1	0.4	0.03	0.54	0.03	46.6
6	R2	19	1.0	20	1.0	0.016	4.6	LOS A	0.1	0.4	0.03	0.54	0.03	46.1
Approach		20	1.0	21	1.0	0.016	4.6	LOS A	0.1	0.4	0.03	0.54	0.03	46.1
North: Witton Place														
7	L2	8	1.0	8	1.0	0.005	4.6	LOS A	0.0	0.0	0.00	0.47	0.00	46.9
8	T1	1	0.0	1	0.0	0.005	0.0	LOS A	0.0	0.0	0.00	0.47	0.00	47.4
Approach		9	0.9	9	0.9	0.005	4.1	NA	0.0	0.0	0.00	0.47	0.00	47.0
All Vehicles		33	0.8	35	0.8	0.016	4.0	NA	0.1	0.4	0.02	0.48	0.02	46.7

2023 PM Peak Hour Witton Place & Taloumbi Place

MOVEMENT SUMMARY

▽ Site: 2 [Witton Place & Taloumbi Place 2023 PM Peak (Site Folder: General)]

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
2	T1	1	0.0	1	0.0	0.001	0.0	LOS A	0.0	0.0	0.08	0.27	0.08	48.3
3	R2	1	0.0	1	0.0	0.001	4.6	LOS A	0.0	0.0	0.08	0.27	0.08	47.4
Approach		2	0.0	2	0.0	0.001	2.3	NA	0.0	0.0	0.08	0.27	0.08	47.8
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.013	4.6	LOS A	0.0	0.3	0.04	0.54	0.04	46.5
6	R2	15	1.0	16	1.0	0.013	4.6	LOS A	0.0	0.3	0.04	0.54	0.04	46.1
Approach		16	0.9	17	0.9	0.013	4.6	LOS A	0.0	0.3	0.04	0.54	0.04	46.1
North: Witton Place														
7	L2	22	1.0	23	1.0	0.014	4.6	LOS A	0.0	0.0	0.00	0.49	0.00	46.8
8	T1	2	0.0	2	0.0	0.014	0.0	LOS A	0.0	0.0	0.00	0.49	0.00	47.3
Approach		24	0.9	25	0.9	0.014	4.2	NA	0.0	0.0	0.00	0.49	0.00	46.9
All Vehicles		42	0.9	44	0.9	0.014	4.3	NA	0.0	0.3	0.02	0.50	0.02	46.6

Base 2033 AM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo Road & Witton Place Base 2033 AM Peak (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.038	5.2	LOS A	0.1	1.0	0.48	0.66	0.48	47.5
3	R2	20	1.0	21	1.0	0.038	8.3	LOS A	0.1	1.0	0.48	0.66	0.48	47.4
Approach		22	1.0	23	1.0	0.038	8.0	LOS A	0.1	1.0	0.48	0.66	0.48	47.4
East: Cargo Road														
4	L2	7	1.0	7	1.0	0.004	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	162	5.0	171	5.0	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		169	4.8	178	4.8	0.090	0.3	NA	0.0	0.0	0.00	0.02	0.00	59.7
West: Cargo Road														
11	T1	262	5.0	276	5.0	0.146	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.1	LOS A	0.0	0.0	0.28	0.54	0.28	48.8
Approach		264	5.0	278	5.0	0.146	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles		455	4.7	479	4.7	0.146	0.5	NA	0.1	1.0	0.02	0.04	0.02	59.0

Base 2033 PM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo Road & Witton Place Base 2033 PM Peak (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.024	5.5	LOS A	0.1	0.6	0.43	0.60	0.43	48.2
3	R2	13	1.0	14	1.0	0.024	7.4	LOS A	0.1	0.6	0.43	0.60	0.43	48.0
Approach		16	1.0	17	1.0	0.024	7.0	LOS A	0.1	0.6	0.43	0.60	0.43	48.0
East: Cargo Road														
4	L2	23	1.0	24	1.0	0.013	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	212	5.0	223	5.0	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		235	4.6	247	4.6	0.118	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.3
West: Cargo Road														
11	T1	130	5.0	137	5.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	6.4	LOS A	0.0	0.0	0.33	0.54	0.33	48.7
Approach		131	5.0	138	5.0	0.072	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		382	4.6	402	4.6	0.118	0.7	NA	0.1	0.6	0.02	0.06	0.02	58.9

Base 2033 + Site AM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo Road & Witton Place Base 2033 AM Peak + Site (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.045	5.4	LOS A	0.2	1.1	0.54	0.71	0.54	46.7
3	R2	20	1.0	21	1.0	0.045	9.8	LOS A	0.2	1.1	0.54	0.71	0.54	46.5
Approach		22	1.0	23	1.0	0.045	9.4	LOS A	0.2	1.1	0.54	0.71	0.54	46.5
East: Cargo Road														
4	L2	7	1.0	7	1.0	0.004	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	200	5.0	211	5.0	0.111	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		207	4.9	218	4.9	0.111	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
West: Cargo Road														
11	T1	334	5.0	352	5.0	0.186	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.3	LOS A	0.0	0.0	0.31	0.54	0.31	48.7
Approach		336	5.0	354	5.0	0.186	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles		565	4.8	595	4.8	0.186	0.5	NA	0.2	1.1	0.02	0.04	0.02	59.1

Base 2033 + Site PM Peak Hour Cargo Road & Witton Place

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo Road & Witton Place Base 2033 PM Peak + Site (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.027	5.8	LOS A	0.1	0.7	0.49	0.65	0.49	47.6
3	R2	13	1.0	14	1.0	0.027	8.5	LOS A	0.1	0.7	0.49	0.65	0.49	47.4
Approach		16	1.0	17	1.0	0.027	8.0	LOS A	0.1	0.7	0.49	0.65	0.49	47.4
East: Cargo Road														
4	L2	23	1.0	24	1.0	0.013	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	274	5.0	288	5.0	0.153	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		297	4.7	313	4.7	0.153	0.5	NA	0.0	0.0	0.00	0.04	0.00	59.4
West: Cargo Road														
11	T1	162	5.0	171	5.0	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	6.7	LOS A	0.0	0.0	0.38	0.55	0.38	48.6
Approach		163	5.0	172	5.0	0.090	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		476	4.7	501	4.7	0.153	0.6	NA	0.1	0.7	0.02	0.05	0.02	59.0

Base 2033 + Site AM Peak Hour Cargo Road & Road 1

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 AM Peak + Site (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	6	1.0	6	1.0	0.048	5.2	LOS A	0.2	1.1	0.39	0.64	0.39	45.5
3	R2	33	1.0	35	1.0	0.048	6.7	LOS A	0.2	1.1	0.39	0.64	0.39	45.1
Approach		39	1.0	41	1.0	0.048	6.5	LOS A	0.2	1.1	0.39	0.64	0.39	45.1
East: Cargo Road														
4	L2	14	1.0	15	1.0	0.113	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.2
5	T1	188	5.0	198	5.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	49.7
Approach		202	4.7	213	4.7	0.113	0.3	NA	0.0	0.0	0.00	0.04	0.00	49.7
West: Cargo Road														
11	T1	264	5.0	278	5.0	0.149	0.0	LOS A	0.0	0.2	0.01	0.01	0.01	49.9
12	R2	3	1.0	3	1.0	0.149	5.4	LOS A	0.0	0.2	0.01	0.01	0.01	48.9
Approach		267	5.0	281	5.0	0.149	0.1	NA	0.0	0.2	0.01	0.01	0.01	49.9
All Vehicles		508	4.6	535	4.6	0.149	0.7	NA	0.2	1.1	0.04	0.07	0.04	49.4

Base 2033 + Site PM Peak Hour Cargo Road & Road 1

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 PM Peak + Site (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	2	1.0	2	1.0	0.018	5.4	LOS A	0.1	0.4	0.39	0.61	0.39	45.6
3	R2	13	1.0	14	1.0	0.018	6.4	LOS A	0.1	0.4	0.39	0.61	0.39	45.2
Approach		15	1.0	16	1.0	0.018	6.2	LOS A	0.1	0.4	0.39	0.61	0.39	45.3
East: Cargo Road														
4	L2	30	1.0	32	1.0	0.155	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	49.1
5	T1	247	5.0	260	5.0	0.155	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	49.6
Approach		277	4.6	292	4.6	0.155	0.5	NA	0.0	0.0	0.00	0.06	0.00	49.5
West: Cargo Road														
11	T1	150	5.0	158	5.0	0.088	0.1	LOS A	0.0	0.3	0.03	0.02	0.03	49.8
12	R2	5	1.0	5	1.0	0.088	5.6	LOS A	0.0	0.3	0.03	0.02	0.03	48.8
Approach		155	4.9	163	4.9	0.088	0.2	NA	0.0	0.3	0.03	0.02	0.03	49.8
All Vehicles		447	4.6	471	4.6	0.155	0.6	NA	0.1	0.4	0.02	0.06	0.02	49.5

Base 2033 + Site +WPCA AM Cargo Road & Witton Place Assignment 1

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 AM Peak + WPCA Assignment 1 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.146	5.6	LOS A	0.6	3.9	0.58	0.80	0.58	46.4
3	R2	69	1.0	73	1.0	0.146	10.0	LOS A	0.6	3.9	0.58	0.80	0.58	46.2
Approach		71	1.0	75	1.0	0.146	9.9	LOS A	0.6	3.9	0.58	0.80	0.58	46.2
East: Cargo Road														
4	L2	28	1.0	29	1.0	0.016	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	215	5.0	226	5.0	0.120	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		243	4.5	256	4.5	0.120	0.7	NA	0.0	0.0	0.00	0.07	0.00	59.1
West: Cargo Road														
11	T1	297	5.0	313	5.0	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.4	LOS A	0.0	0.1	0.34	0.55	0.34	48.6
Approach		299	5.0	315	5.0	0.166	0.1	NA	0.0	0.1	0.00	0.00	0.00	59.8
All Vehicles		613	4.3	645	4.3	0.166	1.5	NA	0.6	3.9	0.07	0.12	0.07	57.6

Base 2033 + Site +WPCA PM Cargo Road & Witton Place Assignment 1

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 PM Peak + WPCA Assignment 1 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.068	6.0	LOS A	0.2	1.7	0.54	0.73	0.54	46.9
3	R2	32	1.0	34	1.0	0.068	9.4	LOS A	0.2	1.7	0.54	0.73	0.54	46.7
Approach		35	1.0	37	1.0	0.068	9.1	LOS A	0.2	1.7	0.54	0.73	0.54	46.7
East: Cargo Road														
4	L2	68	1.0	72	1.0	0.039	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	304	5.0	320	5.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		372	4.3	392	4.3	0.169	1.1	NA	0.0	0.0	0.00	0.11	0.00	58.6
West: Cargo Road														
11	T1	163	5.0	172	5.0	0.091	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	7.1	LOS A	0.0	0.0	0.43	0.56	0.43	48.4
Approach		164	5.0	173	5.0	0.091	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		571	4.3	601	4.3	0.169	1.3	NA	0.2	1.7	0.03	0.11	0.03	58.1

Base 2033 + Site +WPCA AM Cargo Road & Road 1 Assignment 1

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 AM Peak + WPCA Assignment 1 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	14	1.0	15	1.0	0.057	5.3	LOS A	0.2	1.4	0.39	0.63	0.39	45.5
3	R2	33	1.0	35	1.0	0.057	7.1	LOS A	0.2	1.4	0.39	0.63	0.39	45.0
Approach		47	1.0	49	1.0	0.057	6.6	LOS A	0.2	1.4	0.39	0.63	0.39	45.2
East: Cargo Road														
4	L2	14	1.0	15	1.0	0.121	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.2
5	T1	202	5.0	213	5.0	0.121	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	49.7
Approach		216	4.7	227	4.7	0.121	0.3	NA	0.0	0.0	0.00	0.04	0.00	49.7
West: Cargo Road														
11	T1	303	5.0	319	5.0	0.173	0.0	LOS A	0.1	0.4	0.02	0.01	0.02	49.9
12	R2	6	1.0	6	1.0	0.173	5.5	LOS A	0.1	0.4	0.02	0.01	0.02	48.9
Approach		309	4.9	325	4.9	0.173	0.1	NA	0.1	0.4	0.02	0.01	0.02	49.9
All Vehicles		572	4.5	602	4.5	0.173	0.7	NA	0.2	1.4	0.04	0.07	0.04	49.4

Base 2033 + Site +WPCA PM Cargo Road & Road 1 Assignment 1

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 PM Peak + WPCA Assignment 1 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	6	1.0	6	1.0	0.022	5.5	LOS A	0.1	0.5	0.39	0.60	0.39	45.6
3	R2	13	1.0	14	1.0	0.022	6.6	LOS A	0.1	0.5	0.39	0.60	0.39	45.2
Approach		19	1.0	20	1.0	0.022	6.2	LOS A	0.1	0.5	0.39	0.60	0.39	45.4
East: Cargo Road														
4	L2	30	1.0	32	1.0	0.172	4.6	LOS A	0.0	0.0	0.00	0.05	0.00	49.1
5	T1	277	5.0	292	5.0	0.172	0.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.6
Approach		307	4.6	323	4.6	0.172	0.5	NA	0.0	0.0	0.00	0.05	0.00	49.6
West: Cargo Road														
11	T1	150	5.0	158	5.0	0.089	0.1	LOS A	0.1	0.4	0.04	0.02	0.04	49.8
12	R2	6	1.0	6	1.0	0.089	5.8	LOS A	0.1	0.4	0.04	0.02	0.04	48.8
Approach		156	4.8	164	4.8	0.089	0.3	NA	0.1	0.4	0.04	0.02	0.04	49.7
All Vehicles		482	4.5	507	4.5	0.172	0.7	NA	0.1	0.5	0.03	0.06	0.03	49.4

Base 2033 + Site +WPCA AM Witton Place & Taloumbi Place & Road 2 Assignment 1

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 AM Peak + WPCA Assignment 1 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	48.2
2	T1	3	0.0	3	0.0	0.003	0.0	LOS A	0.0	0.0	0.02	0.22	0.02	48.7
3	R2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	47.8
Approach		5	0.0	5	0.0	0.003	1.8	NA	0.0	0.0	0.02	0.22	0.02	48.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.021	4.6	LOS A	0.1	0.5	0.04	0.55	0.04	46.5
5	T1	1	0.0	1	0.0	0.021	3.3	LOS A	0.1	0.5	0.04	0.55	0.04	46.5
6	R2	19	1.0	20	1.0	0.021	4.9	LOS A	0.1	0.5	0.04	0.55	0.04	46.0
Approach		21	0.9	22	0.9	0.021	4.8	LOS A	0.1	0.5	0.04	0.55	0.04	46.1
North: Witton Place														
7	L2	8	1.0	8	1.0	0.017	4.6	LOS A	0.1	0.5	0.03	0.52	0.03	46.6
8	T1	1	0.0	1	0.0	0.017	0.0	LOS A	0.1	0.5	0.03	0.52	0.03	47.1
9	R2	21	0.0	22	0.0	0.017	4.6	LOS A	0.1	0.5	0.03	0.52	0.03	46.2
Approach		30	0.3	32	0.3	0.017	4.4	NA	0.1	0.5	0.03	0.52	0.03	46.4
West: Road 2														
10	L2	49	0.0	52	0.0	0.033	4.6	LOS A	0.1	0.9	0.02	0.52	0.02	46.6
11	T1	1	0.0	1	0.0	0.033	3.3	LOS A	0.1	0.9	0.02	0.52	0.02	46.7
12	R2	1	0.0	1	0.0	0.033	4.7	LOS A	0.1	0.9	0.02	0.52	0.02	46.2
Approach		51	0.0	54	0.0	0.033	4.5	LOS A	0.1	0.9	0.02	0.52	0.02	46.6
All Vehicles		107	0.3	113	0.3	0.033	4.4	NA	0.1	0.9	0.03	0.51	0.03	46.5

Base 2033 + Site +WPCA PM Witton Place & Taloumbi Place & Road 2 Assignment 1

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 PM Peak + WPCA Assignment 1 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	47.4
2	T1	1	0.0	1	0.0	0.002	0.0	LOS A	0.0	0.0	0.07	0.35	0.07	47.8
3	R2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	46.9
Approach		3	0.0	3	0.0	0.002	3.1	NA	0.0	0.0	0.07	0.35	0.07	47.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.017	4.6	LOS A	0.1	0.4	0.06	0.54	0.06	46.5
5	T1	1	0.0	1	0.0	0.017	3.4	LOS A	0.1	0.4	0.06	0.54	0.06	46.5
6	R2	15	1.0	16	1.0	0.017	4.9	LOS A	0.1	0.4	0.06	0.54	0.06	46.0
Approach		17	0.9	18	0.9	0.017	4.8	LOS A	0.1	0.4	0.06	0.54	0.06	46.1
North: Witton Place														
7	L2	22	1.0	23	1.0	0.040	4.6	LOS A	0.2	1.3	0.02	0.52	0.02	46.6
8	T1	2	0.0	2	0.0	0.040	0.0	LOS A	0.2	1.3	0.02	0.52	0.02	47.1
9	R2	45	0.0	47	0.0	0.040	4.6	LOS A	0.2	1.3	0.02	0.52	0.02	46.2
Approach		69	0.3	73	0.3	0.040	4.4	NA	0.2	1.3	0.02	0.52	0.02	46.4
West: Road 2														
10	L2	19	0.0	20	0.0	0.014	4.6	LOS A	0.1	0.4	0.01	0.52	0.01	46.7
11	T1	1	0.0	1	0.0	0.014	3.4	LOS A	0.1	0.4	0.01	0.52	0.01	46.7
12	R2	1	0.0	1	0.0	0.014	4.8	LOS A	0.1	0.4	0.01	0.52	0.01	46.2
Approach		21	0.0	22	0.0	0.014	4.5	LOS A	0.1	0.4	0.01	0.52	0.01	46.6
All Vehicles		110	0.3	116	0.3	0.040	4.5	NA	0.2	1.3	0.02	0.52	0.02	46.4

Base 2033 + Site +WPCA AM Cargo Road & Witton Place Assignment 2

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 AM Peak + WPCA Assignment 2 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.117	5.6	LOS A	0.4	3.0	0.58	0.79	0.58	46.3
3	R2	53	1.0	56	1.0	0.117	10.2	LOS A	0.4	3.0	0.58	0.79	0.58	46.1
Approach		55	1.0	58	1.0	0.117	10.1	LOS A	0.4	3.0	0.58	0.79	0.58	46.1
East: Cargo Road														
4	L2	21	1.0	22	1.0	0.012	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	222	5.0	234	5.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		243	4.7	256	4.7	0.124	0.5	NA	0.0	0.0	0.00	0.05	0.00	59.3
West: Cargo Road														
11	T1	313	5.0	329	5.0	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.4	LOS A	0.0	0.1	0.34	0.55	0.34	48.6
Approach		315	5.0	332	5.0	0.174	0.1	NA	0.0	0.1	0.00	0.00	0.00	59.8
All Vehicles		613	4.5	645	4.5	0.174	1.1	NA	0.4	3.0	0.05	0.09	0.05	58.1

Base 2033 + Site +WPCA PM Cargo Road & Witton Place Assignment 2

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 PM Peak + WPCA Assignment 2 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.057	6.1	LOS A	0.2	1.5	0.55	0.73	0.55	46.8
3	R2	26	1.0	27	1.0	0.057	9.5	LOS A	0.2	1.5	0.55	0.73	0.55	46.7
Approach		29	1.0	31	1.0	0.057	9.2	LOS A	0.2	1.5	0.55	0.73	0.55	46.7
East: Cargo Road														
4	L2	53	1.0	56	1.0	0.030	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	319	5.0	336	5.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		372	4.4	392	4.4	0.178	0.8	NA	0.0	0.0	0.00	0.08	0.00	58.9
West: Cargo Road														
11	T1	170	5.0	179	5.0	0.095	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	7.1	LOS A	0.0	0.0	0.43	0.56	0.43	48.4
Approach		171	5.0	180	5.0	0.095	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		572	4.4	602	4.4	0.178	1.0	NA	0.2	1.5	0.03	0.09	0.03	58.4

Base 2033 + Site +WPCA AM Cargo Road & Road 1 Assignment 2

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 AM Peak + WPCA Assignment 2 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	14	1.0	15	1.0	0.080	5.3	LOS A	0.3	1.9	0.41	0.66	0.41	45.3
3	R2	49	1.0	52	1.0	0.080	7.2	LOS A	0.3	1.9	0.41	0.66	0.41	44.9
Approach		63	1.0	66	1.0	0.080	6.8	LOS A	0.3	1.9	0.41	0.66	0.41	45.0
East: Cargo Road														
4	L2	21	1.0	22	1.0	0.125	4.6	LOS A	0.0	0.0	0.00	0.05	0.00	49.2
5	T1	202	5.0	213	5.0	0.125	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	49.6
Approach		223	4.6	235	4.6	0.125	0.5	NA	0.0	0.0	0.00	0.05	0.00	49.6
West: Cargo Road														
11	T1	301	5.0	317	5.0	0.172	0.0	LOS A	0.1	0.4	0.02	0.01	0.02	49.9
12	R2	6	1.0	6	1.0	0.172	5.5	LOS A	0.1	0.4	0.02	0.01	0.02	48.9
Approach		307	4.9	323	4.9	0.172	0.1	NA	0.1	0.4	0.02	0.01	0.02	49.9
All Vehicles		593	4.4	624	4.4	0.172	1.0	NA	0.3	1.9	0.05	0.10	0.05	49.2

Base 2033 + Site +WPCA PM Cargo Road & Road 1 Assignment 2

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 PM Peak + WPCA Assignment 2 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	6	1.0	6	1.0	0.030	5.5	LOS A	0.1	0.7	0.41	0.62	0.41	45.5
3	R2	19	1.0	20	1.0	0.030	6.7	LOS A	0.1	0.7	0.41	0.62	0.41	45.1
Approach		25	1.0	26	1.0	0.030	6.4	LOS A	0.1	0.7	0.41	0.62	0.41	45.2
East: Cargo Road														
4	L2	45	1.0	47	1.0	0.180	4.6	LOS A	0.0	0.0	0.00	0.08	0.00	49.0
5	T1	277	5.0	292	5.0	0.180	0.1	LOS A	0.0	0.0	0.00	0.08	0.00	49.5
Approach		322	4.4	339	4.4	0.180	0.7	NA	0.0	0.0	0.00	0.08	0.00	49.4
West: Cargo Road														
11	T1	150	5.0	158	5.0	0.094	0.2	LOS A	0.1	0.9	0.08	0.05	0.08	49.5
12	R2	13	1.0	14	1.0	0.094	5.9	LOS A	0.1	0.9	0.08	0.05	0.08	48.5
Approach		163	4.7	172	4.7	0.094	0.6	NA	0.1	0.9	0.08	0.05	0.08	49.4
All Vehicles		510	4.3	537	4.3	0.180	0.9	NA	0.1	0.9	0.05	0.09	0.05	49.2

Base 2033 + Site +WPCA AM Witton Place & Taloumbi Place & Road 2 Assignment 2

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 AM Peak + WPCA Assignment 2 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	48.2
2	T1	3	0.0	3	0.0	0.003	0.0	LOS A	0.0	0.0	0.02	0.22	0.02	48.7
3	R2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	47.8
Approach		5	0.0	5	0.0	0.003	1.8	NA	0.0	0.0	0.02	0.22	0.02	48.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.020	4.6	LOS A	0.1	0.5	0.04	0.54	0.04	46.5
5	T1	1	0.0	1	0.0	0.020	3.3	LOS A	0.1	0.5	0.04	0.54	0.04	46.6
6	R2	19	1.0	20	1.0	0.020	4.8	LOS A	0.1	0.5	0.04	0.54	0.04	46.1
Approach		21	0.9	22	0.9	0.020	4.7	LOS A	0.1	0.5	0.04	0.54	0.04	46.1
North: Witton Place														
7	L2	8	1.0	8	1.0	0.013	4.6	LOS A	0.1	0.4	0.03	0.51	0.03	46.7
8	T1	1	0.0	1	0.0	0.013	0.0	LOS A	0.1	0.4	0.03	0.51	0.03	47.1
9	R2	14	0.0	15	0.0	0.013	4.6	LOS A	0.1	0.4	0.03	0.51	0.03	46.2
Approach		23	0.3	24	0.3	0.013	4.4	NA	0.1	0.4	0.03	0.51	0.03	46.4
West: Road 2														
10	L2	33	0.0	35	0.0	0.023	4.6	LOS A	0.1	0.6	0.02	0.52	0.02	46.6
11	T1	1	0.0	1	0.0	0.023	3.3	LOS A	0.1	0.6	0.02	0.52	0.02	46.7
12	R2	1	0.0	1	0.0	0.023	4.7	LOS A	0.1	0.6	0.02	0.52	0.02	46.2
Approach		35	0.0	37	0.0	0.023	4.5	LOS A	0.1	0.6	0.02	0.52	0.02	46.6
All Vehicles		84	0.3	88	0.3	0.023	4.4	NA	0.1	0.6	0.03	0.50	0.03	46.5

Base 2033 + Site +WPCA PM Witton Place & Taloumbi Place & Road 2 Assignment 2

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 PM Peak + WPCA Assignment 2 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	47.4
2	T1	1	0.0	1	0.0	0.002	0.0	LOS A	0.0	0.0	0.07	0.35	0.07	47.8
3	R2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	46.9
Approach		3	0.0	3	0.0	0.002	3.1	NA	0.0	0.0	0.07	0.35	0.07	47.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.016	4.6	LOS A	0.1	0.4	0.06	0.54	0.06	46.5
5	T1	1	0.0	1	0.0	0.016	3.3	LOS A	0.1	0.4	0.06	0.54	0.06	46.6
6	R2	15	1.0	16	1.0	0.016	4.8	LOS A	0.1	0.4	0.06	0.54	0.06	46.1
Approach		17	0.9	18	0.9	0.016	4.7	LOS A	0.1	0.4	0.06	0.54	0.06	46.1
North: Witton Place														
7	L2	22	1.0	23	1.0	0.031	4.6	LOS A	0.1	0.9	0.02	0.52	0.02	46.7
8	T1	2	0.0	2	0.0	0.031	0.0	LOS A	0.1	0.9	0.02	0.52	0.02	47.1
9	R2	30	0.0	32	0.0	0.031	4.6	LOS A	0.1	0.9	0.02	0.52	0.02	46.3
Approach		54	0.4	57	0.4	0.031	4.4	NA	0.1	0.9	0.02	0.52	0.02	46.5
West: Road 2														
10	L2	13	0.0	14	0.0	0.010	4.6	LOS A	0.0	0.3	0.01	0.52	0.01	46.7
11	T1	1	0.0	1	0.0	0.010	3.4	LOS A	0.0	0.3	0.01	0.52	0.01	46.7
12	R2	1	0.0	1	0.0	0.010	4.7	LOS A	0.0	0.3	0.01	0.52	0.01	46.2
Approach		15	0.0	16	0.0	0.010	4.5	LOS A	0.0	0.3	0.01	0.52	0.01	46.6
All Vehicles		89	0.4	94	0.4	0.031	4.4	NA	0.1	0.9	0.03	0.52	0.03	46.5

Base 2033 + Site +WPCA AM Cargo Road & Witton Place Assignment 3

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 AM Peak + WPCA Assignment 3 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	2	1.0	2	1.0	0.106	5.5	LOS A	0.4	2.7	0.59	0.80	0.59	46.0
3	R2	45	1.0	47	1.0	0.106	10.8	LOS A	0.4	2.7	0.59	0.80	0.59	45.8
Approach		47	1.0	49	1.0	0.106	10.6	LOS A	0.4	2.7	0.59	0.80	0.59	45.9
East: Cargo Road														
4	L2	18	1.0	19	1.0	0.010	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	211	5.0	222	5.0	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		229	4.7	241	4.7	0.118	0.5	NA	0.0	0.0	0.00	0.05	0.00	59.4
West: Cargo Road														
11	T1	359	5.0	378	5.0	0.200	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
12	R2	2	1.0	2	1.0	0.002	6.4	LOS A	0.0	0.1	0.33	0.55	0.33	48.7
Approach		361	5.0	380	5.0	0.200	0.1	NA	0.0	0.1	0.00	0.00	0.00	59.8
All Vehicles		637	4.6	671	4.6	0.200	1.0	NA	0.4	2.7	0.04	0.08	0.04	58.4

Base 2033 + Site +WPCA PM Cargo Road & Witton Place Assignment 3

MOVEMENT SUMMARY

▽ **Site: 1 [Cargo & Witton Base 2033 PM Peak + WPCA Assignment 3 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	3	1.0	3	1.0	0.049	5.9	LOS A	0.2	1.2	0.53	0.70	0.53	47.1
3	R2	23	1.0	24	1.0	0.049	9.1	LOS A	0.2	1.2	0.53	0.70	0.53	46.9
Approach		26	1.0	27	1.0	0.049	8.8	LOS A	0.2	1.2	0.53	0.70	0.53	46.9
East: Cargo Road														
4	L2	45	1.0	47	1.0	0.026	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
5	T1	296	5.0	312	5.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		341	4.5	359	4.5	0.165	0.8	NA	0.0	0.0	0.00	0.08	0.00	59.0
West: Cargo Road														
11	T1	172	5.0	181	5.0	0.096	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
12	R2	1	1.0	1	1.0	0.001	6.9	LOS A	0.0	0.0	0.41	0.55	0.41	48.5
Approach		173	5.0	182	5.0	0.096	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		540	4.5	568	4.5	0.165	0.9	NA	0.2	1.2	0.03	0.08	0.03	58.5

Base 2033 + Site +WPCA AM Cargo Road & Road 1 Assignment 3

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 AM Peak + WPCA Assignment 3 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	14	1.0	15	1.0	0.091	5.2	LOS A	0.3	2.2	0.41	0.67	0.41	45.3
3	R2	58	1.0	61	1.0	0.091	7.1	LOS A	0.3	2.2	0.41	0.67	0.41	44.9
Approach		72	1.0	76	1.0	0.091	6.8	LOS A	0.3	2.2	0.41	0.67	0.41	45.0
East: Cargo Road														
4	L2	25	1.0	26	1.0	0.119	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	49.1
5	T1	188	5.0	198	5.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	49.6
Approach		213	4.5	224	4.5	0.119	0.6	NA	0.0	0.0	0.00	0.06	0.00	49.5
West: Cargo Road														
11	T1	301	5.0	317	5.0	0.172	0.0	LOS A	0.1	0.4	0.02	0.01	0.02	49.9
12	R2	6	1.0	6	1.0	0.172	5.4	LOS A	0.1	0.4	0.02	0.01	0.02	48.9
Approach		307	4.9	323	4.9	0.172	0.1	NA	0.1	0.4	0.02	0.01	0.02	49.9
All Vehicles		592	4.3	623	4.3	0.172	1.1	NA	0.3	2.2	0.06	0.11	0.06	49.1

Base 2033 + Site +WPCA PM Cargo Road & Road 1 Assignment 3

MOVEMENT SUMMARY

▽ Site: [Cargo Road & Road 1 Base 2033 PM Peak + WPCA Assignment 3 (Site Folder: General)]

Site Category: Proposed Design 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Road 1														
1	L2	6	1.0	6	1.0	0.033	5.4	LOS A	0.1	0.8	0.39	0.62	0.39	45.6
3	R2	22	1.0	23	1.0	0.033	6.5	LOS A	0.1	0.8	0.39	0.62	0.39	45.2
Approach		28	1.0	29	1.0	0.033	6.3	LOS A	0.1	0.8	0.39	0.62	0.39	45.3
East: Cargo Road														
4	L2	52	1.0	55	1.0	0.167	4.6	LOS A	0.0	0.0	0.00	0.09	0.00	48.9
5	T1	247	5.0	260	5.0	0.167	0.1	LOS A	0.0	0.0	0.00	0.09	0.00	49.4
Approach		299	4.3	315	4.3	0.167	0.8	NA	0.0	0.0	0.00	0.09	0.00	49.3
West: Cargo Road														
11	T1	150	5.0	158	5.0	0.094	0.1	LOS A	0.1	0.8	0.08	0.05	0.08	49.5
12	R2	13	1.0	14	1.0	0.094	5.8	LOS A	0.1	0.8	0.08	0.05	0.08	48.5
Approach		163	4.7	172	4.7	0.094	0.6	NA	0.1	0.8	0.08	0.05	0.08	49.4
All Vehicles		490	4.2	516	4.2	0.167	1.1	NA	0.1	0.8	0.05	0.11	0.05	49.1

Base 2033 + Site +WPCA AM Witton Place & Taloumbi Place & Road 2 Assignment 3

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 AM Peak + WPCA Assignment 3 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	48.2
2	T1	3	0.0	3	0.0	0.003	0.0	LOS A	0.0	0.0	0.02	0.22	0.02	48.7
3	R2	1	0.0	1	0.0	0.003	4.6	LOS A	0.0	0.0	0.02	0.22	0.02	47.8
Approach		5	0.0	5	0.0	0.003	1.8	NA	0.0	0.0	0.02	0.22	0.02	48.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.020	4.6	LOS A	0.1	0.5	0.04	0.54	0.04	46.5
5	T1	1	0.0	1	0.0	0.020	3.2	LOS A	0.1	0.5	0.04	0.54	0.04	46.6
6	R2	19	1.0	20	1.0	0.020	4.8	LOS A	0.1	0.5	0.04	0.54	0.04	46.1
Approach		21	0.9	22	0.9	0.020	4.7	LOS A	0.1	0.5	0.04	0.54	0.04	46.1
North: Witton Place														
7	L2	8	1.0	8	1.0	0.012	4.6	LOS A	0.0	0.3	0.03	0.51	0.03	46.7
8	T1	1	0.0	1	0.0	0.012	0.0	LOS A	0.0	0.3	0.03	0.51	0.03	47.1
9	R2	11	0.0	12	0.0	0.012	4.6	LOS A	0.0	0.3	0.03	0.51	0.03	46.3
Approach		20	0.4	21	0.4	0.012	4.3	NA	0.0	0.3	0.03	0.51	0.03	46.5
West: Road 2														
10	L2	25	0.0	26	0.0	0.018	4.6	LOS A	0.1	0.5	0.02	0.52	0.02	46.6
11	T1	1	0.0	1	0.0	0.018	3.3	LOS A	0.1	0.5	0.02	0.52	0.02	46.7
12	R2	1	0.0	1	0.0	0.018	4.6	LOS A	0.1	0.5	0.02	0.52	0.02	46.2
Approach		27	0.0	28	0.0	0.018	4.5	LOS A	0.1	0.5	0.02	0.52	0.02	46.6
All Vehicles		73	0.4	77	0.4	0.020	4.3	NA	0.1	0.5	0.03	0.50	0.03	46.6

Base 2033 + Site +WPCA PM Witton Place & Taloumbi Place & Road 2 Assignment 3

MOVEMENT SUMMARY

▽ **Site: 2 [Witton & Taloumbi & Road 2 2033 PM Peak + WPCA Assignment 3 (Site Folder: General)]**

Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Witton Place														
1	L2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	47.4
2	T1	1	0.0	1	0.0	0.002	0.0	LOS A	0.0	0.0	0.07	0.35	0.07	47.8
3	R2	1	0.0	1	0.0	0.002	4.6	LOS A	0.0	0.0	0.07	0.35	0.07	46.9
Approach		3	0.0	3	0.0	0.002	3.1	NA	0.0	0.0	0.07	0.35	0.07	47.4
East: Taloumbi Place														
4	L2	1	0.0	1	0.0	0.016	4.6	LOS A	0.1	0.4	0.06	0.54	0.06	46.5
5	T1	1	0.0	1	0.0	0.016	3.3	LOS A	0.1	0.4	0.06	0.54	0.06	46.6
6	R2	15	1.0	16	1.0	0.016	4.8	LOS A	0.1	0.4	0.06	0.54	0.06	46.1
Approach		17	0.9	18	0.9	0.016	4.7	LOS A	0.1	0.4	0.06	0.54	0.06	46.2
North: Witton Place														
7	L2	22	1.0	23	1.0	0.027	4.6	LOS A	0.1	0.7	0.02	0.51	0.02	46.7
8	T1	2	0.0	2	0.0	0.027	0.0	LOS A	0.1	0.7	0.02	0.51	0.02	47.1
9	R2	22	0.0	23	0.0	0.027	4.6	LOS A	0.1	0.7	0.02	0.51	0.02	46.3
Approach		46	0.5	48	0.5	0.027	4.4	NA	0.1	0.7	0.02	0.51	0.02	46.5
West: Road 2														
10	L2	10	0.0	11	0.0	0.008	4.6	LOS A	0.0	0.2	0.01	0.52	0.01	46.7
11	T1	1	0.0	1	0.0	0.008	3.3	LOS A	0.0	0.2	0.01	0.52	0.01	46.7
12	R2	1	0.0	1	0.0	0.008	4.7	LOS A	0.0	0.2	0.01	0.52	0.01	46.3
Approach		12	0.0	13	0.0	0.008	4.5	LOS A	0.0	0.2	0.01	0.52	0.01	46.7
All Vehicles		78	0.5	82	0.5	0.027	4.4	NA	0.1	0.7	0.03	0.51	0.03	46.5

Appendix C: Sight Distance Assessment

Prepared by Heath Consulting Engineers, provided as a separate document.

HEATH CONSULTING ENGINEERS

HENGCON PTY LTD
ACN 103 488 348

Postal Address:
PO BOX 2501
ORANGE NSW 2800

Office Location:
351 SUMMER STREET
ORANGE NSW

Our Ref: L01_19_073

14 November 2023

ARC Traffic & Transport
19 Canoon Road
SOUTH TURRAMURRA NSW 2074

Attention:

Dear Sir,

RE. PLANNING PROPOSAL PP-2023-934 - 277 CARGO ROAD, ORANGE – TRANSPORT ASSESSMENT

Reference is made to the Trasport Assessment for the above planning proposal and Transport for New South Wales (TfNSW) request for confirmation of Safe Intersection Sight Distance (SISD) at the proposed intersection location.

On Thursday 9 November 2023 a visual assessment of the SISD was carried out by this office. This assessment involved measuring the required SISD for TfNSW's intersection design speed of 10km/h above the posted speed limit (60km/h) using driver eye height of 1.1m and 1.25m for top of approaching car. From Table 3.2 of Austroads *Guide to Road Design Part 4A: Unsignalised Intersections (2017)* the required SISD for a design speed of 70km/h without grade correction is 151m.

Photographs of the sight distance assessment are included for reference. It must be noted that the photographs were taken from near the edge of the road. This was due to the fact that street trees would have obstructed the view with the photograph taken at 3 to 5m from edge line. It is proposed that the smaller trees to the east and west will be transplanted into the proposed new road to enable the intersection to be constructed. The larger pine trees to the east will be removed as part of the auxiliary left turn treatment construction with the small embankment also cut down for the widening thereby providing the required sight distance when measured at 3 to 5m behind the edge line.

The assessment showed that SISD would be achieved with the proposed intersection construction. Further, it is understood that Council may support a lowering of the posted speed limit to 50km/h and as such the SISD for 60km/h would be reduced to 123m without grade correction.

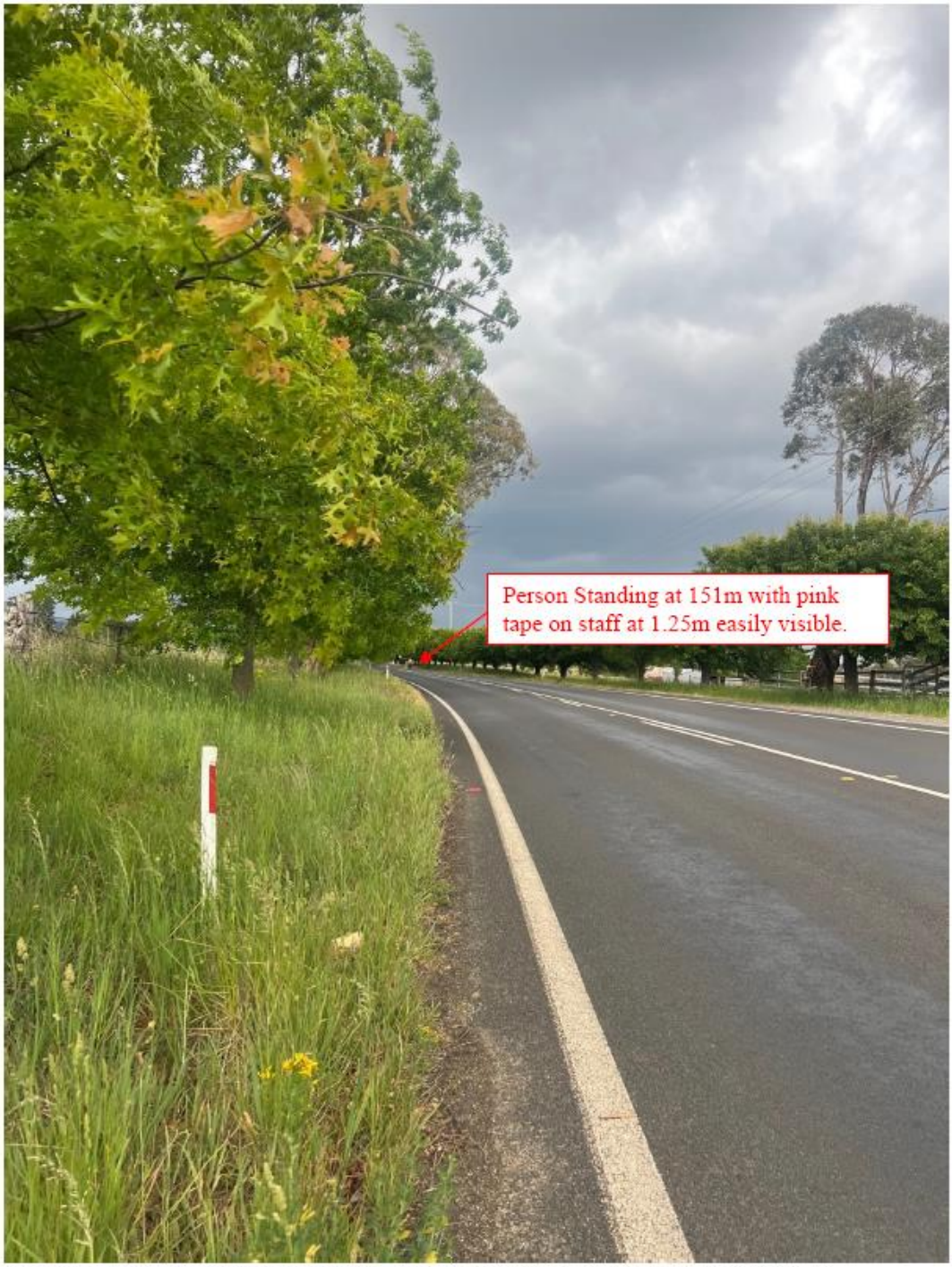


Figure 1 – View to the West from Proposed Intersection. Sight distance exceeds 151m

Three/Four small trees to the west to be transplanted into the road reserve of the proposed road.

Figure 2 – View to the East from Proposed Intersection. Sight distance exceeds 151m

Two small trees to the east to be transplanted into the road reserve of the proposed road. Larger pine trees to be removed as part of AUL construction.

If you have any questions or require additional information do not hesitate to contact the undersigned.

Yours faithfully
Heath Consulting Engineers

Per:
ROGER HEATH