Kialla North Growth Corridor

(Former Investigation Area 3)
Transport Impact Assessment

Prepared by: Stantec Australia Pty Ltd for Greater Shepparton City Council

on 22/12/2021

Reference: V201730

Issue #: A-Dr2

GTAconsultants now Stantec

Kialla North Growth Corridor

(Former Investigation Area 3)
Transport Impact Assessment

Client: Greater Shepparton City Council

on 22/12/2021

Reference: V201730

Issue #: A-Dr2

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A-Dr	30/08/2021	Preliminary Draft	Rebecca Strachan	Reece Humphreys	Reece Humphreys	
A-Dr2	22/12/2021	Draft	Rebecca Strachan	Reece Humphreys	Reece Humphreys	

GTAconsultants now Stantec

Melbourne | Sydney | Brisbane
Adelaide | Perth

CONTENTS

Appendices

Figures

Tables

1. INTRODUCTION

1.1. Background

The *Greater Shepparton Housing Strategy 2011 (GSHS)* was prepared to address the population growth outlined in the *Greater Shepparton 2030 Strategy Plan (2006)*. The GSHS set a target to provide an additional 9,100 dwellings in the region over the next 15 years (increase from approx. 21,000 dwellings in 2006 to 30,500 dwellings in 2031). Amendment C93 to the Greater Shepparton Planning Scheme was approved and gazetted in 2012 to incorporate the principles of the 2030 Plan and propose several areas for further investigation.

The Kialla North Growth Corridor (KNGC) is located on the south-eastern outskirts of Shepparton and is bound by Doyles Road, River Road, Archer Road, and the Broken River. Also formerly known as Investigation Area 3, it has been identified as a key growth area and is currently rural farmland. The Shepparton and Mooroopna 2050: Regional Growth Plan envisages that the Kialla North Growth Corridor could accommodate approximately 2,150 future residents, however Council believes that this number would be lower at approximately 1,800 residents.

This level of growth will create a change to the township, including an increase in local travel demands with the new residents accessing work, retail, schooling, and other broader regional services. Moreover, any planning for this precinct needs to consider the role and function of the network in the area and in particular any potential connections to the Shepparton Alternate Route (SAR).

To successfully support and deliver the anticipated population growth and associated increased travel demands, Council has identified the need to develop an overarching urban structure plan for the township of Kialla. This will help reduce the potential for ad-hoc proposals with poor coordination and integration, ultimately impacting its ongoing liveability and investment.

Council is now seeking to understand the traffic and transport requirements for the KNGC and how they best integrate with the existing environment and other urban structure considerations (i.e., drainage, open space, etc.) to guide the future development of the area.

GTA, now Stantec have been commissioned by the Greater Shepparton City Council (Council) to undertake a transport study for KNGC to confirm the transport network required to support the KNGC, including intersection layouts to input into the Development Contributions Plan (DCP).

1.2. Purpose & Structure of this Report

This report sets out the traffic and transport impact assessment methodology undertaken to determine the anticipated demands on the transport network, including consideration of the following:

1. existing and future road infrastructure and operating conditions surrounding the growth corridor
2. traffic generation and distribution characteristics of the ultimate growth corridor development
3. ability of the proposed road network to accommodate the future demands of the growth corridor
4. a determination of intersection types and layouts to accommodate the future demands of the growth corridor.

The outputs of this report form part of an input into providing a high-level understanding of the transport infrastructure requirements that would form a preliminary DCP.

1.3. References

In preparing this report, reference has been made to the following:

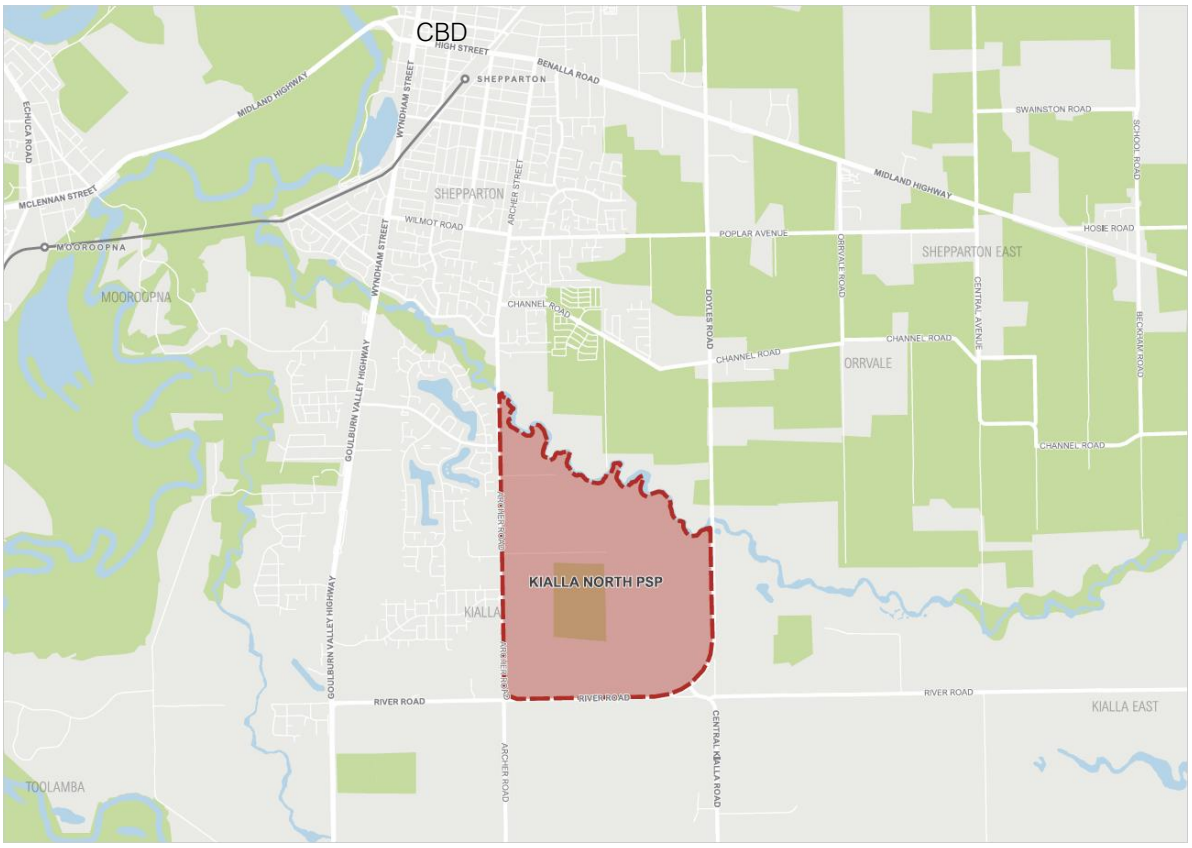
- Greater Shepparton Planning Scheme
- plans and documentation for the growth corridor prepared by Hansen Partnership on behalf of Greater Shepparton City Council
- various technical data as referenced in this report
- an inspection of the site and its surrounds
- other documents as nominated.

2. SITE CONTEXT

2.1. Location

The KNGC is a site of approximately 459 hectares located 3.5km southeast of the Shepparton CBD as shown in Figure 2.1.

Figure 2.1: Study area location



Existing land uses comprise mostly of farmland (crops) and there are a few residential uses scattered throughout the site. The existing road network is described further in Section 3.3.

2.2. Strategic Transport Network in Shepparton

Planning and development of the transport network accessing and within Shepparton is ongoing. Several north-south and east-west network improvements are proposed to support growth and to improve traffic and amenity in the existing parts of Shepparton. These improvements are generally built on the delivery of the Shepparton Bypass, which consists of the continuation of the duplicated four-lane cross-section of Goulburn Valley Highway to travel around the western side of Shepparton to Congupna in the north.

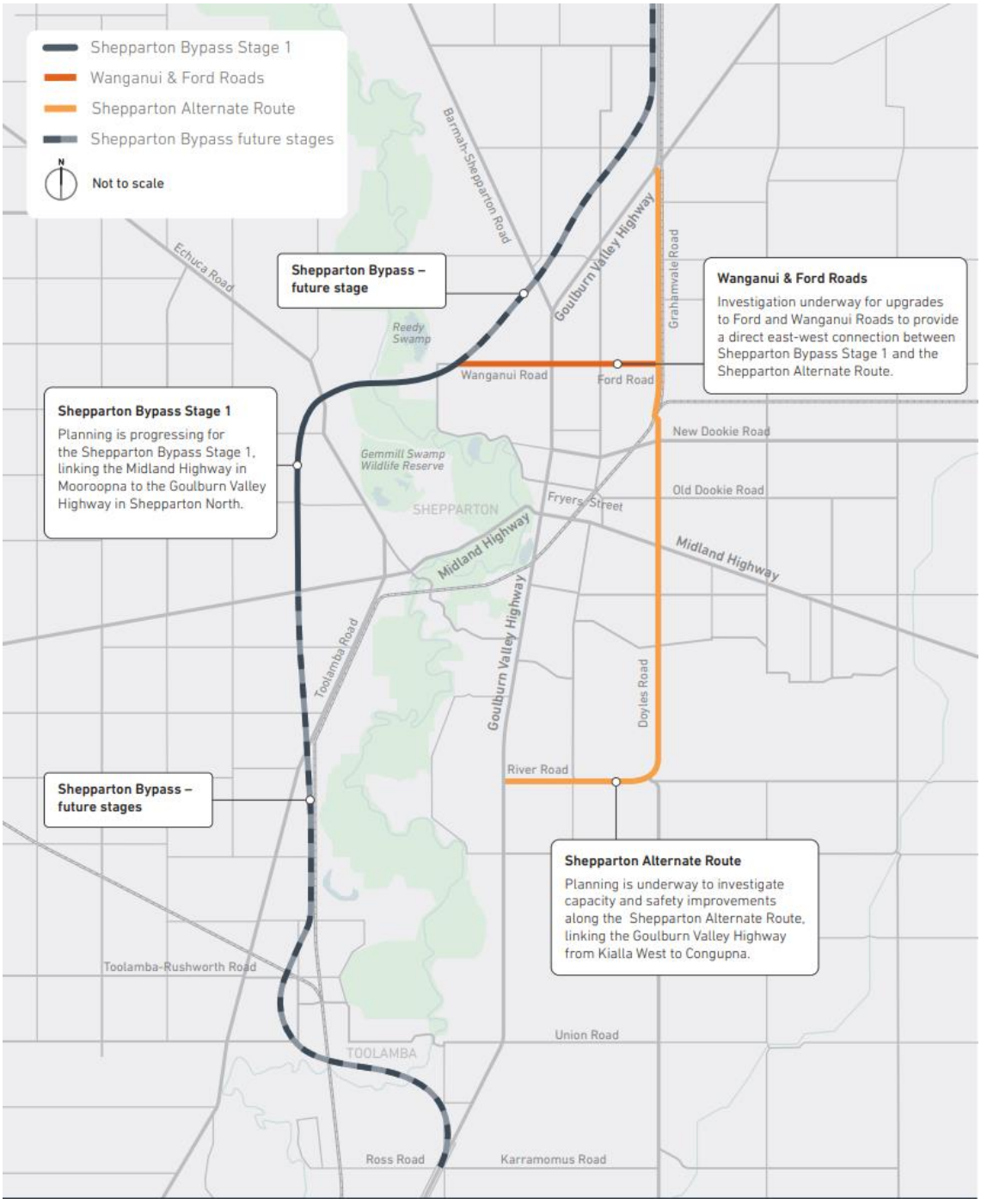
The associated 36km four-lane Shepparton Bypass was estimated to cost approximately $1.3 billion in 2016. As such, the project has been split into five stages, with a single carriageway each way in the first instance, to get the project underway and funded. In this regard, the following shorter-term network improvements are currently being investigated:

- Shepparton Bypass Stage 1: Between Midland Highway and Wanganui Road
- Shepparton Alternative Route (SAR): Upgrade of River Road, Doyles Road and Grahamvale Road
- Link between Bypass and SAR: Upgrade of Wanganui Road and Ford Road
- Midland Highway Safety Improvements.

The associated investigations are currently being led by Regional Roads Victoria (RRV) through a Project Liaison Group (PLG). The PLG includes representatives from Council, relevant Victorian Government agencies, key environment and community groups and local landowners.

An image of the network improvements currently being investigated is presented in Figure 2.2.

Figure 2.2: Shepparton Network Improvements Currently Being Investigated



Source: Major Road Projects Victoria - Bypassing Shepparton

The SAR travels the eastern fringes of the urban area of Shepparton along Doyles Road which abuts the KNGA and consideration for a range of design elements has been included in this report.

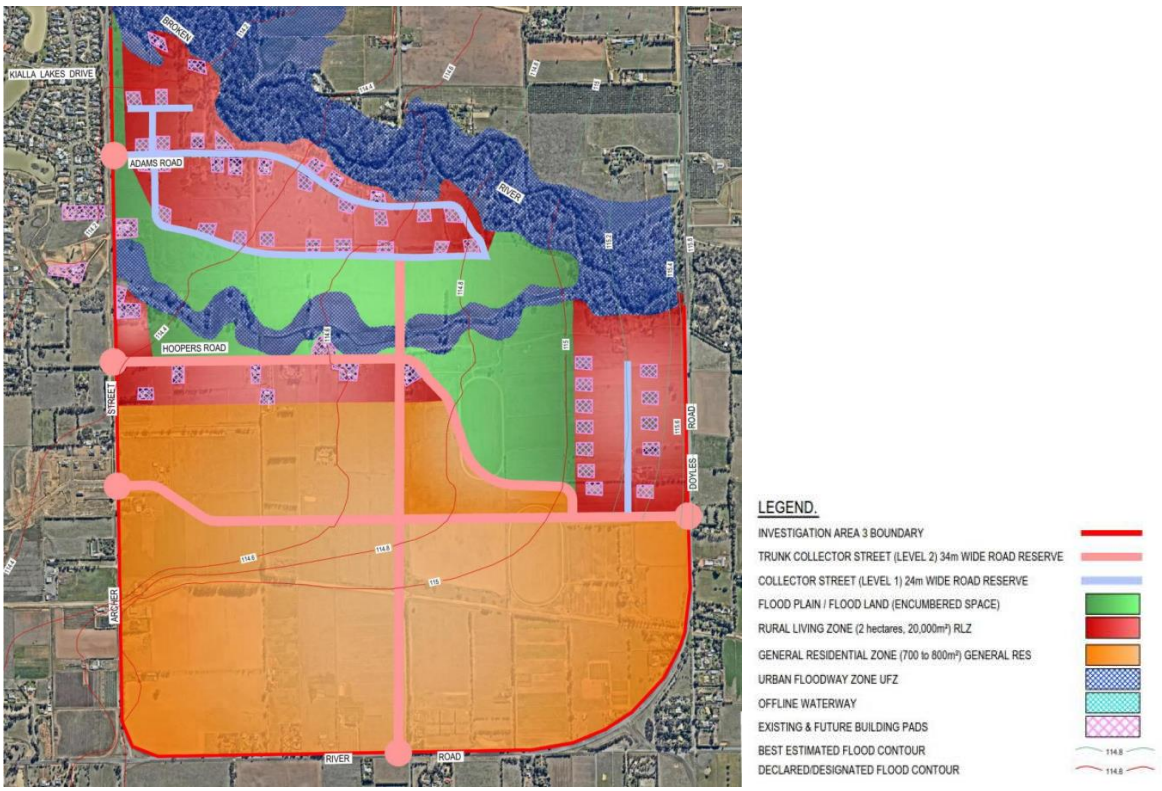
3. PROPOSAL

3.1. Precinct Structure Plan

In 2016, to complete the assessment of Investigation Area 3, Council engaged Water Technology to prepare a model of flood behaviour and a conceptual masterplan to provide an indicative framework for the future development of the KNGC.

It is envisaged that the KNGC will include a range of standard single dwelling low-density residential lots as well as a small number of rural residential lots. The conceptual masterplan is outlined in Figure 3.1 below, noting that the conceptual masterplan was not informed by any other specialist background reports.

Figure 3.1: Kialla North Growth Corridor



Source: Investigation Area 3 Report dated June 2016, Water Technology

This urban structure has been prepared to help inform an understanding of the likely yield for the KNGC and the potential connections to the existing arterial transport network.

3.2. Anticipated Development Yields

The anticipated development yields for the KNGC were provided by the study team and are summarised based on the sub-areas outlined in Figure 3.1. The internal sub-areas (or zones) have been adopted in the modelling process which is summarised in Section 4.

Figure 3.2: Kialla North Growth Corridor Zone Structure

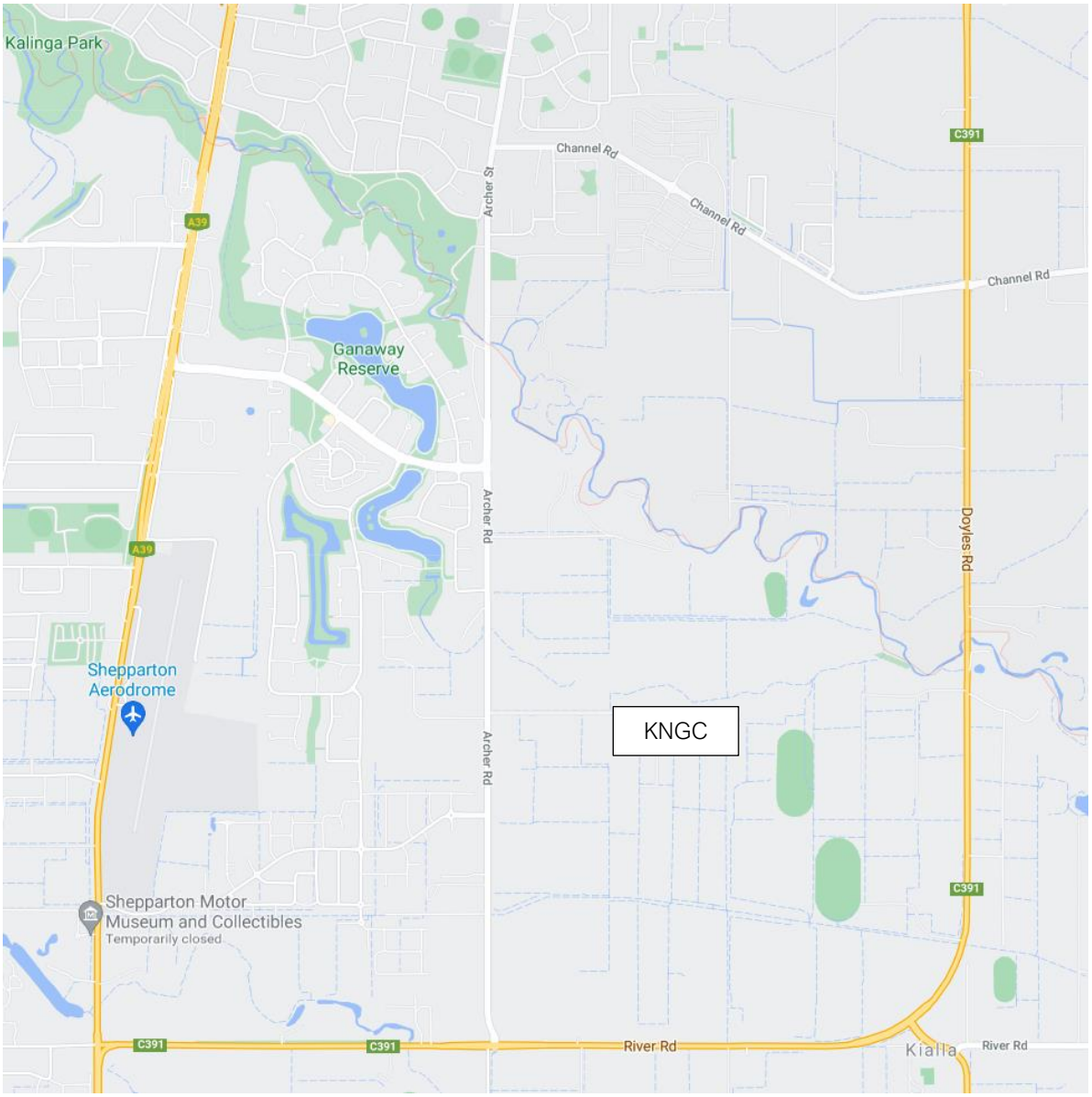
Zone	Land Use Type	Total
1	Rural Residential	30 Dwellings
2	Rural Residential	10 Dwellings
3	Rural Residential	10 Dwellings
4	Residential	340 Dwellings
5	Residential	95 Dwellings
6	Residential	370 Dwellings
7	Residential	345 Dwellings
8	Residential	320 Dwellings
9	Residential	280 Dwellings
	TOTAL	1,800 Dwellings

It is anticipated that the KNGC will ultimately provide up to 1,800 dwellings with most of the yield located in the southern portions of the land.

3.3. KNGC Transport Network

As shown in Figure 3.3, KNGC is bordered by arterial roads on the east and south sides (Doyles Road and River Road respectively), a connector street on the western side (Archer Road) and Broken River to the north.

Figure 3.3: Existing Road network around KNGC



The existing and anticipated future characteristics of the key roads and intersections surrounding and within KNGC are discussed in the following sections.

3.3.1. Arterial Roads

River Road

River Road (C391) functions as a secondary arterial road (RRV controlled) and is the heavy vehicle bypass route for Shepparton. It is also located within a Road Zone (Category 1) in the Greater Shepparton Planning Scheme. It is a two-way road aligned in an east-west direction and configured with a two-lane carriageway (one lane in each direction), with localised widening at some intersections to provide for left and right turn deceleration lanes. The current speed limit is 80km/h.

There is currently a planning study underway to investigate potential capacity upgrades to River Road to form part of the Shepparton Alternative Route (SAR). This would ultimately include roundabout upgrades at River

Road / Archer Road and River Road / Central Kialla Road and asphalt resurfacing to accommodate additional freight movements.

River Road between Goulburn Valley Highway and Doyles Road currently carries approximately 5,700 vehicles on a typical weekday (28% heavy vehicles)[1].

Doyles Road

Doyles Road (C391) functions as a secondary arterial road (RRV controlled) and is the heavy vehicle bypass route for Shepparton. It is also located within a Road Zone (Category 1) in the Greater Shepparton Planning Scheme. It is a two-way road aligned in a north-south direction and configured with a two-lane carriageway (one lane in each direction), with localised widening at some intersections to provide for right turn deceleration lanes.

There is currently a planning study underway to investigate potential capacity upgrades to Doyles Road to form part of the Shepparton Alternative Route (SAR). This would include roundabout upgrades with Central Kialla Road and Channel Road and asphalt resurfacing to accommodate additional freight movements. Further into the future Doyles Road is also likely to be duplicated.

Doyles Road between Midland Highway and Dookie-Shepparton Main Road currently carries approximately 6,600 vehicles per day (26% heavy vehicles)[2].

3.3.2. Local Roads

Archer Road

Archer Road is a local road (Council controlled) and functions as a collector street between River Road and Kialla Lakes Drive. The road is located within a Road Zone (Category 2) in the Greater Shepparton Planning Scheme. It is a two-way road aligned in a north-south direction and configured with a two-lane carriageway (one lane in each direction). The current speed limit is 80km/h.

Archer Road between Sanctuary Drive and River Road currently carries approximately 2,000 vehicles on a typical workday (11% heavy vehicles)[3].

Kialla Lakes Drive

Kialla Lakes Drive is a local road (Council controlled) and functions as a collector street between Goulburn Valley Highway. The road is located within a Road Zone (Category 2) in the Greater Shepparton Planning Scheme. It is a two-way road aligned in a generally east-west direction. The road is configured with a two lane-carriageway (one lane in each direction) and an approximately 10m wide median with trees. Kialla Lakes Drive provides right turn deceleration lanes and a bike lane on both sides of the road. Unrestricted kerbside parallel parking exists on some parts of the road.

Hoopers Road

Hoopers Road is a local road (Council controlled) that functions as an access street. The street is located east of Archer Road and is a no through road. It is a two-way road aligned in an east-west direction and the road has no lane marking.

---

1 Based on Standard Volume Summary Reports prepared by VicRoads for River Road west of Doyles Road intersection, dated 2 February 2021 and 3 February 2021.

2 Based on Standard Volume Summary Reports prepared by VicRoads for Doyles Road between Midland Highway and Dookie-Shepparton Main Road, dated 10 June 2014.

3 Based on Standard Volume Summary Reports prepared by VicRoads for River Road Archer Road Kialla, dated 3 March 2020 and 4 March 2020.

Adams Road

Adams Road is a local road (Council controlled) that functions as an access street. The street is located east of Archer Road and is a no through road. It is a two-way road aligned in an east-west direction and the road has no lane marking. Towards the east, Adams Road becomes unsealed.

Wendouree Drive

Wendouree Drive is a local road (Council controlled) that functions as an access street. Wendouree Drive is located west of Archer Road and is predominantly aligned in a north-south direction until south of Malmsbury Crescent where it bends to become an east-west road. It is proposed that Wendouree Drive will be extended to form a roundabout with Archer Road in the future.

3.3.3. Summary

The current two-way daily traffic volumes are summarised in Table 3.1.

Table 3.1: Summary of Two-Way Daily Volumes on Key Roads (Existing)

Road Name	Daily Traffic Volume	Classification / Authority	No. lanes
River Road	5,700 veh	Primary Arterial – DoT	Four Lanes (two each way)
Doyles Road	6,600 veh	Secondary Arterial – DoT	Two Lanes (one each way)
Archer Road	2,000 veh	Connector Street – Council	Two Lanes (one each way)
Kialla Lakes Drive	N/A	Connector Street – Council	Two Lanes (one each way)
Hoopers Road	N/A	Access Street – Council	Two Lanes (one each way)
Adams Road	N/A	Access Street – Council	Two Lanes (one each way)
Wendouree Drive	N/A	Access Street – Council	Two Lanes (one each way)

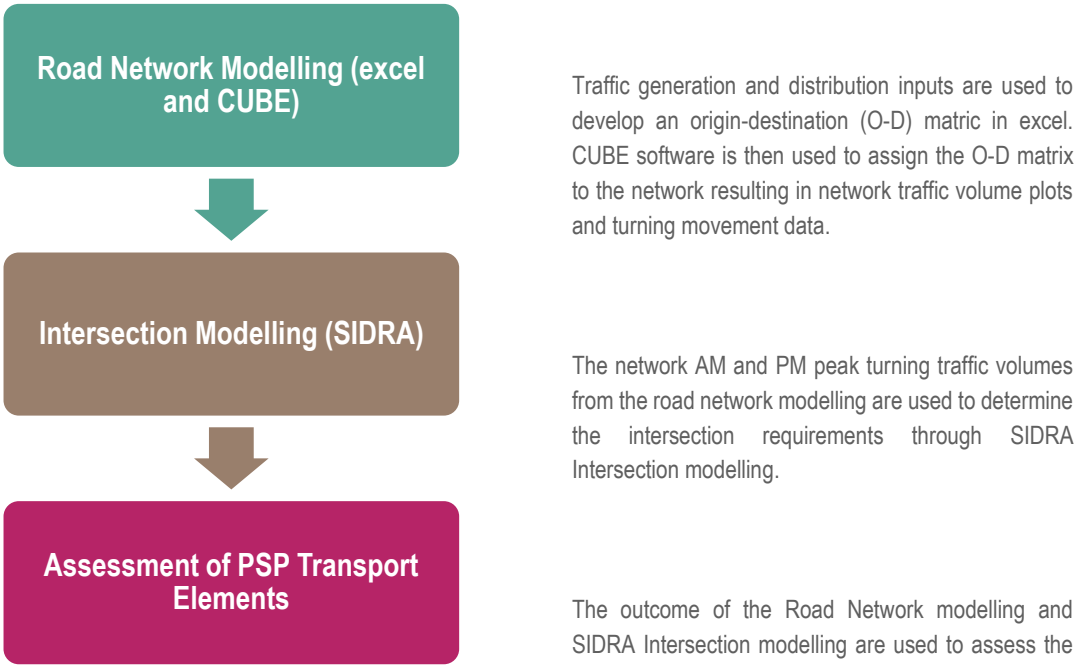
4. FORECAST TRAFFIC VOLUMES

4

4.1. Overview

The approach to the overall transport impact assessment adopted for the analysis of the KNGC is broadly summarised in Figure 4.1

Figure 4.1: Traffic Impact Methodology



It is noted that the road network modelling outlined in this report provides a broad indication of the traffic volumes likely to be generated by KNGC and its surrounds. It is acknowledged that the analysis is based on future road network and development yield inputs, which are centred on a range of underpinning assumptions that may vary as the development of the area proceeds.

Section 4.2 summarises the Road Network Modelling, with the Intersection Modelling and assessments summarised in Section 5.

4.2. Road Network Modelling Methodology

The road network modelling process for this study is based on the following steps:

- Step1: Traffic Generation: the trips generated by the growth area were calculated by applying appropriate generation rates to the land uses defined within each of the internal zones of the study area.
- Step 2: Traffic Distribution: the generated trips are distributed to internal and external zones based on key origins and destinations in and around the growth area. In conjunction with Step 1 this allows an origin-destination (O-D) matrix for the growth area generated traffic to be formulated in excel.
- Step 3: Background Traffic Volume Assessment: the anticipated 2031 background traffic volumes on the network that do not have an origin or destination in the growth area were assessed.
- Step 4: Traffic Assignment: The O-D matrix and background traffic volume data was input into CUBE modelling software which assigned the vehicle trips onto the road network. The CUBE assignment process distributes traffic with consideration given to the travel time and capacity constraints of road links; however, it does not consider changes in travel behaviour because of delays experienced at intersections (which would require more detailed operational modelling).

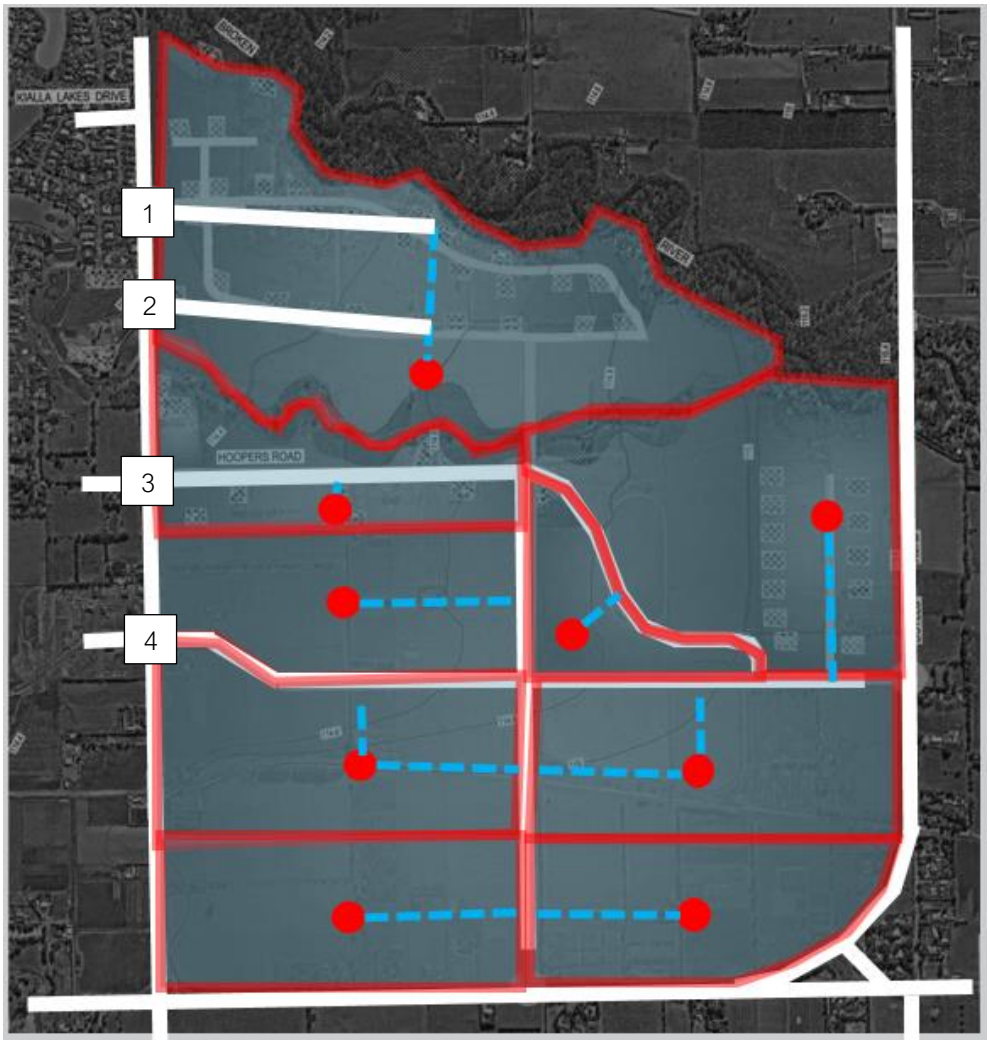
Each of the above steps and the resulting 2031 post-development traffic volumes are summarised in the following sub-sections.

4.2.1. Model Network

A depiction of the modelled network is shown graphically in Figure 4.2. The subject site has been split into nine zones, three of which are low density residential with the remainder being residential. The network includes an internal grid network for access to the land parcels with four access points, all to Archer Road via:

1. Adams Road
2. Access Point 2
3. Hoopers Road
4. Access Point 3 opposite Sanctuary Drive

Figure 4.2: Example of Model Extents



Through discussions with the DoT and MRPV, no connections to River Road and Doyles Road (i.e., the SAR) are currently proposed to be provided. However, there are recommendations from Council that a road reserve should be set aside in the south-eastern corner of the site to allow a connection to Kialla Central Road in the future if the existing intersection is upgraded to a roundabout. This is discussed further in Section 4.7.2.

4.3. Traffic Generation

The traffic generation rates for the residential land use have been sourced from surveys undertaken by GTA and other traffic and transport consultants, as well as the New South Wales Road Transport Authority (RTA) "Guide to Traffic Generating Developments" (RTANSW) document.

The traffic generation rates adopted in the assessment are summarised in Table 4.1.

Table 4.1: Adopted Traffic Generation Rates

Land Use	Generation Rate			Source
	AM Peak	PM Peak	Daily	
Residential	1.0 trips/hh	1.0 trips/hh	10.0 trips/hh	Surveys by GTA and others of comparable sites with limited public transport accessibility

The rates outlined in Table 4.1 are comparable to rates adopted by GTA in the assessment of other recently completed PSPs in Melbourne's growth areas, including the Shepparton South East PSP. For the purpose of this assessment, we have:

- adopted a common rate for the rural and low density residential
- adopted a 10% reduction to the traffic generation rates to reflect internal trips. Although at the current stage of planning there are not proposed to be any land uses other than residential, it is typical that a development of this size would require some local retail land uses and maybe even a school to be provided. Therefore, some allowance has been made for this.

Based on the above, the daily AM and PM peak hour traffic generations, as well as the anticipated development yields for KNGC area are summarised in

Table 4.2: Anticipated Daily Traffic Generation

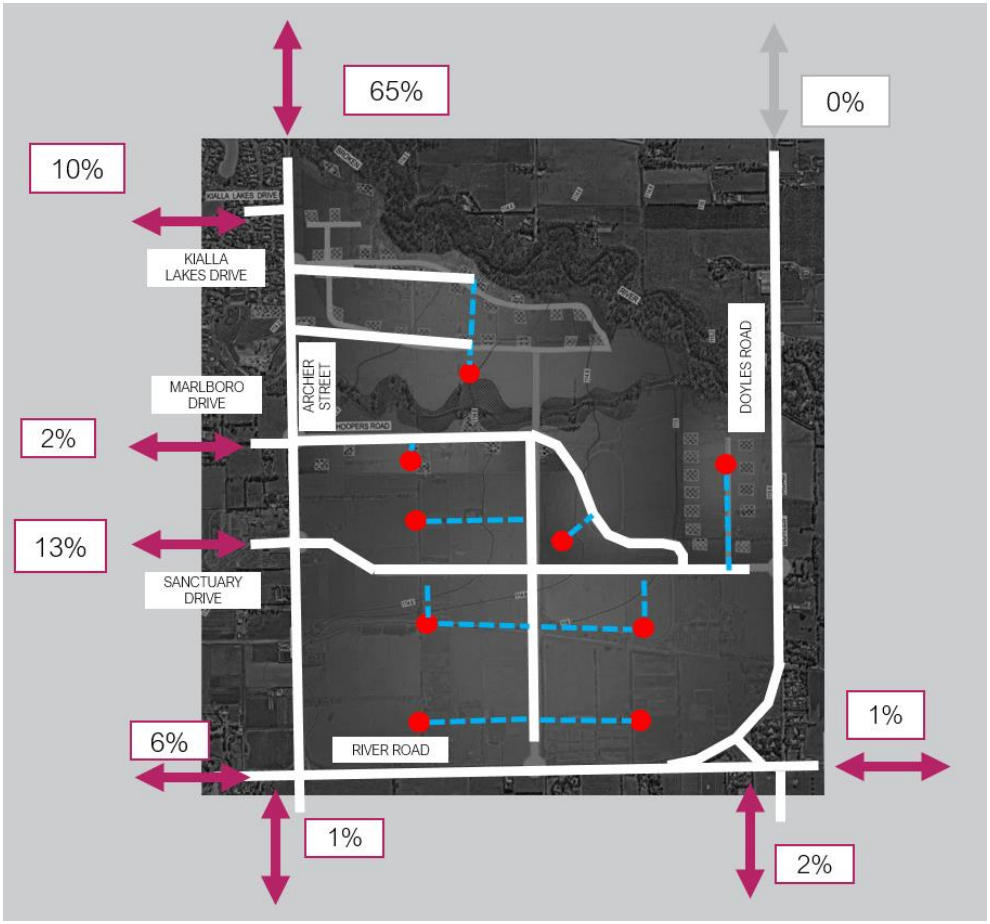
Zone	Land Use	AM Peak Total Trips	PM Peak Total Trips	Daily Total Trips
1	30 Dwellings (Rural Residential)	27	27	270
2	10 Dwellings (Rural Residential)	9	9	90
3	10 Dwellings (Rural Residential)	9	9	90
4	340 Dwellings (Residential)	306	306	3,060
5	95 Dwellings (Residential)	86	86	855
6	370 Dwellings (Residential)	333	333	3,330
7	345 Dwellings (Residential)	311	311	3,105
8	320 Dwellings (Residential)	288	288	2,880
9	280 Dwellings (Residential)	252	252	2,520
Total		**1,620**	**1,620**	**16,200**

Table 4.2 indicates an expected total daily traffic generation of some 16,200 daily vehicle movements, with some 1,620 in the AM and PM peak periods.

4.4. Traffic Distribution

The distribution of the traffic generated by the KNGC onto the external road network has been determined based on the attractiveness of the connecting road network and the surrounding major locations of employment, retail/commercial areas, and community facilities. Most notably in the area are the bordering arterial roads to the north and east of the KNGC, and the Shepparton CBD which is located to the northwest. In this regard, the adopted directional distributions are presented in Figure 4.3.

Figure 4.3: Development Traffic Distribution



In addition to the above, the directional split of traffic (i.e., ratio between the inbound and outbound traffic movements) for the various land uses is outlined in Table 4.3.

Table 4.3: Directional Split of Traffic by Land Use

Land use	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
Residential	20%	80%	60%	40%

4.5. Background Traffic Volume Growth

A strategic transport model has been developed by AECOM for the City of Greater Shepparton and regularly updated to help inform analysis and decision making around the development of the Shepparton transport network.

The model was originally developed in 2012 to help identify the most appropriate overall alignment for the Shepparton Bypass. It was then updated in 2016 to reflect increases in population growth in Shepparton and the staging of the overall bypass (i.e., focussed on Stage 1). More recently, in 2018 the model was updated to reflect more specific elements of the design of Stage 1 of the Shepparton Bypass and other proposed network level interventions.

GTA was not able to obtain a copy of the 2018 model update and have utilised the 2016 version for this study to understand how traffic conditions proximate to the KNGC will change, both immediately following development. This approach is consistent with the modelling completed for the Shepparton South East PSP (SSEPSP) area to the north of Poplar Road. The 2016 model includes the years of 2016, 2021, 2031 and 2041 and includes traffic from the SSEPSP.

4.6. Traffic Assignment – Resultant Volumes

With the above inputs to the CUBE modelling software, the KNGC generated traffic volumes are distributed throughout the internal and connecting road network. Where available route choices exist, the traffic volumes are generally distributed based on the shortest travel times, which take into consideration the capacity constraints defined for each road link. However, due to the coarse nature of the CUBE modelling platform, and our understanding of driver behaviour and likely intersection operations, an iterative process is undertaken through the modification of the capacity constraints of specific road links to achieve a distribution that is consistent with the expected function and role of at least the arterial and connector road network within and connecting to Kialla North.

4.7. Modelling Outputs

The following traffic modelling outputs have been prepared and are presented in Appendix A.

- two-way daily traffic volumes
- two-way AM peak 2-hour traffic volumes
- two-way PM peak 2-hour traffic volumes.

4.7.1. Ultimate Two-Way Volumes

A key component of the modelling outputs is understanding the expected two-way daily traffic volumes on the key roads within and connecting Kialla North against their expected capacity. These two-way daily traffic volumes are summarised in Table 4.4, along with a commentary on the appropriateness of their classification.

Table 4.4: Summary of Ultimate Two-Way Daily Volumes on Key Roads (2031 post-development)

Road Name	Expected Daily Traffic Volume	Proposed Classification and No. lanes	Classification-based Daily Traffic Volume Limit [1] – Planning Scheme	IDM Classification (Indicative Max. Traffic Volumes) [2]	Is Proposed Classification Considered Appropriate?
River Road	12,650vpd	Primary Arterial (2 lanes)	Greater than 7,000vpd	N/A	Yes
Doyles Road	15,750vpd	Secondary Arterial (2 lanes)	Greater than 7,000vpd	N/A	Yes
Archer Road	8,050 - 20,350vpd [3]	Connector Street – Level 2 (2 lanes)	3,000 to 7,000vpd	Connector Street Level 2 (6,000 - 12,000 vpd). Not appropriately classified.	Partially
Adams Road	150vpd	Connector Street – Level 1 (2 lanes)	3,000vpd	Connector Street Level 1 (2,500 -6,000 vpd). Appropriately classified.	Yes
New Northern Access	100vpd	Connector Street – Level 1 (2 lanes)	3,000vpd	Connector Street Level 1 (2,500 -6,000 vpd). Appropriately classified.	Yes
Hoopers Road	5,850vpd	Connector Street – Level 1 (2 lanes)	3,000vpd	Connector Street Level 1 (2,500 -6,000 vpd). Appropriately classified.	Yes
New Southern Access	12,050vpd	Connector Street – Level 2 (2 lanes)	3,000 to 7,000vpd	Connector Street Level 2 (6,000 - 12,000 vpd). Appropriately classified.	No

[1] Based on Table C1 of Clause 55.06 of the Greater Shepparton Planning Scheme, which are generally consistent with the maximum traffic volumes indicated in Table 2 of the Infrastructure Design Manual (version 4.2, dated 1/11/13).

[2] Based on Table 2 Urban Road / Street Characteristics within the Infrastructure Design Manual, Version 5.20

[3] Volume varies along length. Volumes more than 12,000 occur north of Hoopers Road. 20,350vpd volume expected north of Kialla Lakes Drive

Based on

Table 4.4, there are two road links where the proposed road classifications do not align with the daily traffic volume ranges associated with the classification within the Shepparton Planning Scheme. These links are:

- Archer Road
- New Southern Access

For Archer Road, there are three main sections whereby the anticipated Daily Traffic Volumes vary significantly. The relevant sections are discussed below:

- River Road to Hoopers Road: The anticipated daily traffic volume of 8,050-10,950vpd would align with the Planning Scheme volume threshold for a Connector Street – Level 2.
- Hoopers Road to Channel Road: Archer Road is expected to carry more than 15,450vpd and would exceed the theoretical mid-block capacity limits for a Connector Street – Level 2 and instead be carrying volumes which are more consistent with the road classifications for an arterial road. This is not specifically just a function of the proposed KNGC and therefore further discussions are included in Section 4.7.2 regarding the treatment of Archer Road.

It should be noted that the daily traffic volume ranges associated with the classification are only a guide. It is expected that the above roads will be able to accommodate the anticipated ultimate daily traffic volumes through suitable intersection arrangements, which are considered further in the following section of the report.

4.7.2. Archer Road

As identified in the sections above, the forecast volumes for Archer Road, north of Hoppers Road are anticipated to be more in line with those of an arterial road. Therefore, the anticipated volumes may not be representative of the road hierarchy that Council wants for the area and further consideration from council may be necessary to investigate opportunities for local area traffic management or alternative measures to reduce the volume of traffic using Archer Road.

Currently Council is proposed that KNGC have all access occurring from Archer Road and therefore the development will contribute to the high traffic volumes on Archer Road. However, in the longer term when River Road and Doyles Road are upgraded to the SAR, and a roundabout proposed at the intersection with Central Kialla Road, it may be possible to provide an additional access point for KNGC as the fourth leg to the roundabout. If a road reserve was set aside during the planning stages of the project, and the internal road network designed with this in mind, this would allow an alternative access to be provided if necessary, in the future.

5. INTERSECTION ASSESSMENTS

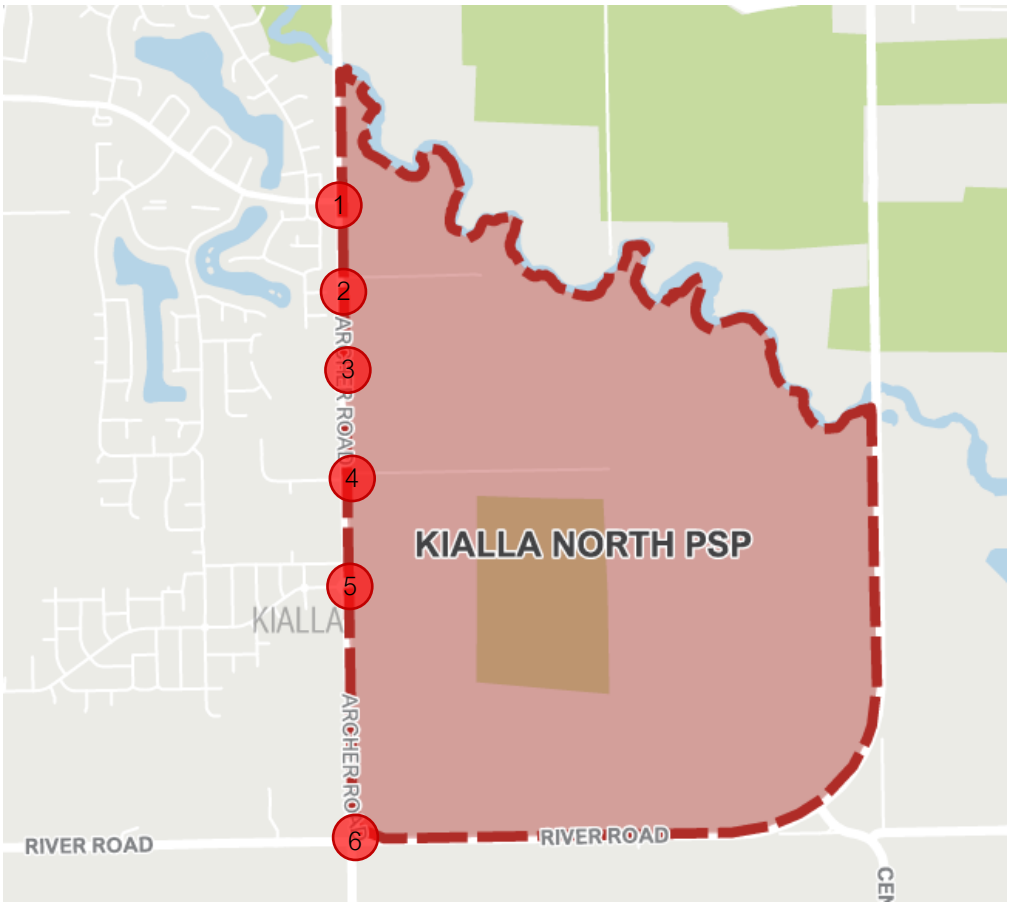
5.1. Overview

Assessments of a select number of intersections have been undertaken to determine the suitability of the proposed layouts with the expected 2031 post-development traffic volumes. The selection of these intersections has been completed in partnership with Council and are generally in accordance with the planning guidelines for connecting arterial and/or connector roads in the context of a precinct structure plan.

It should also be noted that the purpose of assessing the performance of the intersections within and connecting to the KNGC is for the purpose of being able to provide preliminary guidance into determining the cost of constructing them and informing a potential Developer Contributions Pan (DCP).

The intersections that have been assessed are shown in Figure 5.1 and have been determined based on consultation with Council officers. It is noted that the proposed intersection of Archer Road / Wendouree Drive has not been assessed as the traffic demands for Wendouree Drive are outside the scope of works for KNGC. Furthermore, no intersections within KNGC have been assessed as it is expected that the internal demands would be adequately serviced by roundabouts as the volumes will be significantly less than the volumes expected to occur at roundabouts along Archer Road.

Figure 5.1: Intersections to be assessed in the context of Kialla North Growth Corridor



5.2. Intersection Volumes

CUBE modelling software is a coarse modelling platform and hence care should be exercised when extracting individual links or turning movement flows. It is typically not used for the purpose of determining intersection turning movements, as turning movements are influenced by several factors not considered by such a modelling platform.

As such, we have developed an approach that seeks to provide a balanced outcome for each intersection. The approach adopted in arriving at future turning flows for the purpose of assessing specific intersections as part of the KNGC is summarised as follows:

- Extract AM and PM peak period (2-hour) intersection turning movements from the traffic network model for the associated intersections and convert to peak 1-hour flows using the 0.55 factor (industry standard).
- Assess each intersection individually to ensure that turn flows are reasonable having regard for the existing and future road networks and make refinements where appropriate. We note that CUBE has overestimated the amount of traffic from KNGC which would travel north via River Road / Doyles Road and have therefore adjusted the volumes according with percentages included in Figure 4.3.
- Apply engineering 'judgement' to turning movements that exhibit low or unrealistic movements based on the network layout and accounting for typical individual driver behaviour.

The resulting 2031 post-development peak hour traffic volumes for the intersections being assessed are presented in Appendix B.

5.3. Selection of Intersection Treatment Types

VicRoads' *Supplement to Austroads Guide to Traffic Management. Part 6* (Edition 1, October 2015) specifies that at intersections of primary/primary or primary/secondary arterial roads, where traffic volumes during the peak periods are appropriately low enough, the selection of a 'roundabout' treatment should be defined as a "most likely treatment" rather than "may be an appropriate treatment". Signalised intersections may be necessary if the major approach carries at least 600 vehicles per hour (two-way) and the minor road carries at least 200 vehicles per hour (two-way) or if the traffic flows are significantly unbalanced.

In this regard, the internal intersections of KNGC are expected to be suitably serviced by roundabouts. These intersection types tend to be the most land intensive but provide a high level of traffic capacity and low severity car-on-car accidents. However, roundabouts do have limited ability in supporting crossing pedestrians, and the mixing of cyclists and vehicles within the circulating lane. As the designs of the internal roundabouts progress, it is recommended that consideration be given to providing central refuges that are at least 2.0m wide and achieve approach and circulating vehicle speeds of approximately 20km/h to support pedestrian and bicycle movements.

For the intersections with Archer Road, the following design principals have been adopted:

- The posted speed limit along Archer Road will be reduced from 80km/h to 60km/h
- On road bicycle lanes are being proposed at this stage of the project, in accordance with the Infrastructure Design manual. The treatment of bicycles at roundabouts has required the bicycle lanes to end and for bicycles to share the road with other traffic through the roundabout, enabling them to be front and centre of approaching vehicles. Although this may not represent the current safe systems best design practice (segregation is preferred), it is considered an appropriate response for this scope of works given the number of cyclists expected. Council may seek to apply for other funding to provide off road bicycle facilities in the future.

- maximise the use of existing infrastructure as far as practical
- intersections have been designed to accommodate a 12.5m bus and allow for a 19m semi-trailer as a check vehicle

With regards to the intersections interfacing with the surrounding road network, existing intersection types will generally be maintained. The specific proposed intersection treatments are discussed in more detail below.

5.3.1. Archer Road / Kialla Lakes Drive

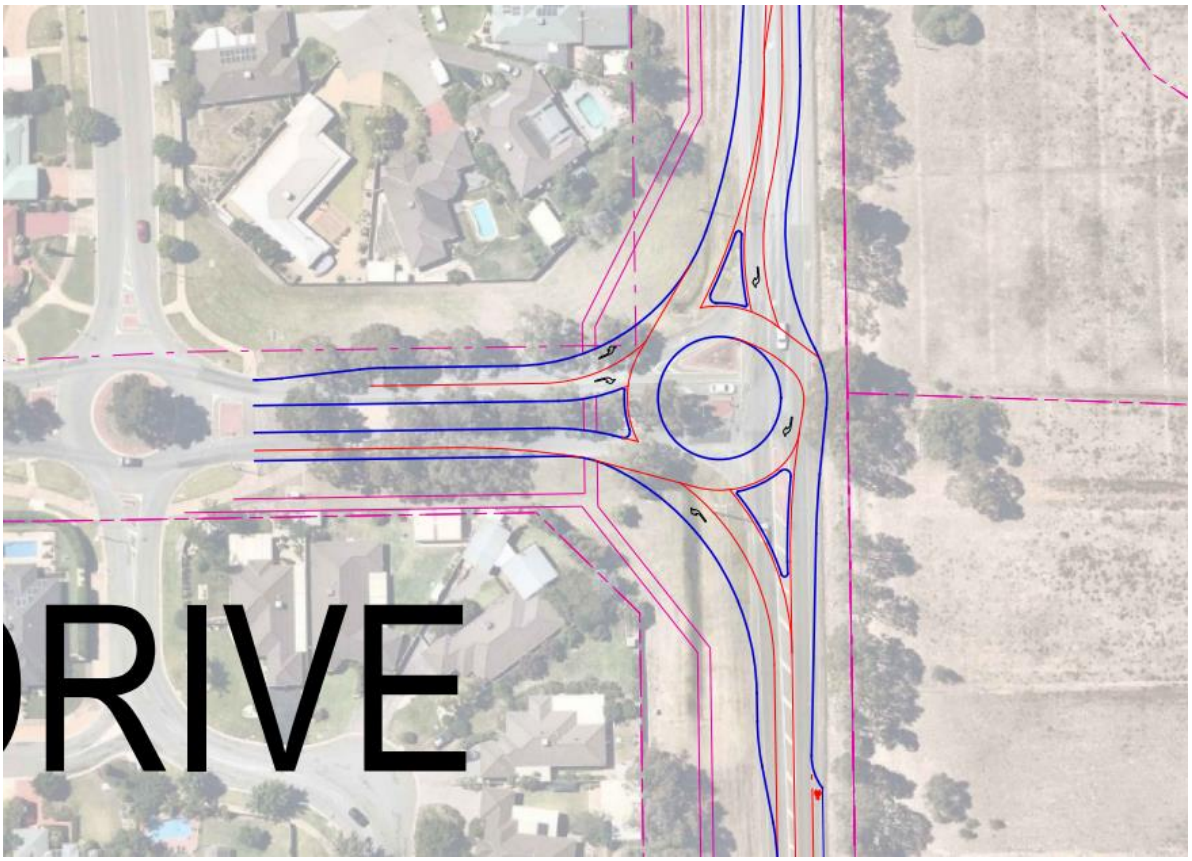
Archer Road / Kialla Lakes Drive is currently an unsignalised T-Intersection. On the north approach a dedicated through lane and a separate short right turn lane is provided whilst on the south approach through and left turn movements share a single lane. On Kialla Lakes Drive, left and right turn movements are separated with a short-left turn slip lane provided.

A review of the Warrants for Turn Lanes (Austroads Guide to Road Design Part 4) identifies that under the future traffic volumes, the left and through movement on the south approach would need to be separated through the provision of a left turn deceleration lane if the existing intersection configuration was retained.

However, under the future volumes and using preliminary intersection analysis it was identified that a roundabout is considered the most preferred treatment to slow all vehicles down on approach to the intersection and introduce appropriate gaps and priority for turning vehicles. Separate turn lanes are proposed on each approach to balance the traffic volume and intersection operation.

The proposed layout is shown in Figure 5.2 and full drawings included in Appendix C.

Figure 5.2: Archer Road / Kialla Lakes Drive intersection design



5.3.2. Archer Road / Adams Road

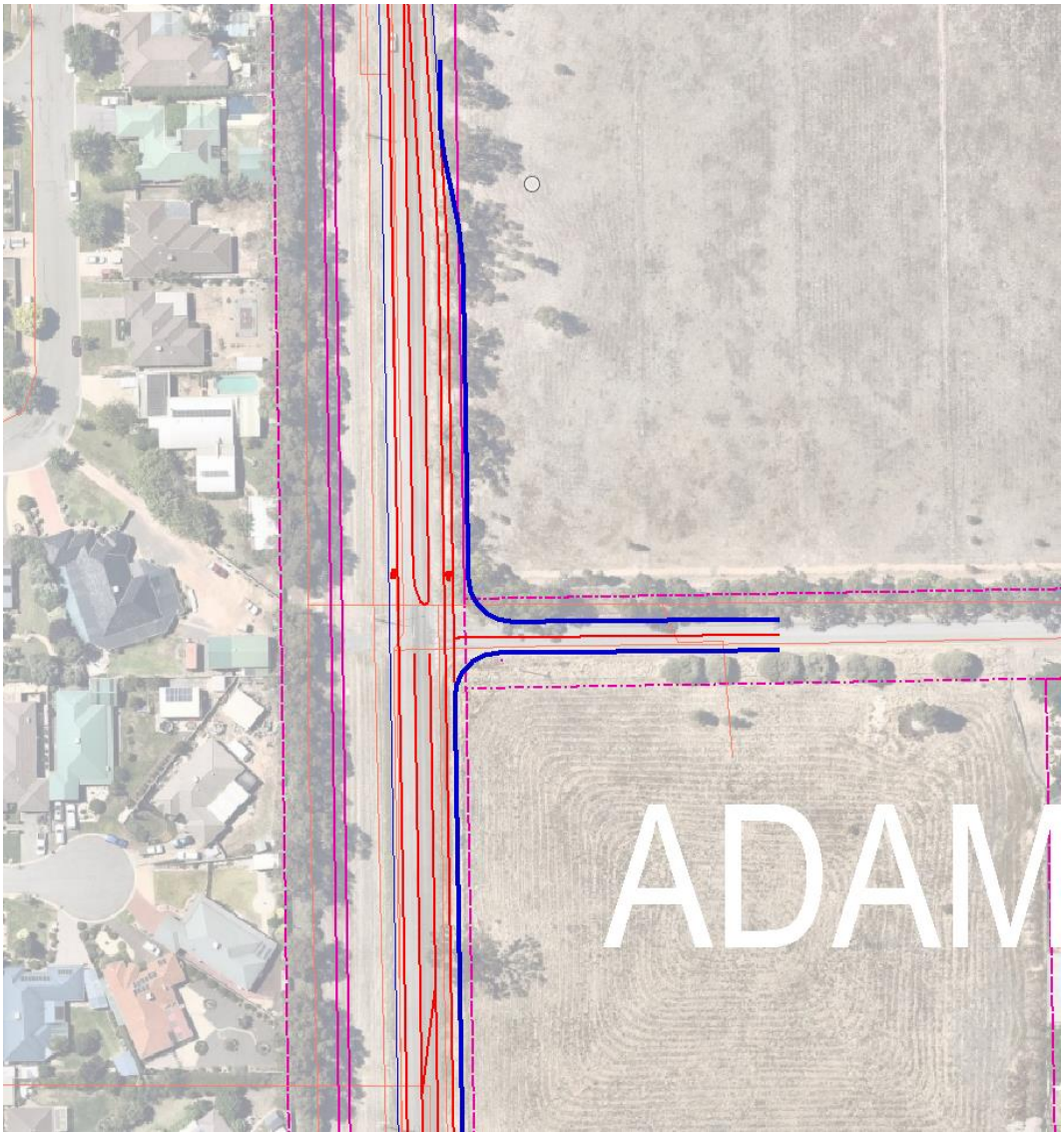
Archer Road / Adams Road is currently an unsignalised T-Intersection. One lane in each direction is provided on Archer Road, resulting in turning vehicles sharing the lane with through traffic. One lane in each direction is also provided on Adams Road.

A review of the Warrants for Turn Lanes (Austroads Guide to Road Design Part 4) identifies that under the future traffic volumes, shared through and turning movements on Archer Road would need to be separated through the provision auxiliary deceleration lanes.

It is noted that a roundabout is not initially considered necessary in the future due to the lower turning movements in comparison to other intersections, although this is confirmed via analysis in Section 5.4.

The proposed layout is shown in Figure 5.3 and full drawings included in Appendix C.

Figure 5.3: Archer Road / Adams Road intersection design

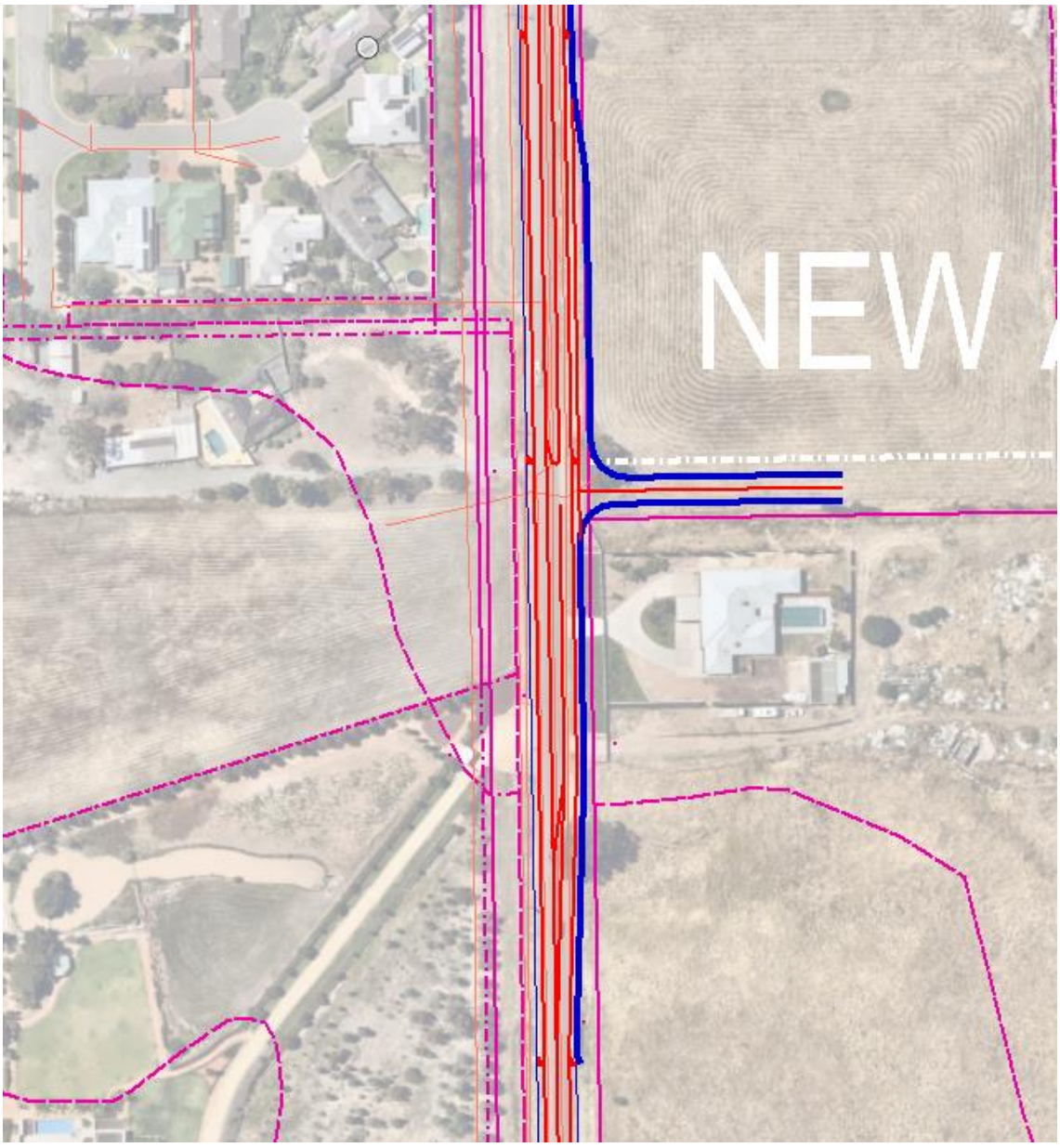


5.3.3. Archer Road / Northern Access Point

A new additional access point is proposed to service the KNGC and provide a secondary access to the rural residential blocks in the northern section of the precinct to meet emergency service requirements. The intersection is proposed to function like Archer Road / Adams Road and therefore will adopt the same intersection layout.

The proposed layout is shown in Figure 5.4 and full drawings included in Appendix C.

Figure 5.4: Archer Road / Northern Access Point intersection design



5.3.4. Archer Road / Hoopers Road / Marlboro Drive

Archer Road / Hoopers Road / Marlboro Drive currently consists of two staggered unsignalized t-intersections.

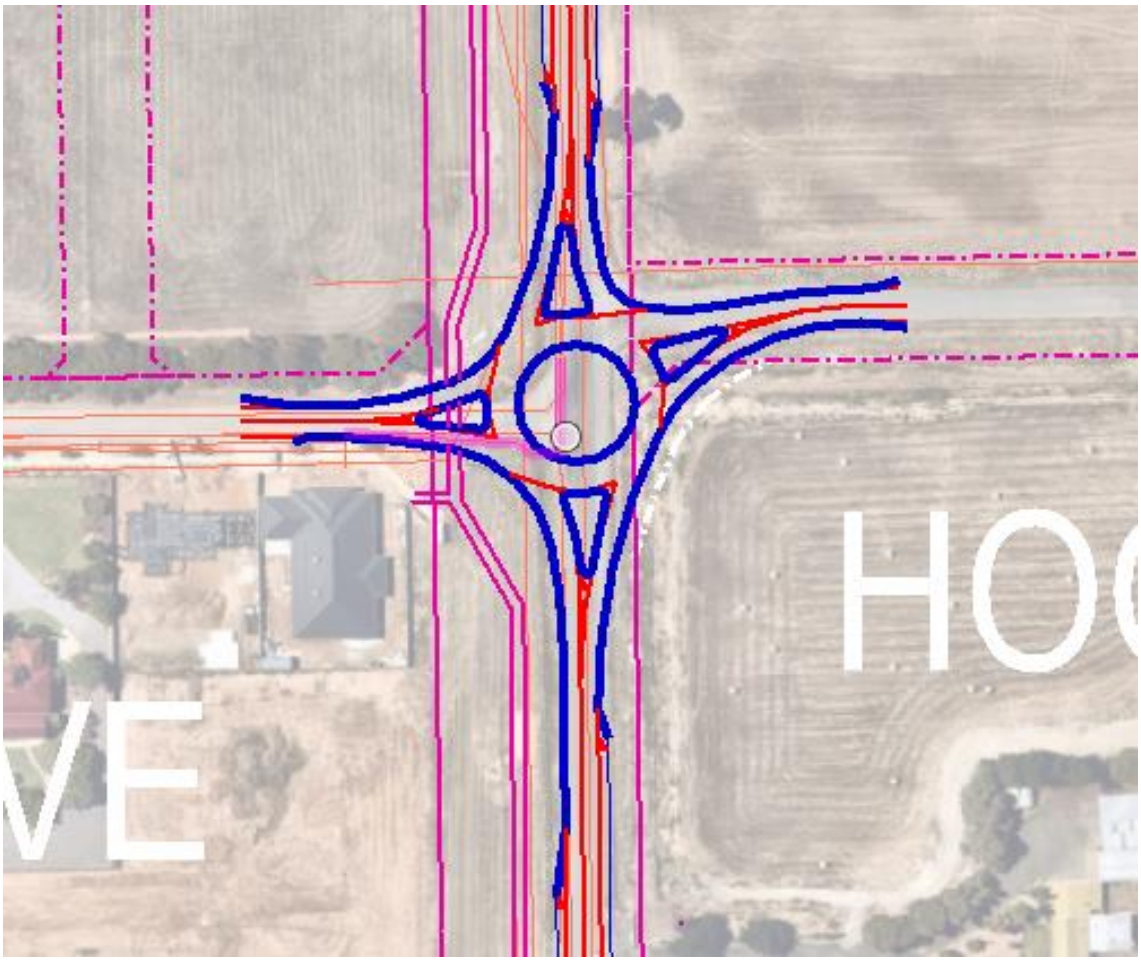
At Archer Road / Hoopers Road through movements and left turn movements on the north approach are separated with a short-left turn lane provided, whilst on the south approach through and right turn vehicles share the single lane. On Hoopers Road, a single lane is provided in each direction.

At Archer Road / Marlboro Drive through and left turn vehicles share the single lane south approach, whilst on the north approach some localised widening on the eastern side of Archer Road would provide sufficient room for a through vehicle to travel around a waiting right turn vehicle. On Marlboro Road, a single lane is provided in each direction.

In the future, it is proposed to realign Hoopers Road on the east approach further south so that it forms a cross intersection with Marlboro Drive and control the new intersection with a roundabout.

The proposed layout is shown in Figure 5.5 and full drawings included in Appendix C.

Figure 5.5: Archer Road / Hoopers Road / Marlboro Drive intersection design



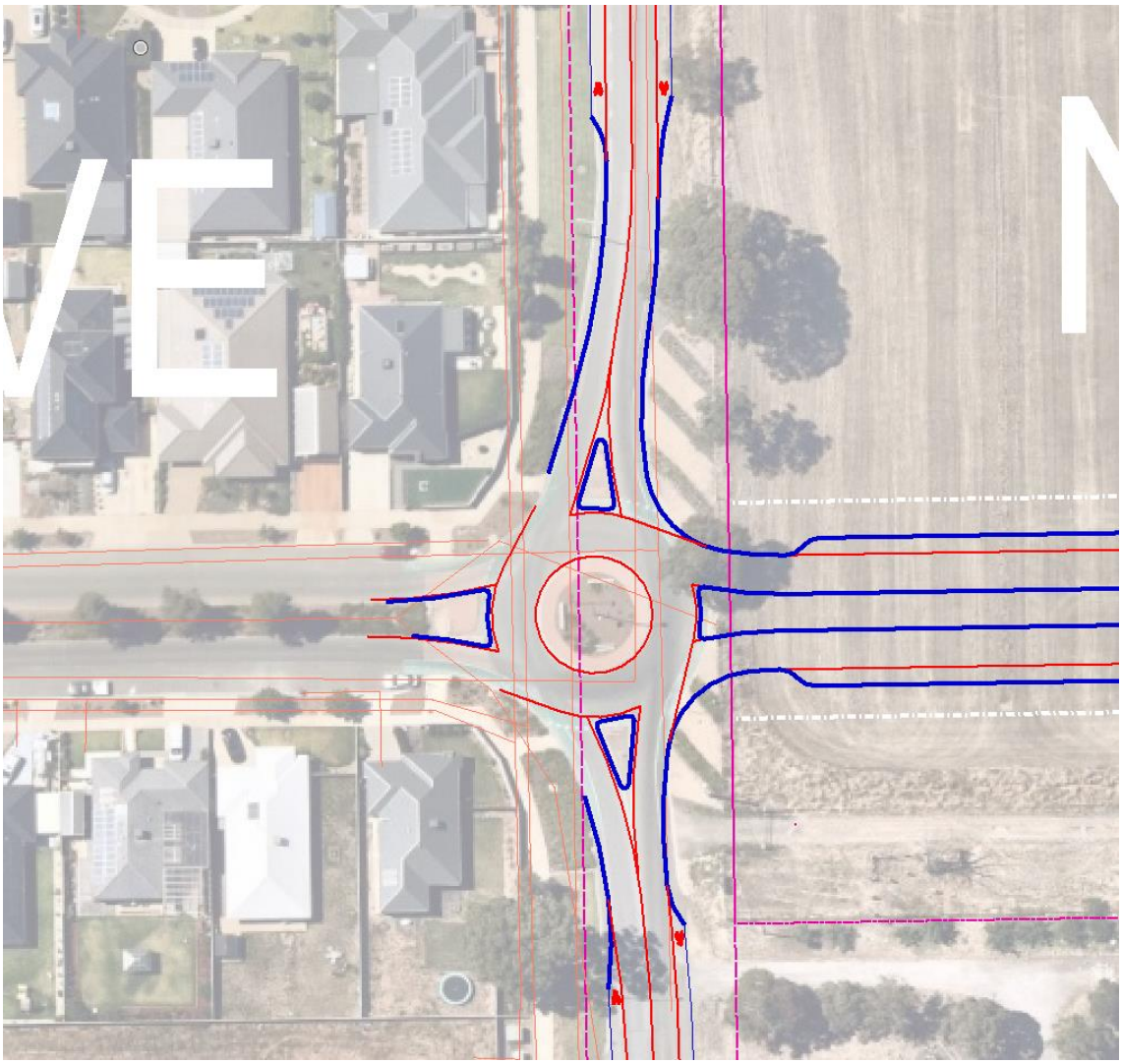
5.3.5. Archer Road / Sanctuary Drive / Southern Access Point

Archer Road / Sanctuary Drive is currently a t-intersection controlled by a roundabout. On each approach there is one lane in each direction, and on Sanctuary Drive a central median is provided and separates the traffic.

In the future it is proposed to provide a new access on the eastern side of Archer Road which will form the fourth leg to the roundabout, with one lane in each direction provided.

The proposed layout is shown in Figure 5.6 and full drawings included in Appendix C.

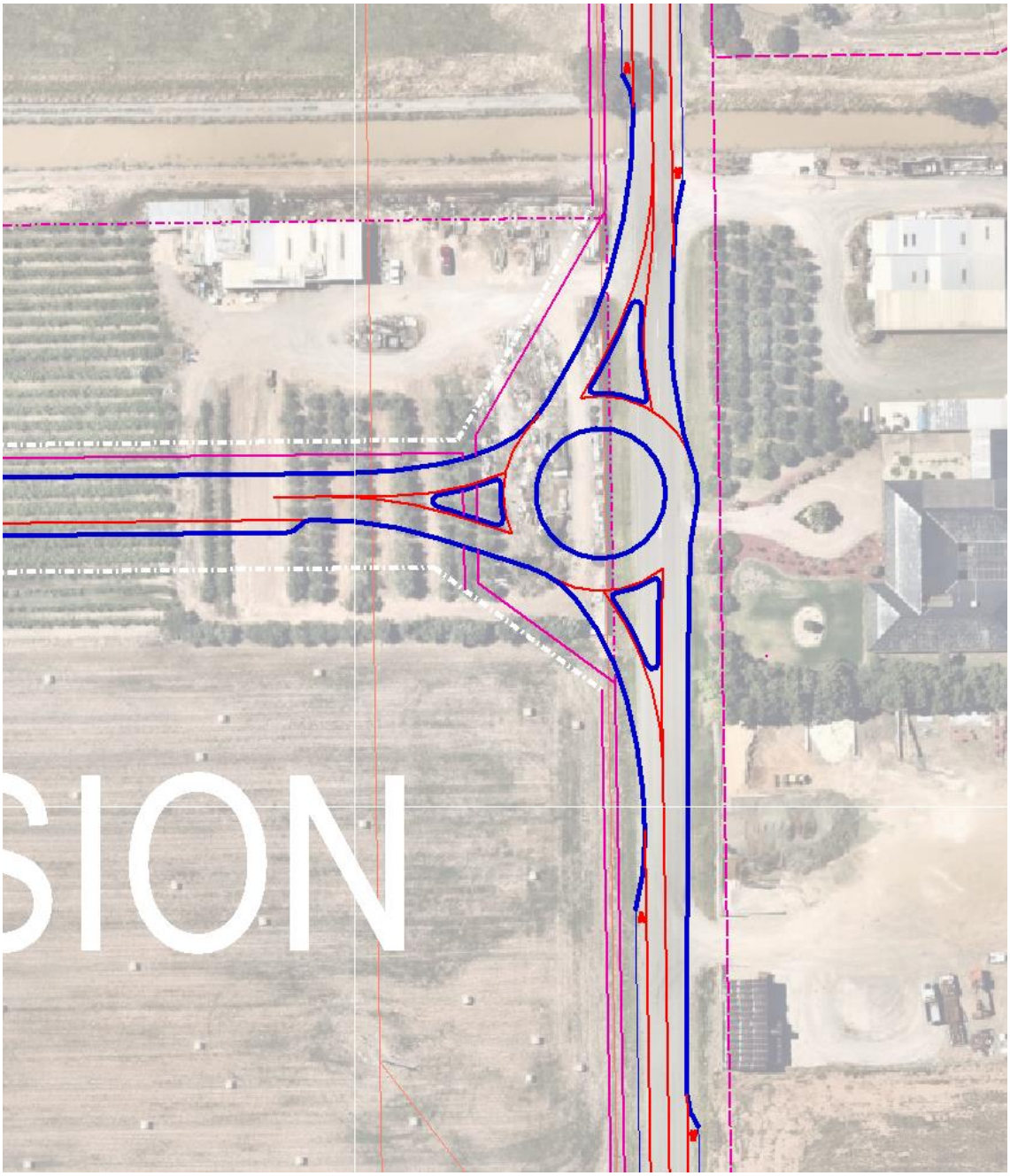
Figure 5.6: Archer Road / Sanctuary Drive / Southern Access Point intersection design



5.3.6. Archer Road / Wendouree Drive

Council has advised that Wendouree Drive will be extended to connect to Archer Road in the future. Although the traffic demands from Wendouree Drive are currently unknown, it is anticipated that they could be similar in quantum to the other intersections along Archer Road and therefore a roundabout would be the preferred intersection treatment. For the purposes of identifying the required road reserves and high-level costs, a roundabout has been included in the drawings. The proposed layout is shown in Figure 5.7 and full drawings included in Appendix C.

Figure 5.7: Archer Road / Wendouree Drive intersection design

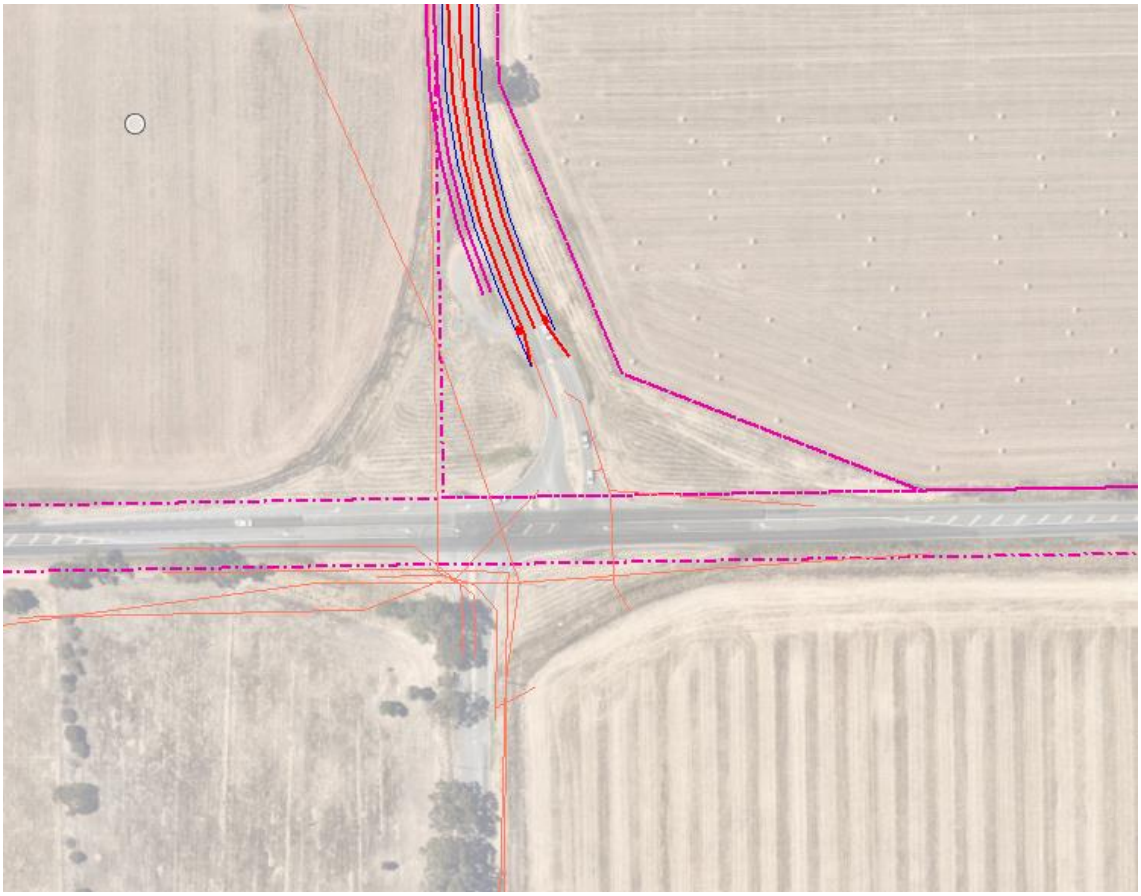


5.3.7. River Road / Archer Road

River Road / Archer Road currently consists of staggered t-intersections. On Archer Road, one lane in each direction is provided. On the River Road east approach, there is a shared through and left turn lane and a short separate right turn lane. On the River Road west approach all three movements have separate lanes, with a short-left turn slip lane provided in addition to a short right turn lane. A painted median is provided on River Road to create separation between the intersections; however, it is noted that the 3.5m lane width is not sufficient to accommodate staged turning movements from Archer Road.

Intersection analysis will identify if the existing intersection configuration is appropriate to accommodate the future demands from a capacity perspective. It is recognised that the intersection will likely be updated to a roundabout in the future when the SAR is completed, however this upgrade may not be specifically required because of the development of KNGC. The existing layout is shown in Figure 5.8 and full drawings included in Appendix C.

Figure 5.8: River Road / Archer Road intersection design



5.4. Intersection Modelling

The key intersections have been assessed under the Future Year 2031 (FY) scenario applies the demand generated from the growth area and the background growth in the network to the proposed intersection layouts.

The key intersections have been assessed using *SIDRA INTERSECTION*, a computer-based modelling package which calculates intersection performance. The software was used to determine the intersection layout requirements required to cater for the anticipated post-development traffic volumes.

The commonly used measure of intersection performance is referred to as the *Degree of Saturation (DOS)*. The DOS represents the flow-to-capacity ratio for the most critical movement on each leg of the intersection.

For signalised intersections, a DOS of around 0.95 has been typically considered the 'ideal' limit, beyond which queues, and delays increase disproportionately[4]. For unsignalised intersections a DOS of 0.90 is considered the 'ideal' limit.

The SIDRA modelling results, and intersection layouts are provided in Appendix D, with a summary of the outputs is shown in Table 5.1.

Table 5.1: Summary of SIDRA outputs

Intersection			AM Peak			PM Peak		
Number	Name	Intersection Type (Future Year)	DOS	Average Delay	LOS	DOS	Average Delay	LOS
1	Kialla Lakes Dr / Archer Rd	Roundabout (3-Way)	0.71	11 sec	B	0.64	10 sec	A
2	Adams Rd / Archer Rd	T-Intersection (Give Way Control)	0.58	2 sec	*F**	0.55	1 sec	*F**
3	Northern Access Point / Archer Rd	T-Intersection (Give Way Control)	0.58	0 sec	*C**	0.55	0 sec	*E**
4	Hoopers Rd / Archer Rd / Marlboro Dr	Roundabout (4-Way)	0.72	11 sec	B	0.68	6 sec	A
5	Southern Access Point / Sanctuary Dr / Archer Rd	Roundabout (4-Way)	0.77	12 sec	B	0.72	11 sec	B
6a	River Rd / Archer Rd North	T-Intersection (Give Way Control)	0.60	5 sec	*B**	0.49	5 sec	*C**
6b	River Rd / Archer Rd South	T-Intersection (Give Way Control)	0.30	2 sec	*C**	0.26	1 sec	*C**

Italics denotes LOS of worst movement rather than intersection average.*

The analysis shows that:

- Each of the intersections are anticipated to operate satisfactorily in the 2031 AM and PM peak periods.
- The proposed roundabout at Kialla Lakes Dr / Archer Rd intersection will operate at acceptable levels with a DoS of approximately 0.71 in the AM peak and 0.64 in the PM peak.
- The proposed T-intersections at Archer Road / Adams Road and Archer Road / Access Point are anticipated to operate satisfactorily with all queues contained within the proposed turn lanes.
- The existing T-intersections at River Road / Archer Road can accommodate the anticipated demands with all queues contained within the existing turn lanes.

[4] SIDRA INTERSECTION adopts the following criteria for Level of Service assessment:

LOS		Intersection Degree of Saturation (DOS) or X value	
		Unsignalised Intersection	Signalised Intersection
A	Excellent	<=0.50	<=0.60
B	Very Good	0.50-0.70	0.60-0.75
C	Good	0.70-0.80	0.75-0.90
D	Acceptable	0.80-0.90	0.90-0.95
E	Poor	0.90-1.00	0.95-1.00
F	Very Poor	>=1.0	>=1.0

5.4.1. Apportionment

An analysis of the traffic modelling outputs has been undertaken to identify the proportion of traffic on Archer Road which has been generated by the SSE PSP. Table 4.3 has been prepared to demonstrate the percentage of traffic on each approach and the overall breakdown of traffic in the two peak periods.

Table 5.2: Summary of Ultimate traffic volumes (2-hour) on key sections of Archer Road (2031)

Section	Daily Midblock Traffic volumes (Two-way)	Daily Midblock Traffic volumes - Without KNGC (Two-way)	Daily Midblock Traffic volumes - Generated by KNGC (Two-way)	KNGC percentage of total traffic
Broken River to Kialla Lakes Drive	19,350vpd	13,550vpd	5,800vpd	30%
Kialla Lakes Drive to Hoopers Road	15,550vpd	5,600vpd	9,950vpd	64%
Hoopers Road to Sanctuary Drive	10,950vpd	5,250vpd	5,700vpd	52%
Sanctuary Drive to River Road	8,050vpd	3,550vpd	4,500vpd	56%
			Average	**50%**

Table 4.3 shows that KNGC is anticipated to contribute to between 30-64% the volume of traffic along the midblock sections of Archer Road in 2031. When considering the length of Archer Road, between River Road and Broken River, KNGC is anticipated to contribute 50% of the total traffic.

6. PLANNING SCHEME CHECKLIST

6.1. Preamble

As the proposal is only in the Structure Plan and rezoning phase, the details are still being developed. However, eventually the development of the site will need to accord with the requirements of Clause 56 of the Greater Shepparton Planning Scheme and the Infrastructure Design Manual. Therefore, this section of the report assesses the proposal against the access and mobility requirements set out within Clause 56.06 of the Planning Scheme for subdivisions.

Clause 56 of the Greater Shepparton Planning Scheme sets out the following purpose:

"To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.
To create liveable and sustainable neighbourhoods and urban places with character and identify.
To achieve residential subdivision outcomes that appropriately respond to the site and its context for:

- *Metropolitan Melbourne growth areas*
- *Infill sites within established residential areas*
- *Regional cities and towns*

To ensure residential subdivision design appropriately provides for:

- *Policy implementation*
- *Liveable and sustainable communities*
- *Resident lot design*
- *Urban landscape*
- *Access and mobility management*
- *Integrated water management*
- *Site management*
- *Utilities."*

Clause 56 consists of several provisions made up of objectives and standards for implementation within the design of a new subdivision. The Clause states the following in respect to objectives and standards:

- *"Objectives. An objective describes the desired outcome to be achieved in the completed subdivision.*
- *Standards. A standard contains the requirements to meet the objective.*

A standard should normally be met. However, if the responsible authority is satisfied that an application for an alternative design solution meets the objective, the alternative design solution may be considered."

The relevant transport and access areas of Clause 56 that will be considered within this report is Clause 56.06, which aims to:

"achieve an urban structure where compact and walkable neighbourhoods are clustered to support larger activity centres on the Principal Public Transport Network in Metropolitan Melbourne and on the regional public transport network outside Metropolitan Melbourne.
To provide for walking (including persons with impaired mobility), cycling, public transport and other motor vehicles in an integrated manner.
To contribute to reduced car dependence, improved energy efficiency, reduced greenhouse gas emissions and reduced air pollution."

Standard C14 of the Clause requires that a plan of the layout of the neighbourhood be prepared that meets the objectives of:

- Clause 56.06-2 Walking and cycling network
- Clause 56.06-3 Public Transport network
- Clause 56.06-4 Neighbourhood street network.

Clause 56.06 divides walking and cycling facilities, public transport facilities and street network design into two areas, being Network Objectives and Detail Objectives, of which much of the latter is a matter for detailed design and therefore only the general intent agreed to as part of the Structure Plan.

6.2. Walking and Cycling

6.2.1. Statutory Requirements

The walking and cycling network and detailed objectives set out within Clauses 56.06-2 and 56.06-5 respectively state the following:

Clause 56.06-2

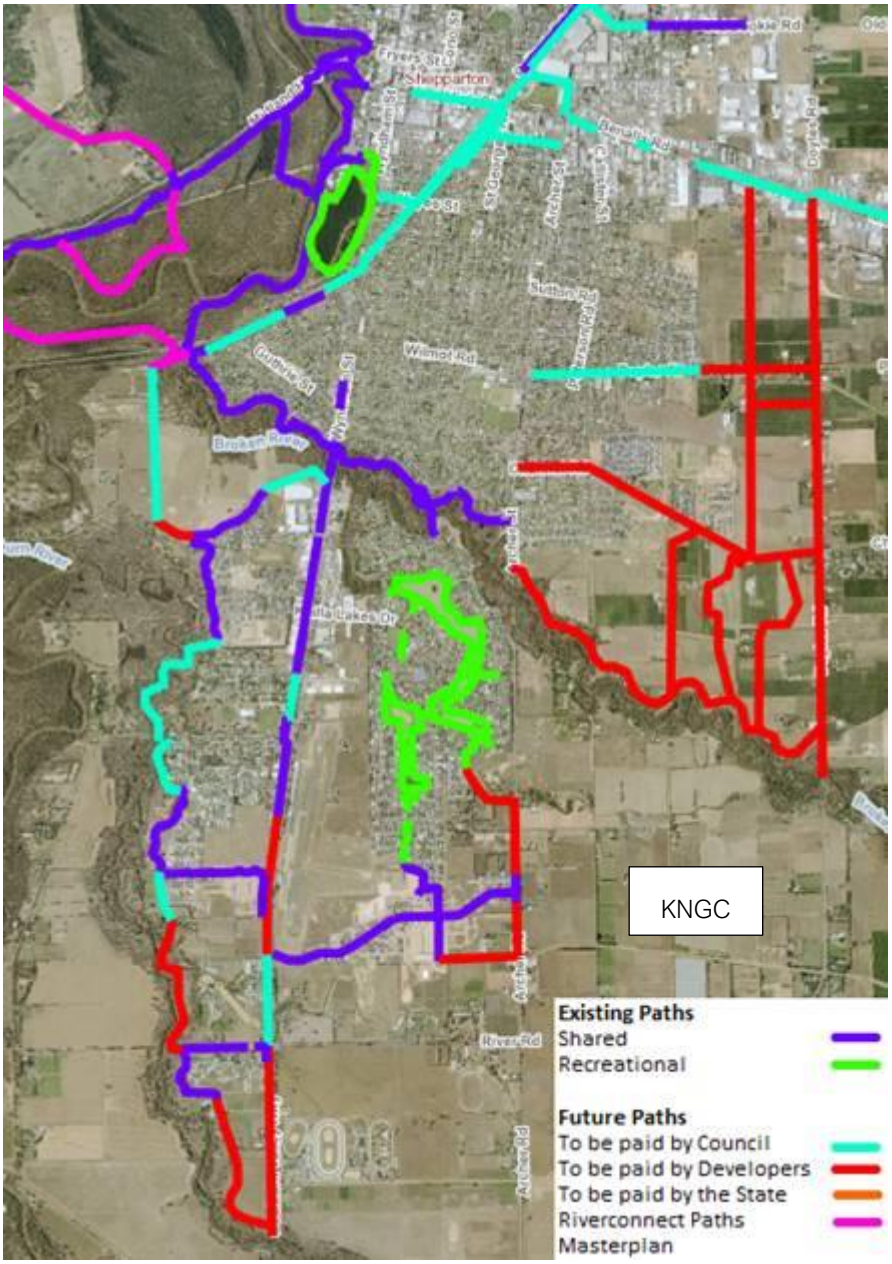
- *"To contribute to community health and well-being by encouraging walking and cycling as part of the daily lives of residents, employees and visitors.*
- *To provide safe and direct movement through and between neighbourhoods by pedestrian and cyclists.*
- *To reduce car use, greenhouse gas emissions and air pollution."*

Clause 56.06-5

- *"To design and construct footpaths, shared cycle path networks that are safe, comfortably, well-constructed and accessible for people with disabilities.*
- *To design footpaths to accommodate wheelchairs, prams, scooters and other footpath vehicles".*

Standards C15 and C18 set out the requirements that should be met to meet the objectives of these Clauses. Figure 6.1 demonstrates the existing and proposed share path network within the surrounding area. It is noted that the proposed shared user path on the western side of Archer Road is complimentary to Figure 6.1.

Figure 6.1: Kialla Shared Path Network



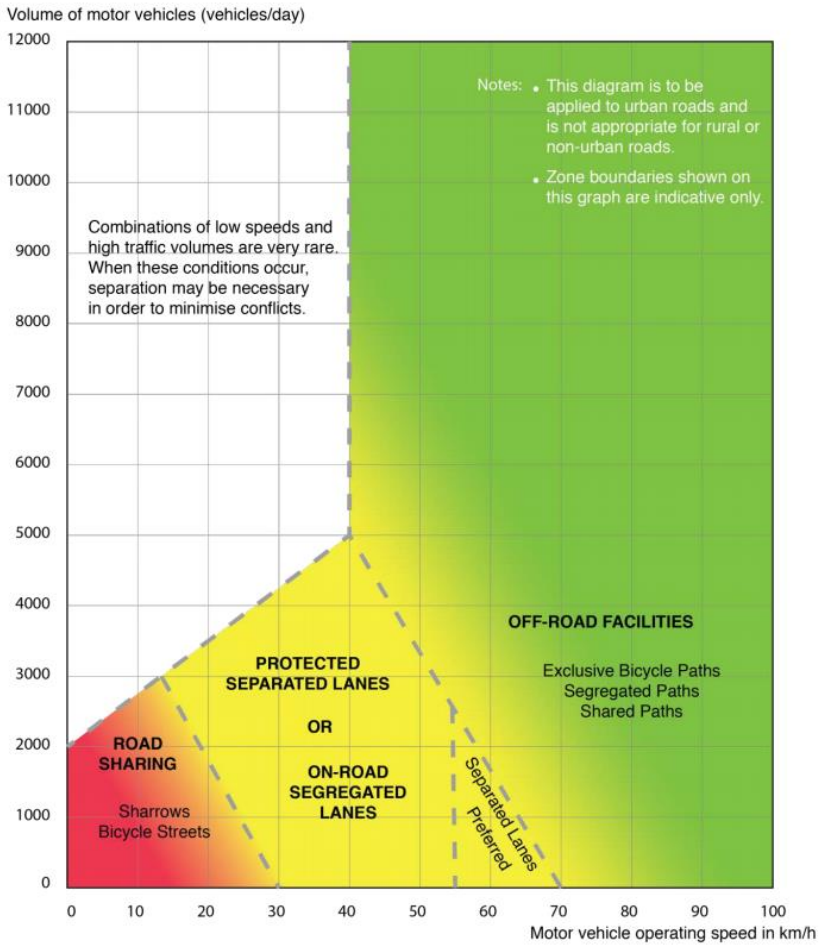
6.2.2. Proposed Treatments

The following active transport facilities are proposed:

- Footpaths will generally be provided on both sides of the roads within the site
- Streets will be designed to encourage pedestrian and bicycle activity when adjacent to open space areas
- Archer Road will have on-road bicycle lanes in addition to a shared path facility on the west side.

It is expected that the on-road traffic volume and speed environments on the other streets in the study area will generally be consistent with Figure 6.2 which reproduces the VicRoads' Design Guidance for Strategically Important Cycling Corridors. This is considered to provide a suitable level of access for pedestrians and cyclists of all abilities.

Figure 6.2: Bicycle facilities based on volume and operating speeds of motor vehicles



Source: VicRoads

To support longer trips and integrate with the broad active transport network, the shared bicycle and pedestrian paths are proposed to directly link to other paths.

6.2.3. Compliance to Clause 56

The objectives of Clauses 56.06-2 and 56.06-5 are met as follows:

- *A majority of lots would be within a reasonable walking distance of the following amenities:*
    - Public transport – it is expected that the KNGC area will be serviced by the bus network and as such stops will need to be provided in a way that all lots are serviced
    - Public open space – suitable green belts and passive open space will need to be provided
    - Community facilities – these are expected to be provided as part of the development.
- The walking and cycling network through the subdivision needs to be logical and should generally follows the pattern of streets and public open spaces as follows:
    - Connector Streets – will consist of either a shared pedestrian cycle path or a dedicated on-road bicycle lane
    - Public Open Spaces - shared paths through open spaces connecting to other facilities where possible.

- The walking and cycling network should link into existing facilities allowing the cycling network to connect into the regional network.
- The proposed road reservations are to be sufficient to provide footpaths and cycle paths in line with the requirements of Table C1 of the Clause.

6.3. Public Transport

6.3.1. Statutory Requirements

Clauses 56.06-3 and 56.06-6 set out the public transport network and detailed design objectives for subdivisions as follows:

Clause 56.06-3

"To provide an arterial road and neighbourhood street network that supports a direct efficient and safe public transport system.

To encourage maximum use of public transport."

Clause 56.06-6

"To provide for the safe, efficient operation of public transport and the comfort and convenience of public transport users, and.

To provide public transport stops that are accessible to people with disabilities."

Standards C16 and C19 set out the standards that need to be met in relation to bus routes and the location and design of bus stops.

6.3.2. Proposed Treatments

All collector roads within KNGC need to be designed to be bus capable. Bus routes and stop will be aligned so that all lots within KNGC area are within 400m of a stop.

6.3.3. Compliance with Clause 56

While the implementation of new bus services and improvement of any of the existing routes is a matter for the public transport operators and DOT, the objectives of Clauses 56.06-3 and 56.06-6 could be met from a planning perspective.

6.4. Neighbourhood Street

6.4.1. Statutory Requirements

Clauses 56.06.4 and 56.06-7 set out the neighbourhood street network and detail objectives and aims as follows:

Clause 56.06.4

"Provide for a direct, safe and easy movement through and between neighbourhoods for pedestrians, cyclists, public transport and other motor vehicles using the neighbourhood street network."

Clause 56.06.7

"To design and construct street carriageways and verges so that the geometry and traffic speeds provide an accessible and safe neighbourhood street system for all users."

Standards C17 and C20 set out several standards that should be met to achieve the aims of Clauses 56.06-4 and Clause 56.06-7.

6.4.2. Proposed Treatments

The proposed subdivision would connect into the existing street network through a series of connecter and local access streets, all of which should have suitable pedestrian infrastructure. Table 6.1 demonstrates the road hierarchy requirements of Clause 56.06-7 of the Greater Shepparton Planning Scheme.

Table 6.1: Proposed Road Hierarchy Details

Street Type	Road Reservation Width	Carriageway Width	Verge Width
Access Street	16.0m	7.3m (kerbside parking on both sides permitted)	8.6m (2 x 1.5m pedestrian path 2 x 2.8m nature strip)
Connector Street - Level 1	24.0m	12.6m (7.0m traffic, 2 x 2.3m parking bay	12.4m (2 x 2.5m shared path 2 x 3.7m nature strip)
Connector Street - Level 2	30.0m	17.6m (2 x 3.5m traffic, 2 x 2.3m parking, 6.0m median)	12.4m (2 x 2.5m shared path 2 x 3.7m nature strip)

The current concept design plans have the following road reserves and configurations proposed:

- Adams Road – 20.8m road reserve (existing) with 2x3.5m traffic lanes.
- Northern Access – 16m road reserve with 2x3.5m traffic lanes
- Hoopers Road – 20.8m road reserve (existing) with 2x3.5m traffic lanes and 2x2.3m parking lanes
- Southern Access – 30m road reserve with 2 x 5.0m traffic lanes, 2x2.3m parking lanes and 6m median.

Overall, the proposed configurations align with the road hierarchy and can be further refined in the detailed design stage.

7. COST ESTIMATES

7.1. Cost Estimates

High level cost estimates for the project will be completed following approval from council for the functional design plans.

8. CONCLUSION

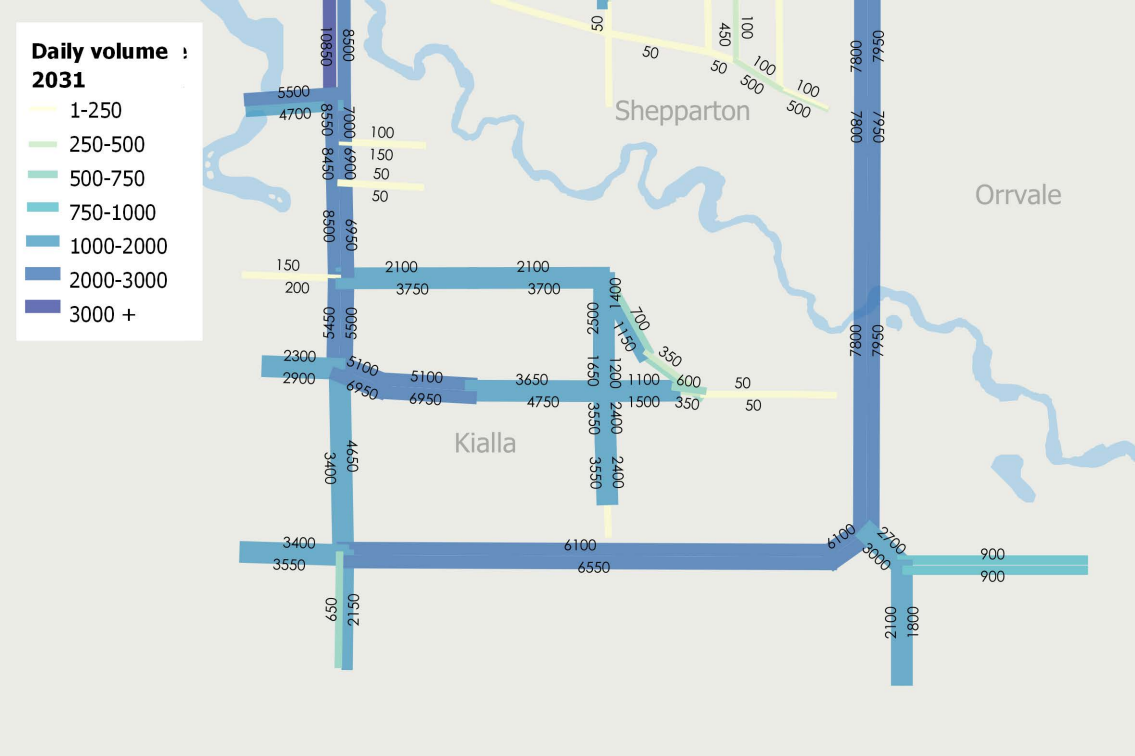
This report addresses the land use inputs, traffic demands and resulting road network layout for the purposes of the KNGC. Based on the analysis and discussions presented within this report, the following conclusions are made:

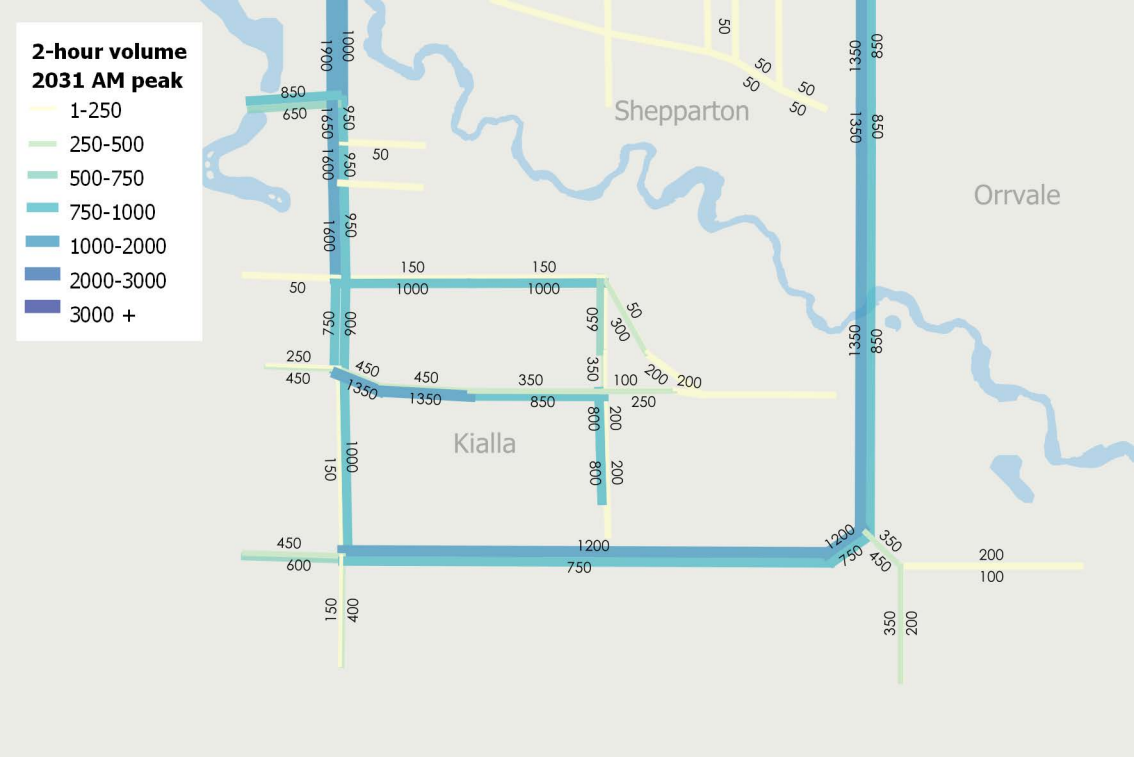
1. KNGC is proposed to consist of residential land uses only
2. When fully built out, KNGC is anticipated to generate some additional 16,200 daily vehicle movements to the network.
3. The intersection analysis presented in this report indicates that the proposed layouts can cater for the ultimate design volumes generated from KNGC, as well as any expected traffic growth in the surrounding network.
4. The anticipated traffic volumes along Archer Road, north of Hoopers Road are expected to exceed the theoretical mid-block capacity limits for a Connector Street – Level 2 and instead be carrying volumes which are more consistent with the road classifications for an arterial road. LATM measures are likely to be necessary along Archer Road, north of Kialla Lakes Drive in the future to manage the anticipated volumes.
5. When considering the length of Archer Road, between River Road and Broken River, KNGC is anticipated to contribute 50% of the total traffic.
6. The proposal has been assessed against the access and mobility requirements set out within Clause 56.06 of the Greater Shepparton Planning Scheme and the IDM Guidelines and there are no reasons why it should not be able to comply noting that further design and development work will occur later.

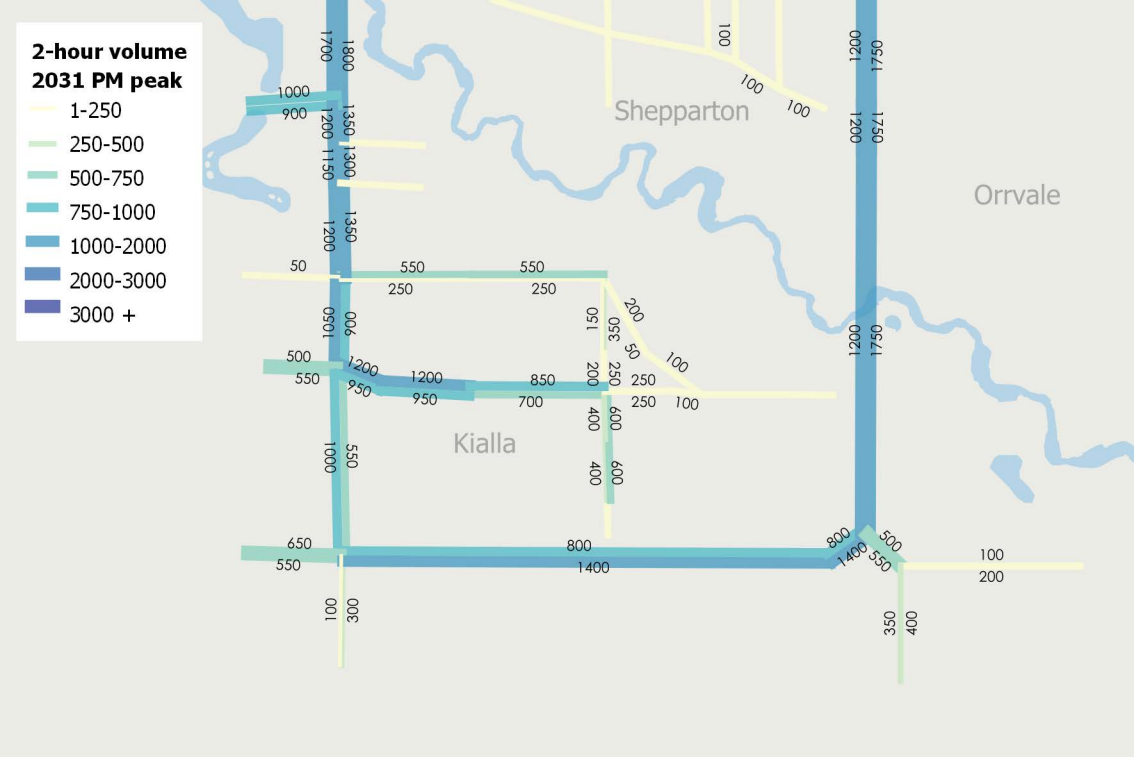
Overall, based on the findings presented in this report, there is no traffic and transport reasons as to why the KNGC should not proceed.

A.MODEL OUTPUTS

A


Daily volume
2031
1-250
250-500
500-750
750-1000
1000-2000
2000-3000
3000 +
Shepparton
Orrvale
Kialla
10850
8500
5500
4700
8550
8450
7000
6900
100
150
50
50
6900
6950
150
200
2100
3750
2100
3700
5450
5500
2300
2900
5100
6950
5100
6950
3650
4750
2500
1650
1400
1150
700
1200
350
1100
600
1500
350
50
50
3550
2400
3550
2400
4650
3400
3400
3550
6100
6550
650
2150
6100
2700
3000
900
900
2100
1800
7800
7950
7800
7950
7800
7950
450
100
50
50
100
500
100
500


2-hour volume
2031 AM peak
1-250
250-500
500-750
750-1000
1000-2000
2000-3000
3000 +
Shepparton
Orrvale
Kialla


2-hour volume
2031 PM peak
1-250
250-500
500-750
750-1000
1000-2000
2000-3000
3000 +
Shepparton
Orrvale
Kialla

B.TRAFFIC VOLUMES

2031 Post-Development Peak Hour Traffic Volumes

B

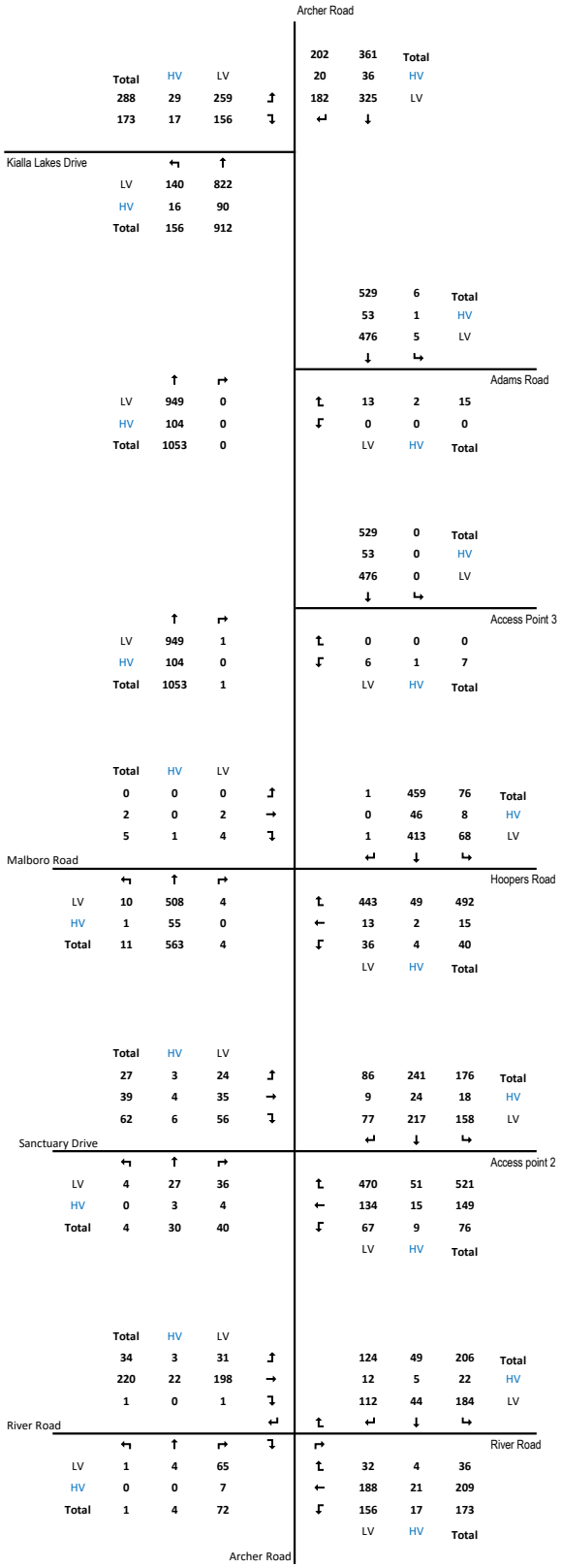
Period: AM Peak - Result

(LV) = Light Vehicles
(HV) = Heavy Vehicles
Total = LV + HV

Formulas

0.55	=	2hr to 1 hr Converion Rate
10%	=	% Heavy Vehicles

Site Generated	1659
Leaving Network	2904
Total	9533



Archer Road	Total	HV	LV	Kialla Lakes Drive	Total	HV	LV	Adams Road	Total	HV	LV	Access Point 3	Total	HV	LV	Malboro Road	Total	HV	LV	Hoopers Road	Total	HV	LV	Sanctuary Drive	Total	HV	LV	Access point 2	Total	HV	LV	River Road	Total	HV	LV	River Road
	288	29	259		822	90	732		15	2	13		1	0	1		40	4	36		492	49	443		176	24	152		521	51	470		206	22	184		173	17	156
	173	17	156		912	156	756		0	0	0		7	1	6		4	0	4		15	2	13		40	4	36		149	15	134		31	3	28		72	7	65
	202	20	182		1068	156	912		15	2	13		8	1	7		44	4	40		507	51	456		216	28	188		670	66	604		237	25	212		245	24	221
	361	36	325		1068	156	912		15	2	13		8	1	7		44	4	40		507	51	456		216	28	188		670	66	604		237	25	212		245	24	221
	Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV		Total	HV	LV

Check			Check
1068	1068	534	535

Check			Check
1053	1053	529	529

Check			Check
1054	1055	536	536

Check			Check
578	578	504	503

Check			Check
74	74	379	379

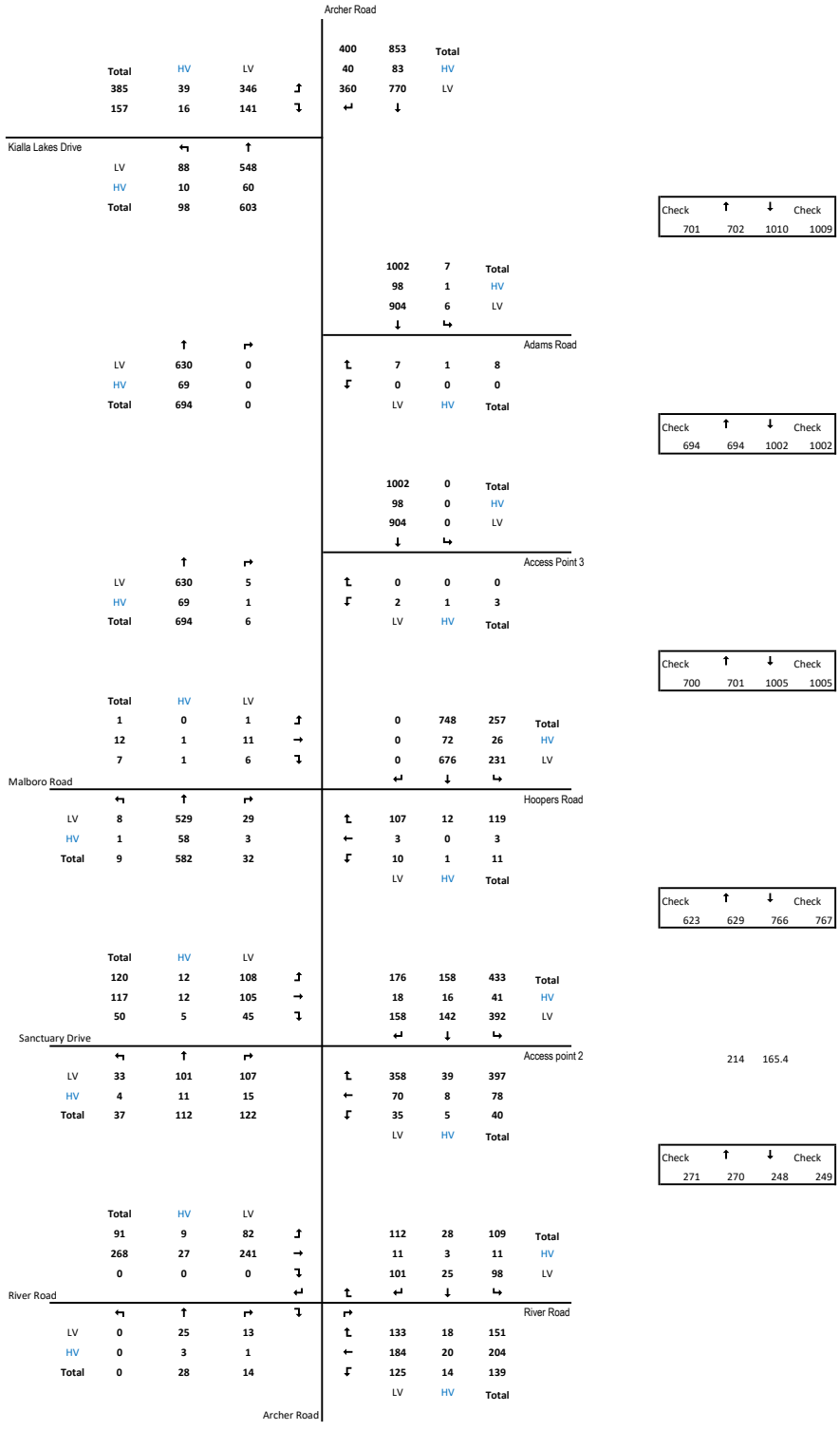
Period: PM Peak - Result

(LV) = Light Vehicles
(HV) = Heavy Vehicles
Total = Li LV + HV

Formulas

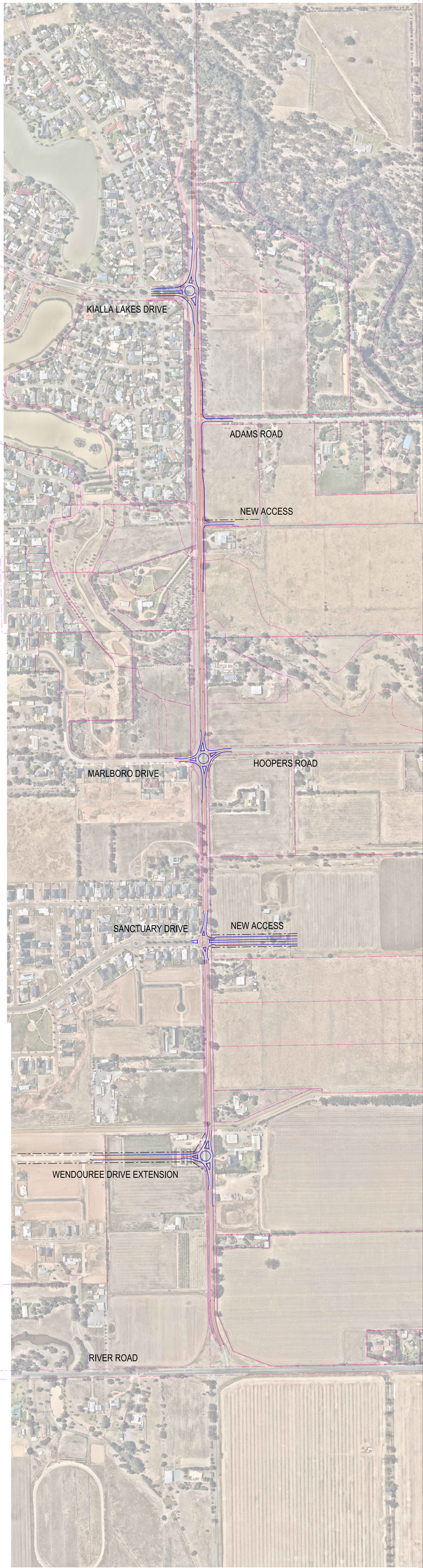
0.55	=	2hr to 1 hr Converion Rate
10%	=	% Heavy Vehicles

Site Generated	1645
Leaving Network	4185
Total	10677



C. CONCEPT DESIGN PLANS

C


KIALLA LAKES DRIVE
ADAMS ROAD
NEW ACCESS
HOOPERS ROAD
MARLBORO DRIVE
SANCTUARY DRIVE
NEW ACCESS
WENDOUREE DRIVE EXTENSION
RIVER ROAD

D. SIDRA MODEL RESULTS

D

USER REPORT FOR NETWORK

All Movement Classes

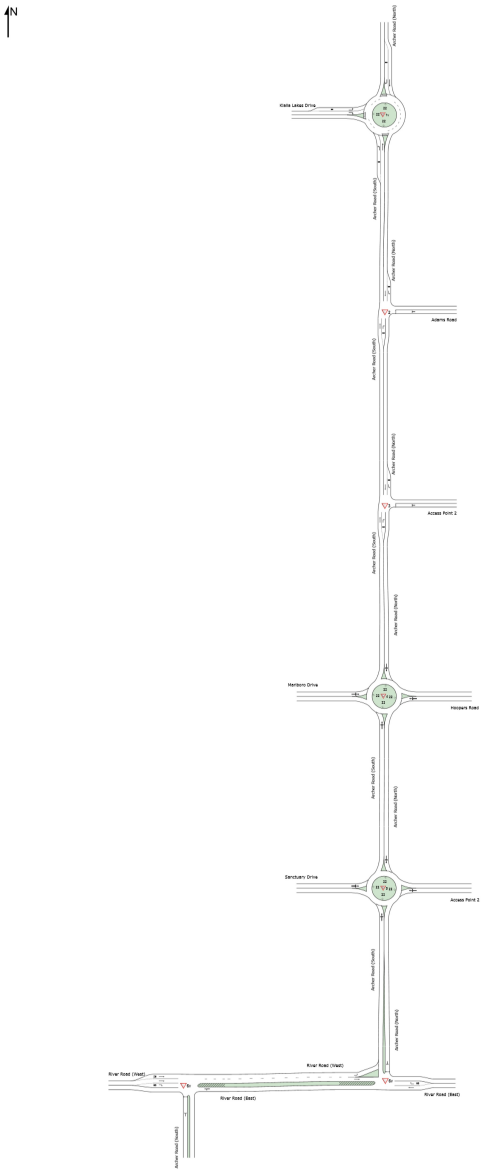
Project: 211214-Kialla North Growth Corridor-Network - Updated **Template: Network Graphics**

Network: N101 [Network-AM - Roundabout- Mitigated - Adjusted Volumes (Network Folder: General)]

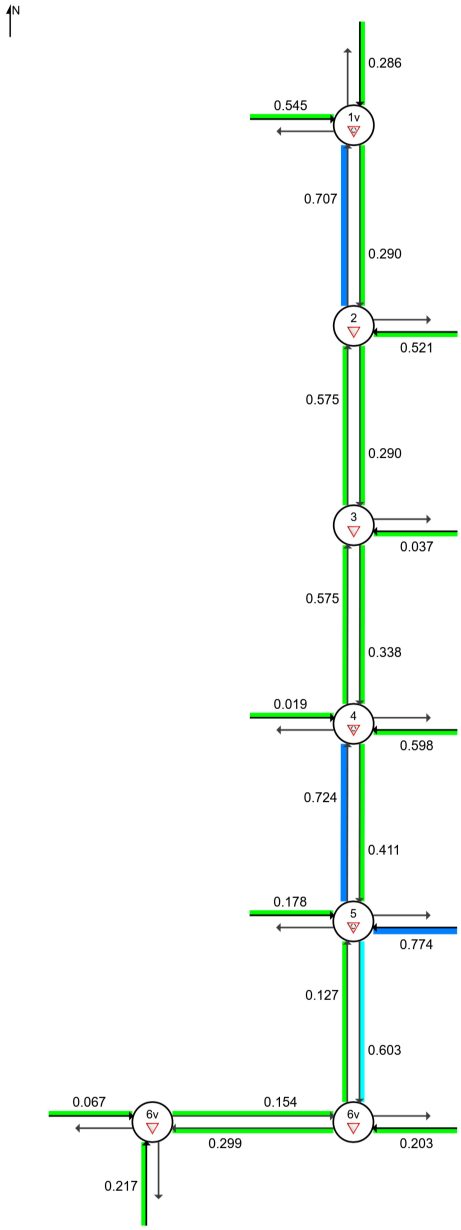
New Network
Network Category: (None)

Network Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



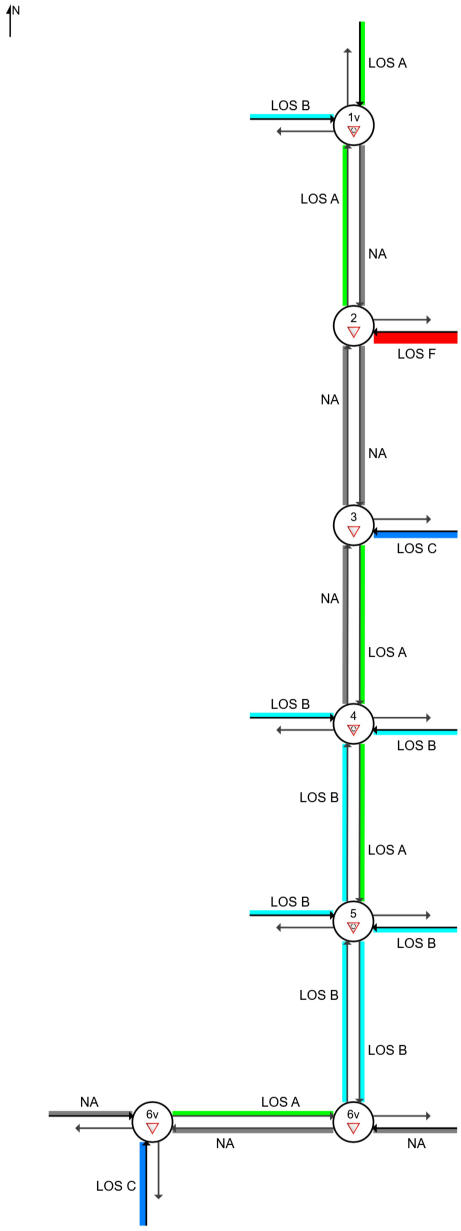
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Approach Level of Service

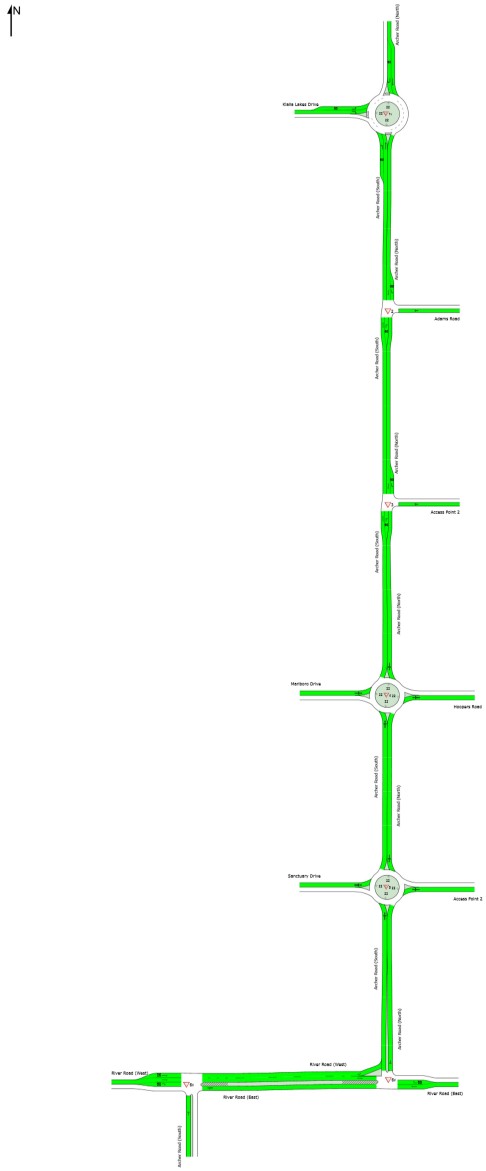


Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	NA (TWSC)

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Geometric Delay is included).

Lane Blockage Probability



Colour code based on Lane Blockage Probability

[= 0%] [0 – 10%] [10 – 30%] [> 30%]

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 211214-Kialla North Growth Corridor-Network - Updated

Template: Site Report

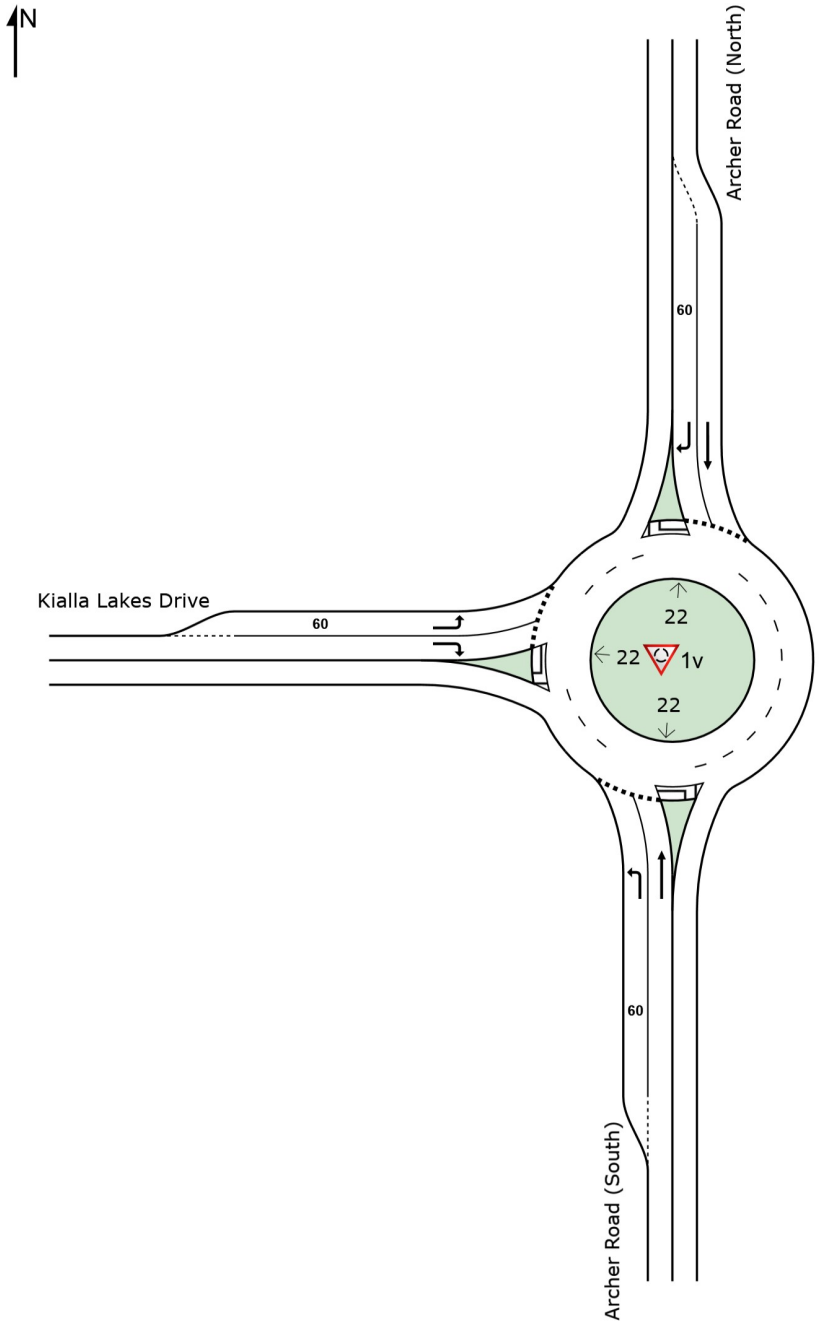
Site: 1v [1-AM-Kialla Lakes Dr / Archer Rd Intersection - Proposed Roundabout - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Kialla Lakes Dr / Archer Rd Intersection
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	156	10.3	156	10.3	789	0.198	100	8.1	LOS A	0.5	3.7	Short	60	0.0	NA
Lane 2[d]	912	9.9	912	9.9	1290	0.707	100	8.4	LOS A	3.4	26.1	Full	270	0.0	0.0
Approach	1068	9.9	1068	9.9		0.707		8.3	LOS A	3.4	26.1				
North: Archer Road (North)															
Lane 1[d]	361	10.0	361	10.0	1263	0.286	100	7.0	LOS A	0.9	7.0	Full	500	0.0	0.0
Lane 2	202	9.9	202	9.9	1013	0.199	100	12.3	LOS B	0.6	4.3	Short	60	0.0	NA
Approach	563	9.9	563	9.9		0.286		8.9	LOS A	0.9	7.0				
West: Kialla Lakes Drive															
Lane 1[d]	288	10.1	288	10.1	529	0.545	100	16.8	LOS B	2.3	17.3	Short	60	0.0	NA
Lane 2	173	9.8	173	9.8	390	0.444	100	21.7	LOS C	1.4	11.0	Full	500	0.0	0.0
Approach	461	10.0	461	10.0		0.545		18.7	LOS B	2.3	17.3				
Intersection	2092	9.9	2092	9.9		0.707		10.8	LOS B	3.4	26.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

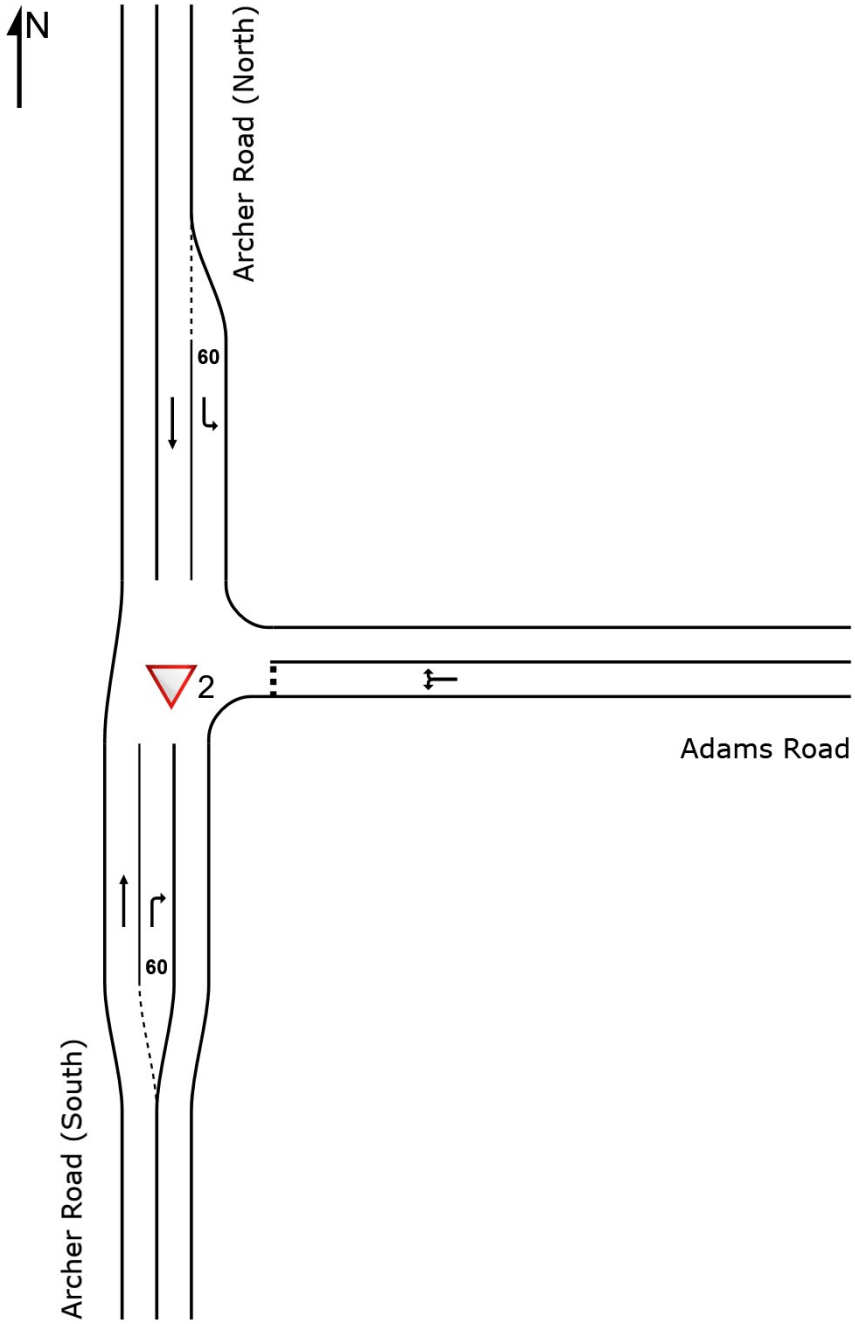
Site: 2 [2-AM-Adams Rd / Archer Rd Intersection - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Adams Rd / Archer Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	1053	9.9	1053	9.9	1832	0.575	100	0.2	LOS A	0.0	0.0	Full	280	0.0	0.0
Lane 2	1	0.0	1	0.0	758	0.001	100	8.2	LOS A	0.0	0.0	Short	60	0.0	NA
Approach	1054	9.9	1054	9.9		0.575		0.2	NA	0.0	0.0				
East: Adams Road															
Lane 1	16	12.5	16	12.5	31	0.521	100	174.5	LOS F	0.6	4.7	Full	500	0.0	0.0
Approach	16	12.5	16	12.5		0.521		174.5	LOS F	0.6	4.7				
North: Archer Road (North)															
Lane 1	6	16.7	6	16.7	1660	0.004	100	5.7	LOS A	0.0	0.0	Short	60	0.0	NA
Lane 2	532	10.0	532	10.0	1831	0.290	100	0.0	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	538	10.1	538	10.1		0.290		0.1	NA	0.0	0.0				
Intersection	1608	10.0	1608	10.0		0.575		1.9	NA	0.6	4.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

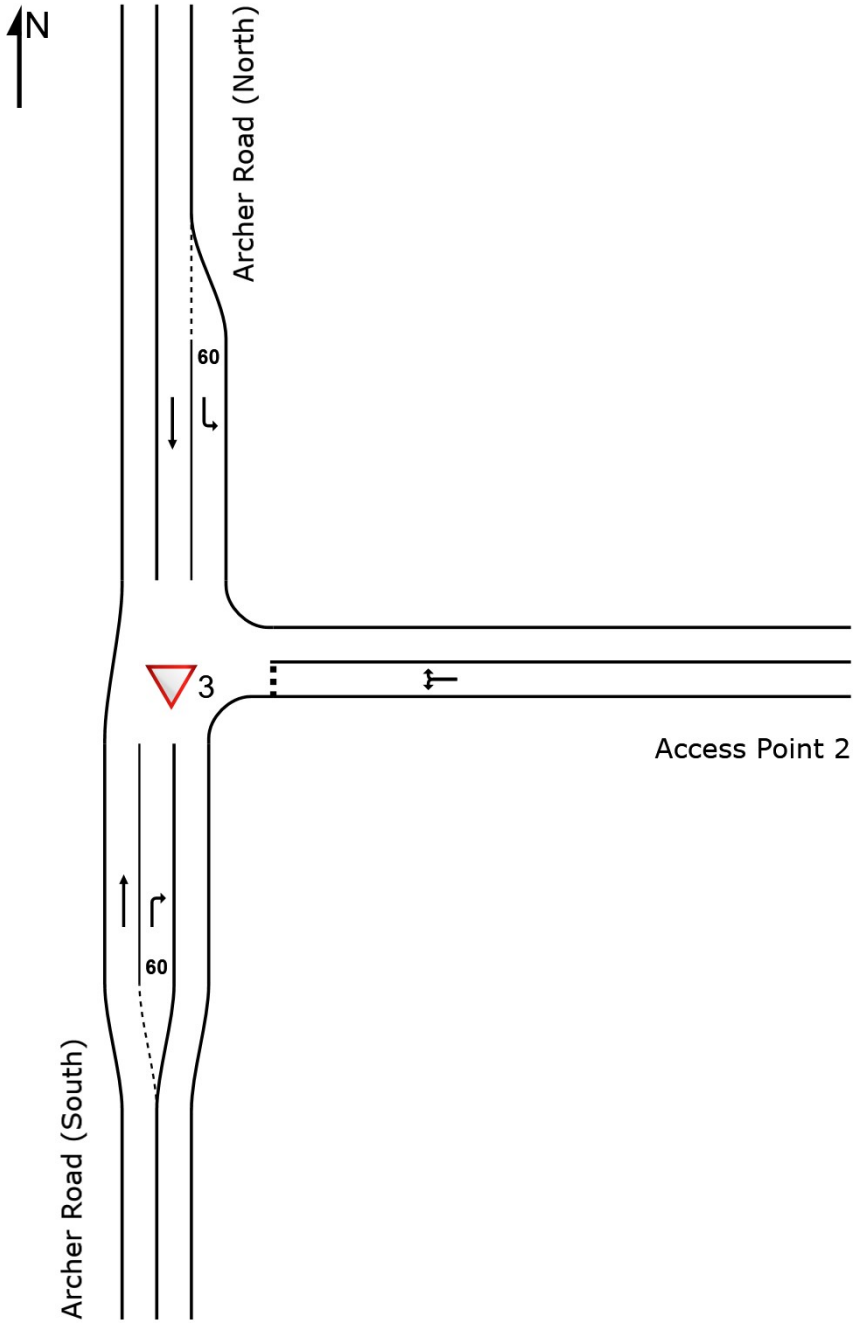
Site: 3 [3-AM-Access point 3 / Archer Rd Intersection - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Adams Rd / Archer Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	1053	9.9	1053	9.9	1832	0.575	100	0.3	LOS A	0.0	0.0	Full	520	0.0	0.0
Lane 2	1	0.0	1	0.0	759	0.001	100	8.2	LOS A	0.0	0.0	Short	60	0.0	NA
Approach	1054	9.9	1054	9.9		0.575		0.3	NA	0.0	0.0				
East: Access Point 2															
Lane 1	8	12.5	8	12.5	219	0.037	100	19.4	LOS C	0.0	0.3	Full	500	0.0	0.0
Approach	8	12.5	8	12.5		0.037		19.4	LOS C	0.0	0.3				
North: Archer Road (North)															
Lane 1	1	0.0	1	0.0	1857	0.001	100	5.5	LOS A	0.0	0.0	Short	60	0.0	NA
Lane 2	532	10.0	532	10.0	1831	0.290	100	0.1	LOS A	0.0	0.0	Full	280	0.0	0.0
Approach	533	10.0	533	10.0		0.290		0.1	NA	0.0	0.0				
Intersection	1595	9.9	1595	9.9		0.575		0.3	NA	0.0	0.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

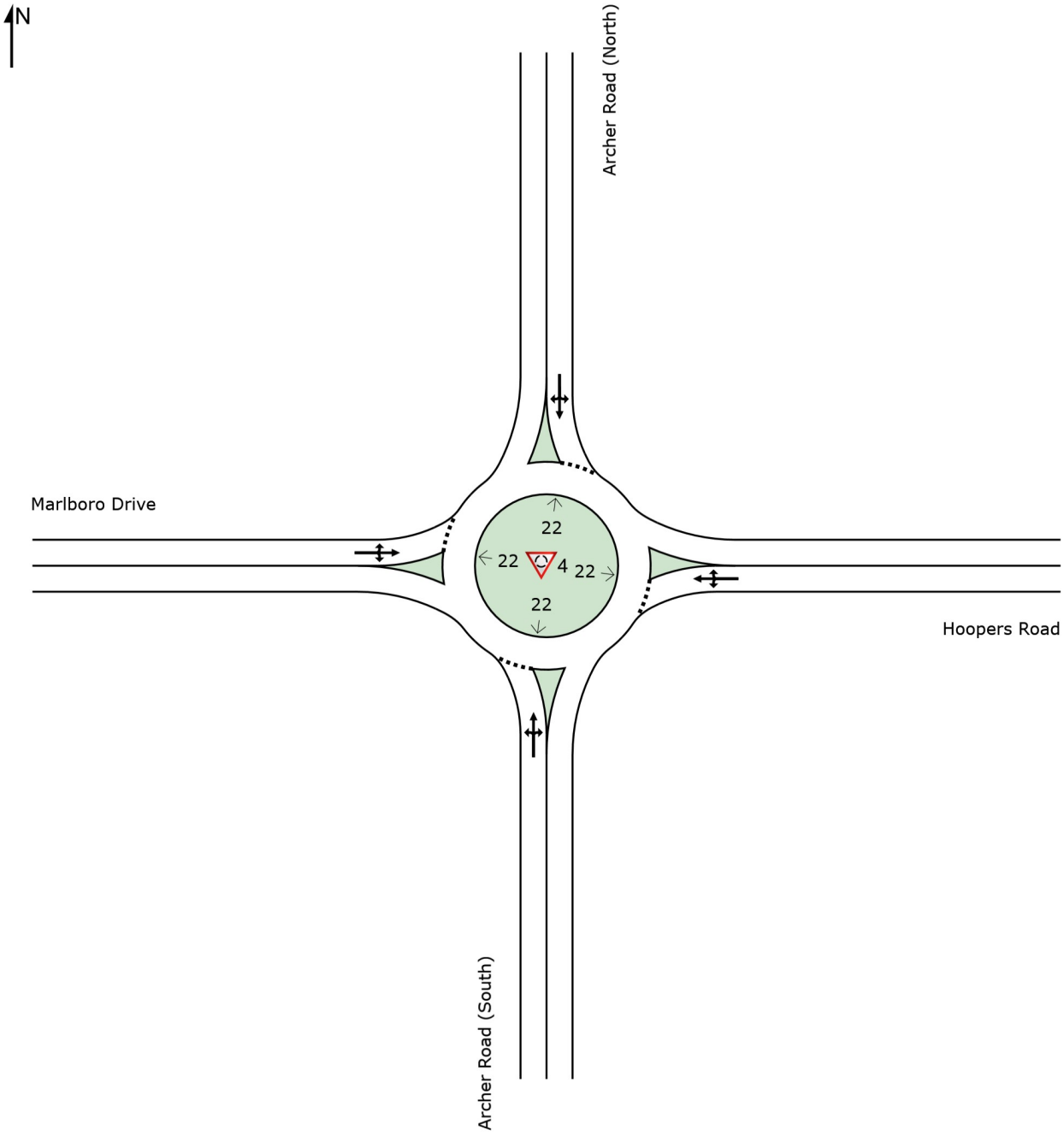
Site: 4 [4-AM-Hoopers Rd / Archer Rd / Marlboro Dr Roundabout - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Hoopers Rd / Archer Rd / Marlboro Dr Roundabout
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance															
	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1[d]	578	9.7	578	9.7	798	0.724	100	13.2	LOS B	3.7	27.7	Full	420	0.0	0.0
Approach	578	9.7	578	9.7		0.724		13.2	LOS B	3.7	27.7				
East: Hoopers Road															
Lane 1[d]	547	10.1	547	10.1	914	0.598	100	14.2	LOS B	2.2	16.8	Full	500	0.0	0.0
Approach	547	10.1	547	10.1		0.598		14.2	LOS B	2.2	16.8				
North: Archer Road (North)															
Lane 1[d]	539	10.1	539	10.1	1594	0.338	100	4.1	LOS A	1.0	7.9	Full	520	0.0	0.0
Approach	539	10.1	539	10.1		0.338		4.1	LOS A	1.0	7.9				
West: Marlboro Drive															
Lane 1[d]	8	12.5	8	12.5	419	0.019	100	16.7	LOS B	0.1	0.4	Full	500	0.0	0.0
Approach	8	12.5	8	12.5		0.019		16.7	LOS B	0.1	0.4				
Intersection	1672	9.9	1672	9.9		0.724		10.6	LOS B	3.7	27.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

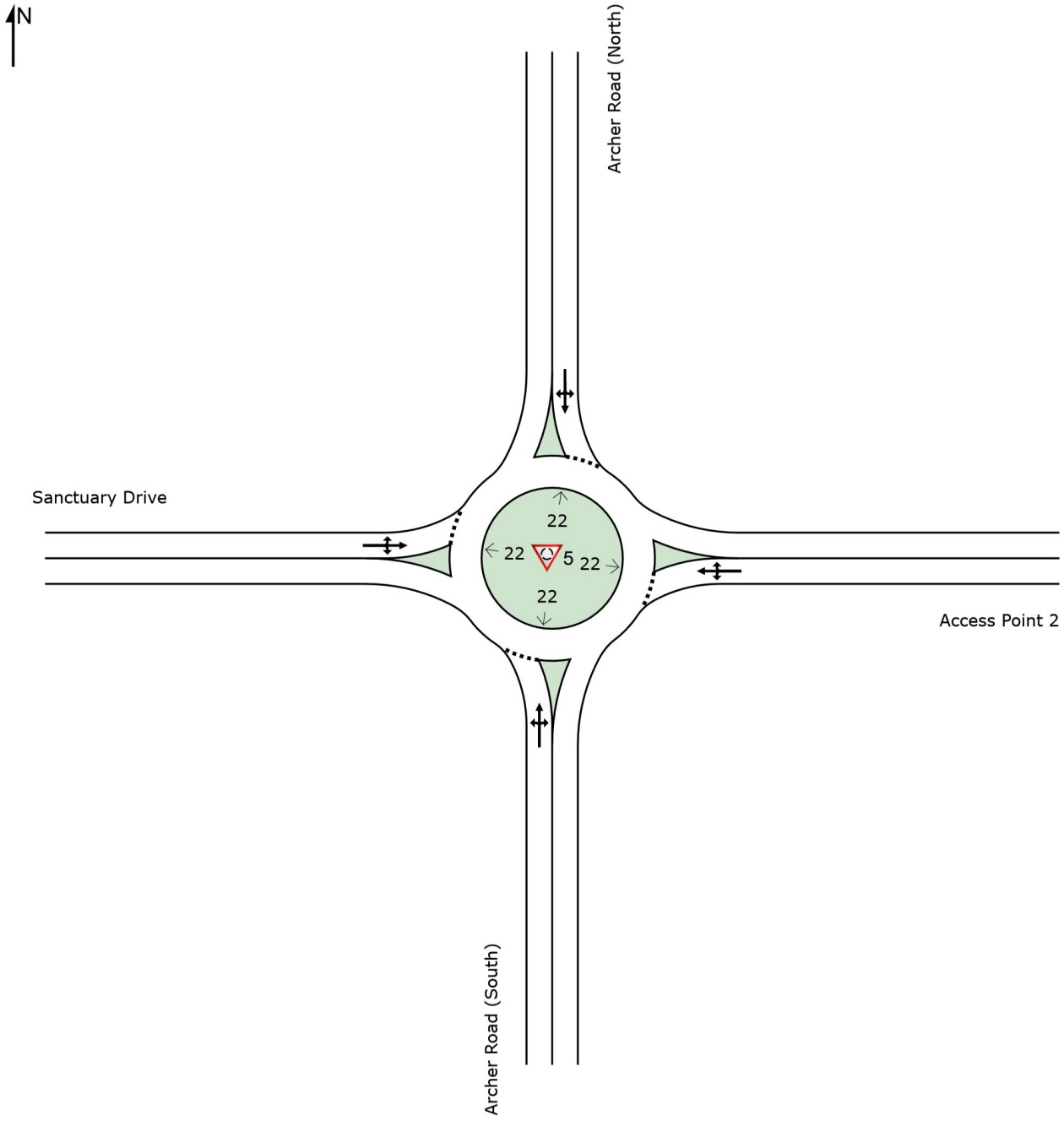
Site: 5 [5-AM-Sanctuary Dr / Archer Rd Roundabout - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Sanctuary Dr / Archer Rd Roundabout
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV] %	[Total veh/h	HV] %	veh/h	v/c	%	sec		[Veh	Dist] m		m	%	%
South: Archer Road (South)															
Lane 1[d]	74	9.4	74	9.4	583	0.127	100	11.8	LOS B	0.3	2.6	Full	1000	0.0	0.0
Approach	74	9.4	74	9.4		0.127		11.8	LOS B	0.3	2.6				
East: Access Point 2															
Lane 1[d]	746	10.1	746	10.1	963	0.774	100	15.8	LOS B	4.5	34.1	Full	500	0.0	0.0
Approach	746	10.1	746	10.1		0.774		15.8	LOS B	4.5	34.1				
North: Archer Road (North)															
Lane 1[d]	506	10.1	506	10.1	1231	0.411	100	5.8	LOS A	1.2	9.4	Full	420	0.0	0.0
Approach	506	10.1	506	10.1		0.411		5.8	LOS A	1.2	9.4				
West: Sanctuary Drive															
Lane 1[d]	128	10.2	128	10.2	721	0.178	100	10.1	LOS B	0.5	3.5	Full	500	0.0	0.0
Approach	128	10.2	128	10.2		0.178		10.1	LOS B	0.5	3.5				
Intersection	1454	10.1	1454	10.1		0.774		11.6	LOS B	4.5	34.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

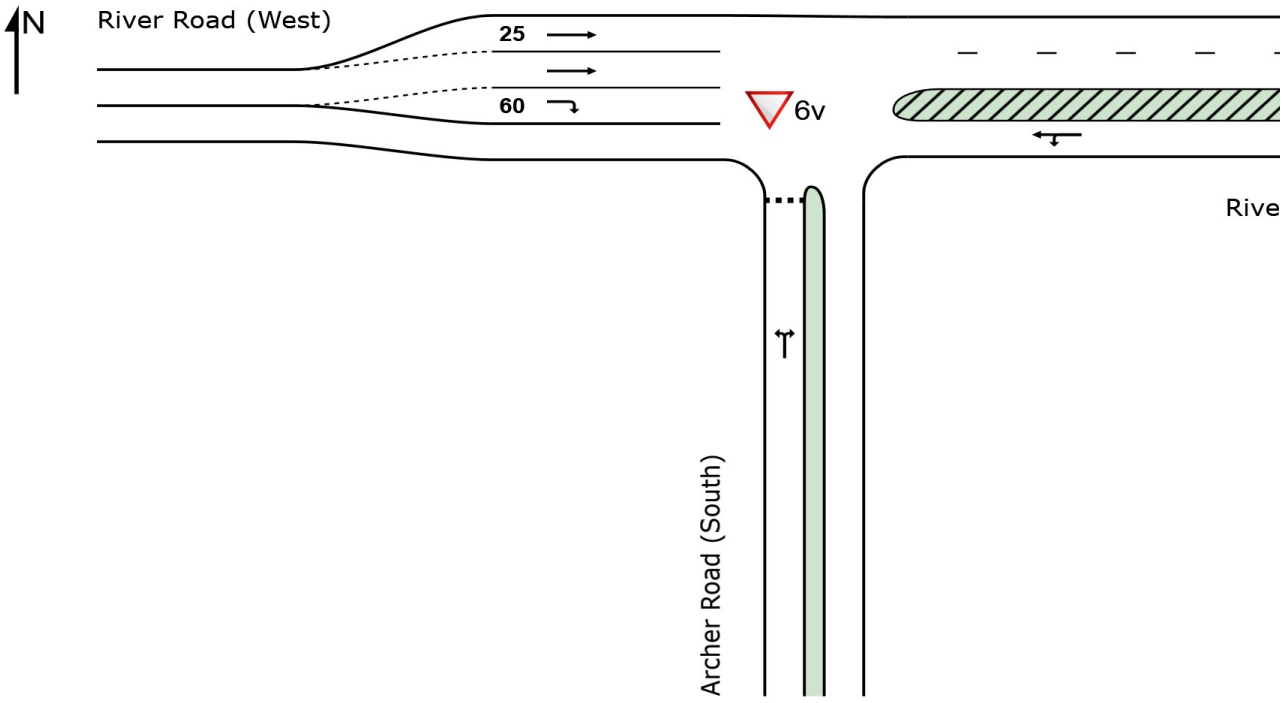
Site: 6v [6-AM-River Rd / Archer Rd - West - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Archer Rd / River Rd Roundabout
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	77	9.1	77	9.1	355	0.217	100	15.1	LOS C	0.3	2.5	Full	500	0.0	0.0
Approach	77	9.1	77	9.1		0.217		15.1	LOS C	0.3	2.5				
East: River Road (East)															
Lane 1	555	9.9	555	9.9	1857	0.299	100	1.3	LOS A	0.0	0.0	Full	35	0.0	0.0
Approach	555	9.9	555	9.9		0.299		1.3	NA	0.0	0.0				
West: River Road (West)															
Lane 1	127	9.8	127	9.8	1899	0.067	100	0.0	LOS A	0.0	0.0	Short	25	0.0	NA
Lane 2	127	9.8	127	9.8	1899	0.067	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	1	0.0	1	0.0	971	0.001	100	7.7	LOS A	0.0	0.0	Short	60	0.0	NA
Approach	255	9.8	255	9.8		0.067		0.0	NA	0.0	0.0				
Intersection	887	9.8	887	9.8		0.299		2.2	NA	0.3	2.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

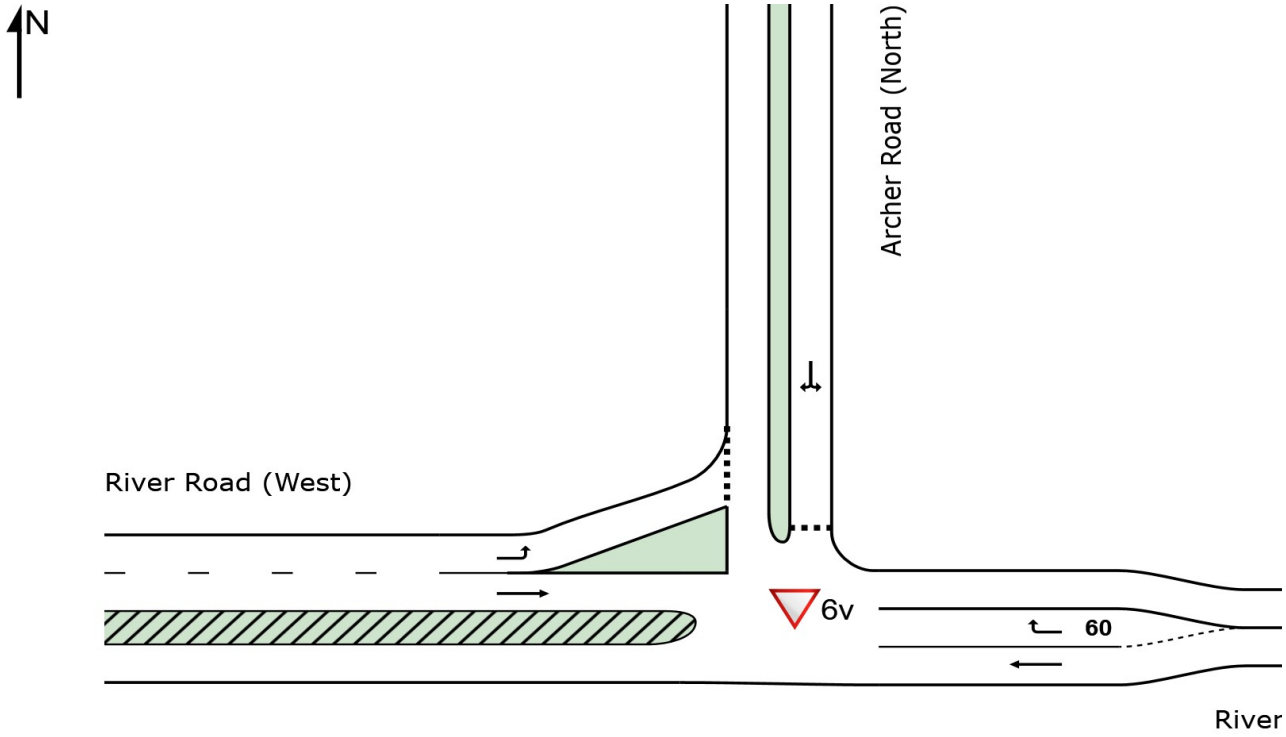
Site: 6v [6-AM-River Rd / Archer Rd - East - Adjusted volumes (Site Folder: General)]

Network: 15 [Network-AM - Roundabout-Mitigated - Adjusted Volumes (Network Folder: General)]

Archer Rd / River Rd Roundabout
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: River Road (East)															
Lane 1	382	9.9	382	9.9	1882	0.203	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	36	11.1	36	11.1	1258	0.029	100	6.7	LOS A	0.0	0.4	Short	60	0.0	NA
Approach	418	10.0	418	10.0		0.203		0.6	NA	0.0	0.4				
North: Archer Road (North)															
Lane 1	379	10.3	379	10.3	629	0.603	100	14.8	LOS B	1.9	14.5	Full	1000	0.0	0.0
Approach	379	10.3	379	10.3		0.603		14.8	LOS B	1.9	14.5				
West: River Road (West)															
Lane 1	38	7.9	38	7.9	1524	0.025	100	3.6	LOS A	0.0	0.3	Full	35	0.0	0.0
Lane 2	292	9.9	292	9.9	1898	0.154	100	0.0	LOS A	0.0	0.0	Full	35	0.0	0.0
Approach	330	9.7	330	9.7		0.154		0.4	LOS A	0.0	0.3				
Intersection	1127	10.0	1127	10.0		0.603		5.3	NA	1.9	14.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

USER REPORT FOR NETWORK

All Movement Classes

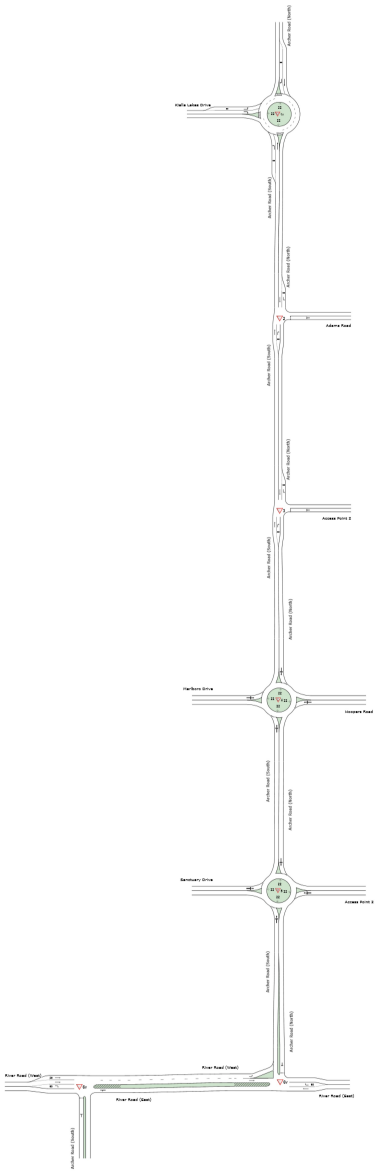
Project: 211214-Kialla North Growth Corridor-Network - Updated **Template: Network Graphics**

Network: N101 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

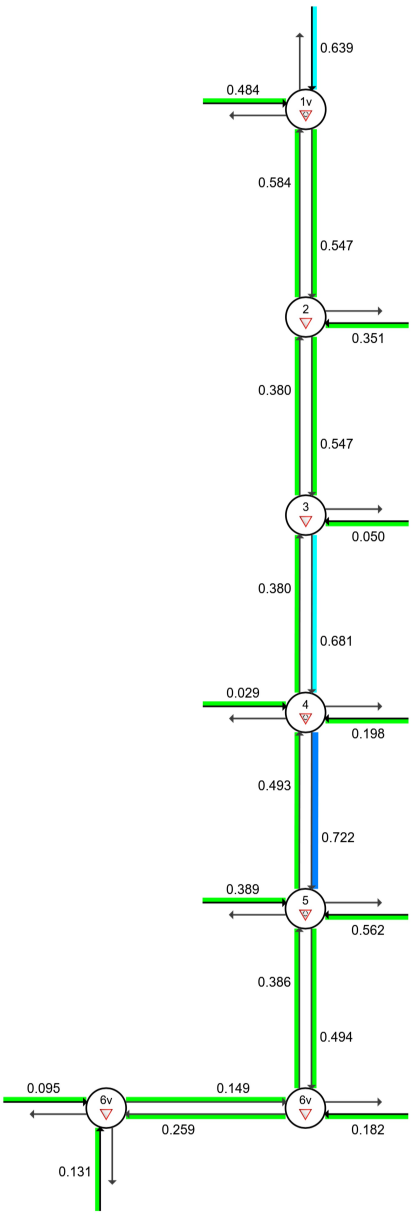
New Network
Network Category: (None)

Network Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



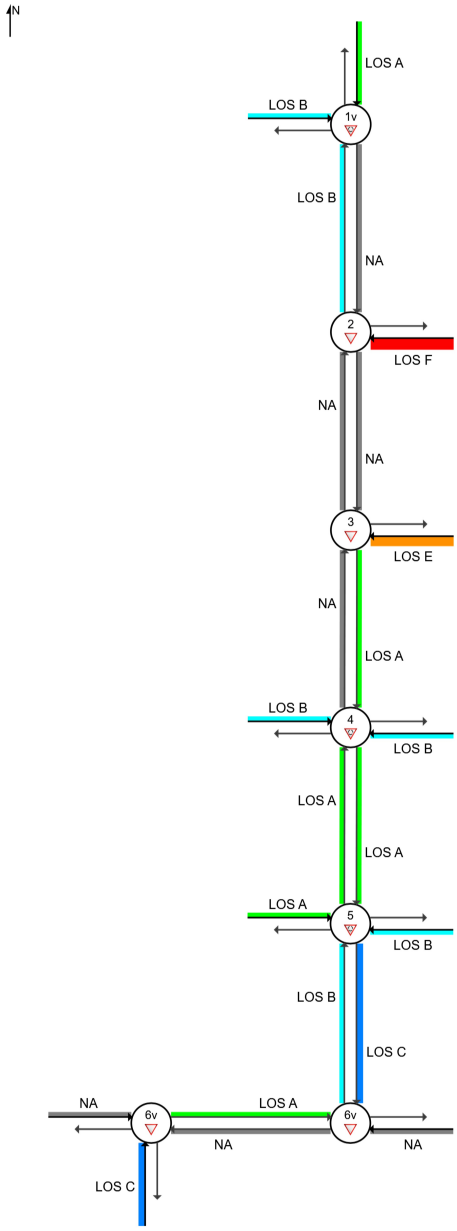
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Approach Level of Service

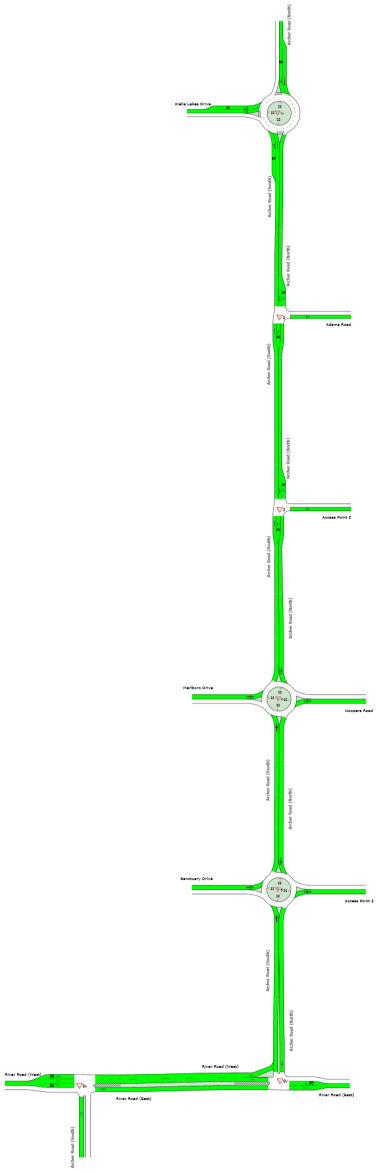


Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F | NA (TWSC)

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Geometric Delay is included).

Lane Blockage Probability



Colour code based on Lane Blockage Probability

[= 0%] [0 – 10%] [10 – 30%] [> 30%]

USER REPORT FOR NETWORK SITE

All Movement Classes

Project: 211214-Kialla North Growth Corridor-Network - Updated

Template: Site Report

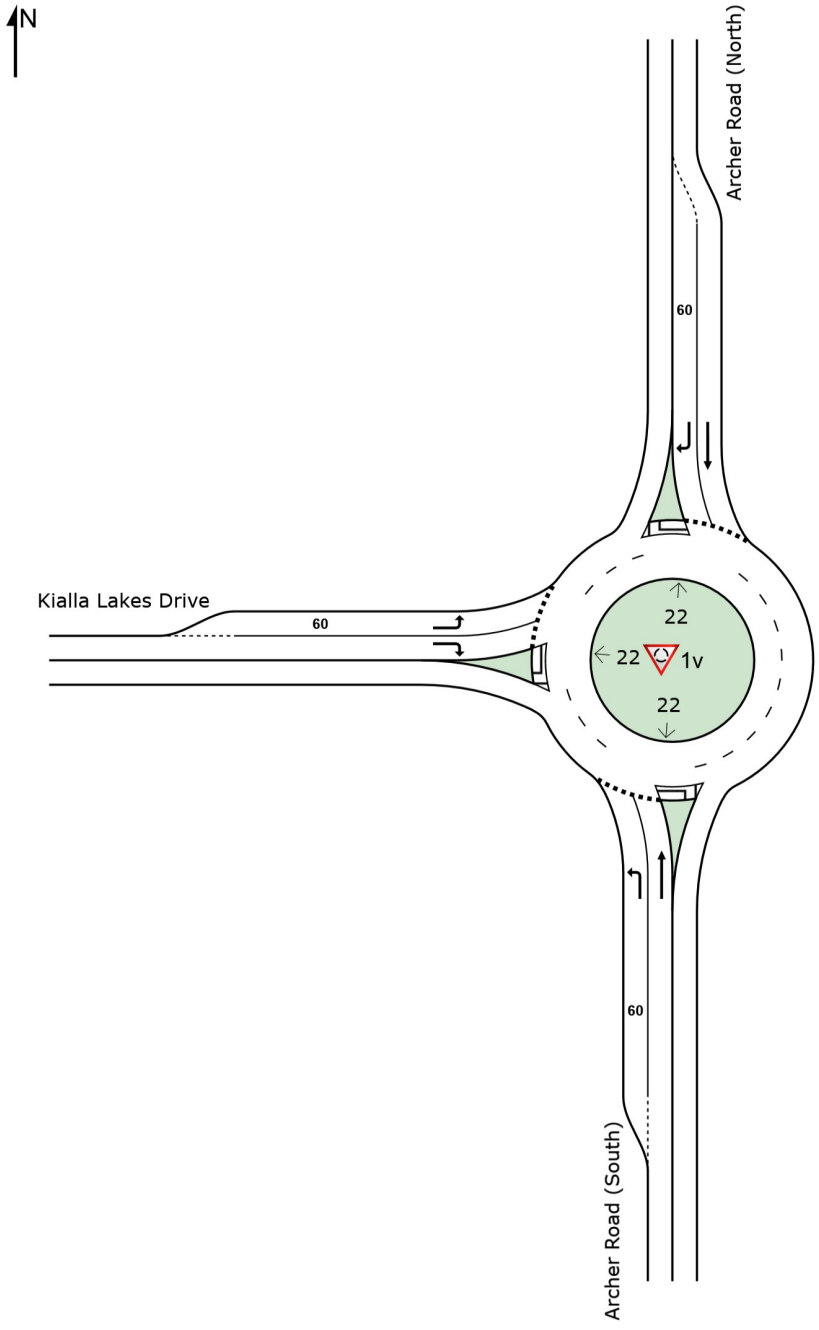
Site: 1v [1-PM-Kialla Lakes Dr / Archer Rd Intersection - Proposed Roundabout - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Kialla Lakes Dr / Archer Rd Intersection
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	98	10.2	98	10.2	637	0.154	100	9.9	LOS A	0.4	2.8	Short	60	0.0	NA
Lane 2[d]	604	10.0	604	10.0	1035	0.584	100	10.1	LOS B	2.4	18.1	Full	270	0.0	0.0
Approach	702	10.0	702	10.0		0.584		10.1	LOS B	2.4	18.1				
North: Archer Road (North)															
Lane 1[d]	854	9.7	854	9.7	1337	0.639	100	7.4	LOS A	3.0	22.9	Full	500	0.0	0.0
Lane 2	400	10.0	400	10.0	1024	0.391	100	12.5	LOS B	1.3	9.8	Short	60	0.0	NA
Approach	1254	9.8	1254	9.8		0.639		9.1	LOS A	3.0	22.9				
West: Kialla Lakes Drive															
Lane 1[d]	385	10.1	385	10.1	796	0.484	100	9.3	LOS A	1.8	13.5	Short	60	0.0	NA
Lane 2	157	10.2	157	10.2	566	0.277	100	14.6	LOS B	0.8	5.8	Full	500	0.0	0.0
Approach	542	10.1	542	10.1		0.484		10.9	LOS B	1.8	13.5				
Intersection	2499	9.9	2499	9.9		0.639		9.7	LOS A	3.0	22.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

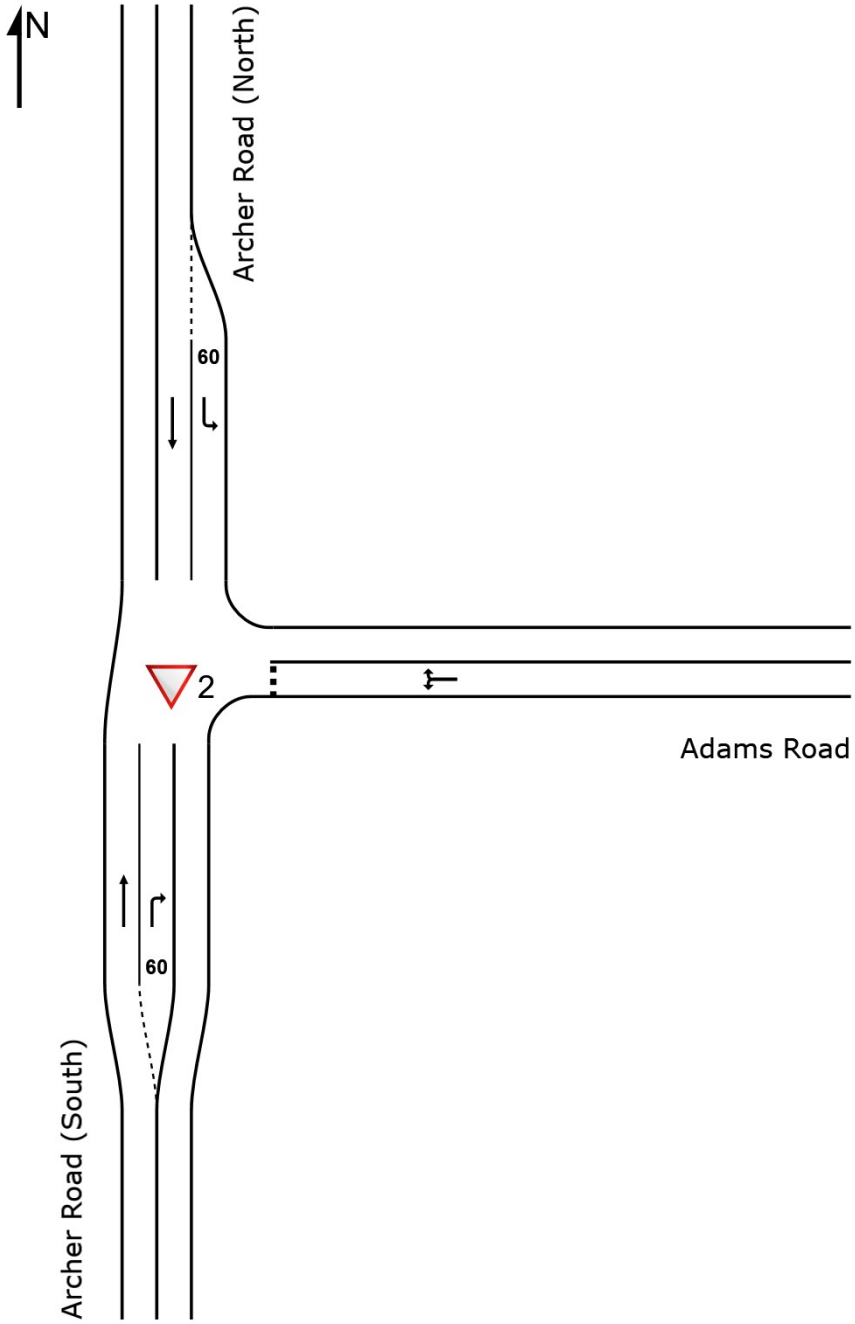
Site: 2 [2-PM-Adams Rd / Archer Rd Intersection - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Adams Rd / Archer Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	695	9.9	695	9.9	1832	0.380	100	0.1	LOS A	0.0	0.0	Full	280	0.0	0.0
Lane 2	1	0.0	1	0.0	297	0.003	100	15.9	LOS C	0.0	0.0	Short	60	0.0	NA
Approach	696	9.9	696	9.9		0.380		0.1	NA	0.0	0.0				
East: Adams Road															
Lane 1	9	11.1	9	11.1	26	0.351	100	171.8	LOS F	0.4	2.9	Full	500	0.0	0.0
Approach	9	11.1	9	11.1		0.351		171.8	LOS F	0.4	2.9				
North: Archer Road (North)															
Lane 1	7	14.3	7	14.3	1685	0.004	100	5.7	LOS A	0.0	0.0	Short	60	0.0	NA
Lane 2	1003	9.8	1003	9.8	1833	0.547	100	0.1	LOS A	0.0	0.0	Full	270	0.0	0.0
Approach	1010	9.8	1010	9.8		0.547		0.2	NA	0.0	0.0				
Intersection	1716	9.9	1716	9.9		0.547		1.0	NA	0.4	2.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

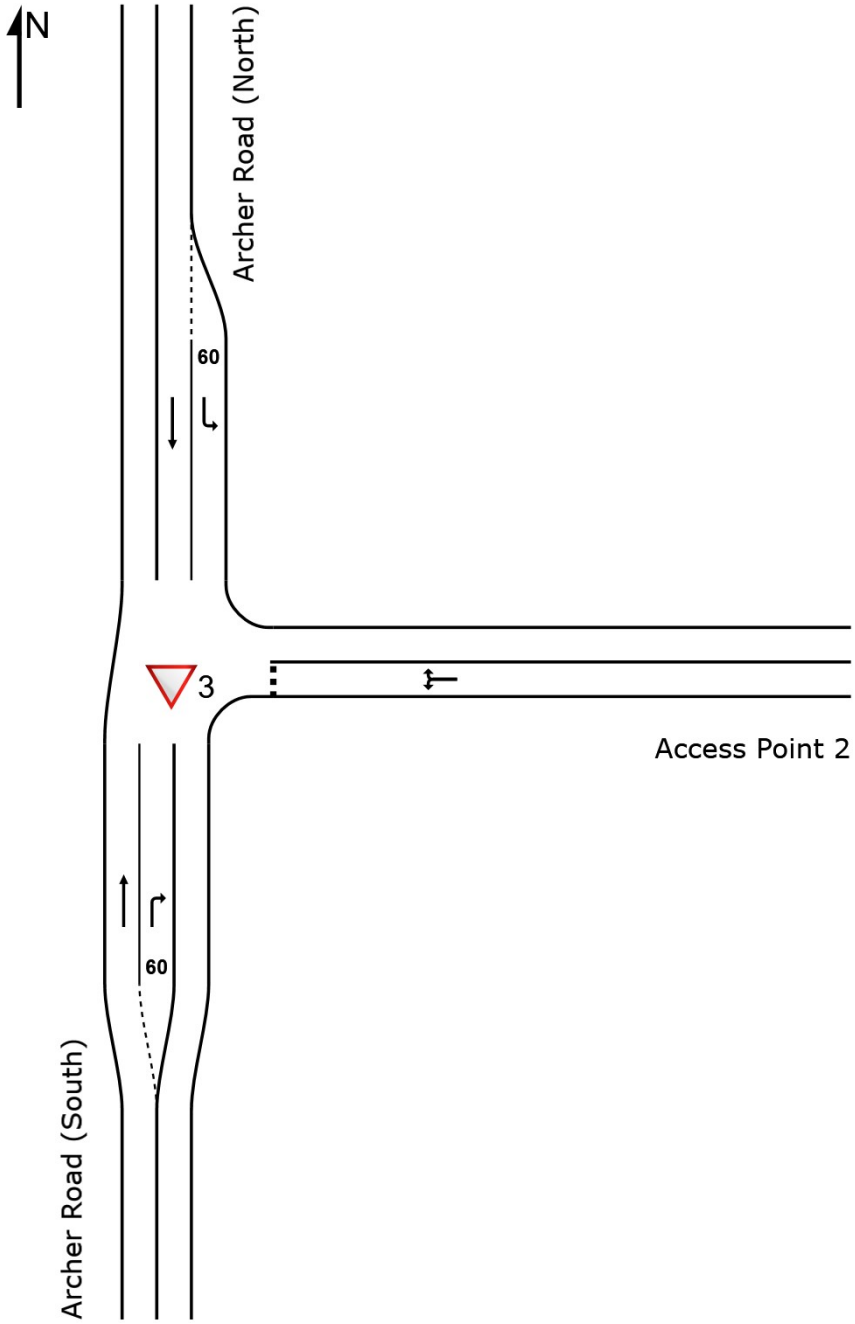
Site: 3 [3-PM-Access point 3 / Archer Rd Intersection - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Adams Rd / Archer Rd Intersection
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	695	9.9	695	9.9	1832	0.380	100	0.1	LOS A	0.0	0.0	Full	520	0.0	0.0
Lane 2	6	16.7	6	16.7	231	0.026	100	19.8	LOS C	0.0	0.3	Short	60	0.0	NA
Approach	701	10.0	701	10.0		0.380		0.3	NA	0.0	0.3				
East: Access Point 2															
Lane 1	4	25.0	4	25.0	81	0.050	100	46.2	LOS E	0.1	0.5	Full	500	0.0	0.0
Approach	4	25.0	4	25.0		0.050		46.2	LOS E	0.1	0.5				
North: Archer Road (North)															
Lane 1	1	0.0	1	0.0	1857	0.001	100	5.5	LOS A	0.0	0.0	Short	60	0.0	NA
Lane 2	1003	9.8	1003	9.8	1833	0.547	100	0.2	LOS A	0.0	0.0	Full	280	0.0	0.0
Approach	1004	9.8	1004	9.8		0.547		0.2	NA	0.0	0.0				
Intersection	1710	9.9	1710	9.9		0.547		0.3	NA	0.1	0.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

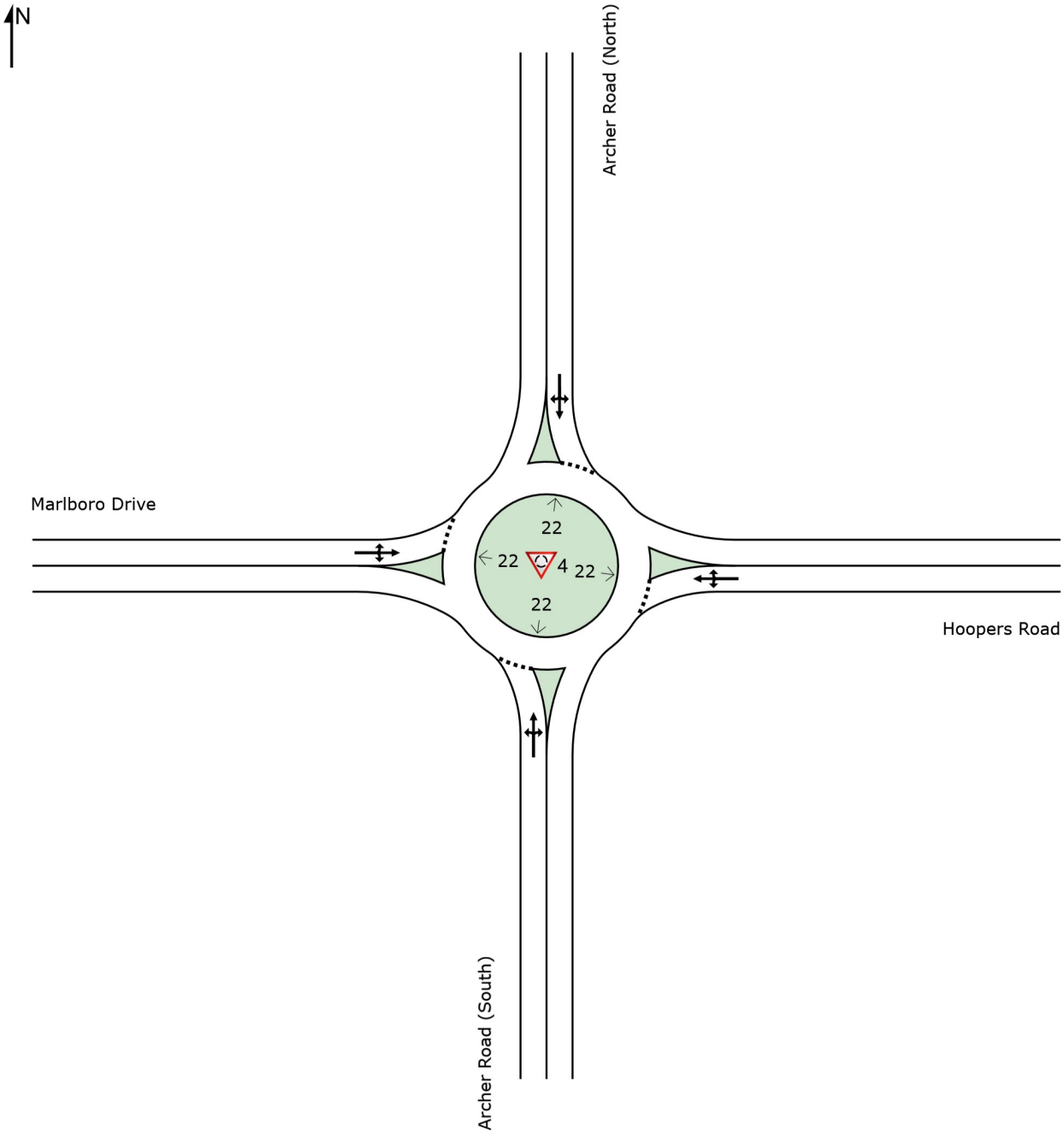
Site: 4 [4-PM-Hoopers Rd / Archer Rd / Marlboro Dr Roundabout - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Hoopers Rd / Archer Rd / Marlboro Dr Roundabout
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1[d]	624	10.0	624	10.0	1267	0.493	100	5.2	LOS A	1.7	13.3	Full	420	0.0	0.0
Approach	624	10.0	624	10.0		0.493		5.2	LOS A	1.7	13.3				
East: Hoopers Road															
Lane 1[d]	133	9.8	133	9.8	672	0.198	100	13.8	LOS B	0.5	3.8	Full	500	0.0	0.0
Approach	133	9.8	133	9.8		0.198		13.8	LOS B	0.5	3.8				
North: Archer Road (North)															
Lane 1[d]	1007	9.7	1007	9.7	1480	0.681	100	4.6	LOS A	3.2	24.6	Full	520	0.0	0.0
Approach	1007	9.7	1007	9.7		0.681		4.6	LOS A	3.2	24.6				
West: Marlboro Drive															
Lane 1[d]	20	10.0	20	10.0	681	0.029	100	10.3	LOS B	0.1	0.5	Full	500	0.0	0.0
Approach	20	10.0	20	10.0		0.029		10.3	LOS B	0.1	0.5				
Intersection	1785	9.8	1785	9.8		0.681		5.5	LOS A	3.2	24.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

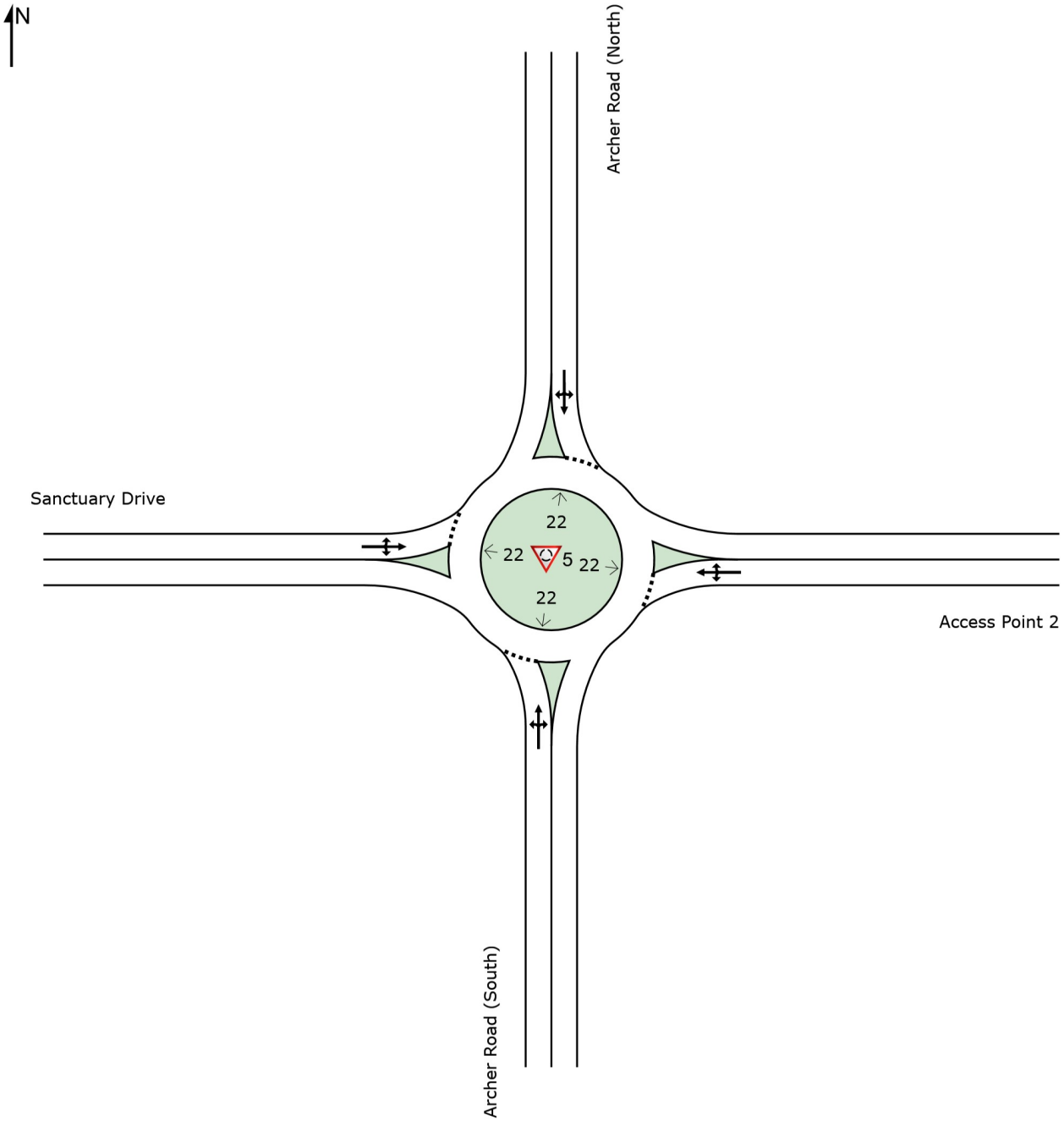
Site: 5 [5-PM-Sanctuary Dr / Archer Rd Roundabout - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Sanctuary Dr / Archer Rd Roundabout
Site Category: (None)
Roundabout

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance															
	DEMAND FLOWS		ARRIVAL FLOWS		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV] %	[Total veh/h	HV] %	veh/h	v/c	%	sec		[Veh	Dist] m		m	%	%
South: Archer Road (South)															
Lane 1[d]	272	11.1	272	11.1	706	0.386	100	11.2	LOS B	1.1	8.3	Full	1000	0.0	0.0
Approach	272	11.1	272	11.1		0.386		11.2	LOS B	1.1	8.3				
East: Access Point 2															
Lane 1[d]	515	10.1	515	10.1	916	0.562	100	11.8	LOS B	2.0	15.4	Full	500	0.0	0.0
Approach	515	10.1	515	10.1		0.562		11.8	LOS B	2.0	15.4				
North: Archer Road (North)															
Lane 1[d]	768	9.8	768	9.8	1064	0.722	100	9.9	LOS A	3.6	27.5	Full	420	0.0	0.0
Approach	768	9.8	768	9.8		0.722		9.9	LOS A	3.6	27.5				
West: Sanctuary Drive															
Lane 1[d]	287	10.1	287	10.1	737	0.389	100	9.6	LOS A	1.1	8.2	Full	500	0.0	0.0
Approach	287	10.1	287	10.1		0.389		9.6	LOS A	1.1	8.2				
Intersection	1843	10.1	1843	10.1		0.722		10.6	LOS B	3.6	27.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

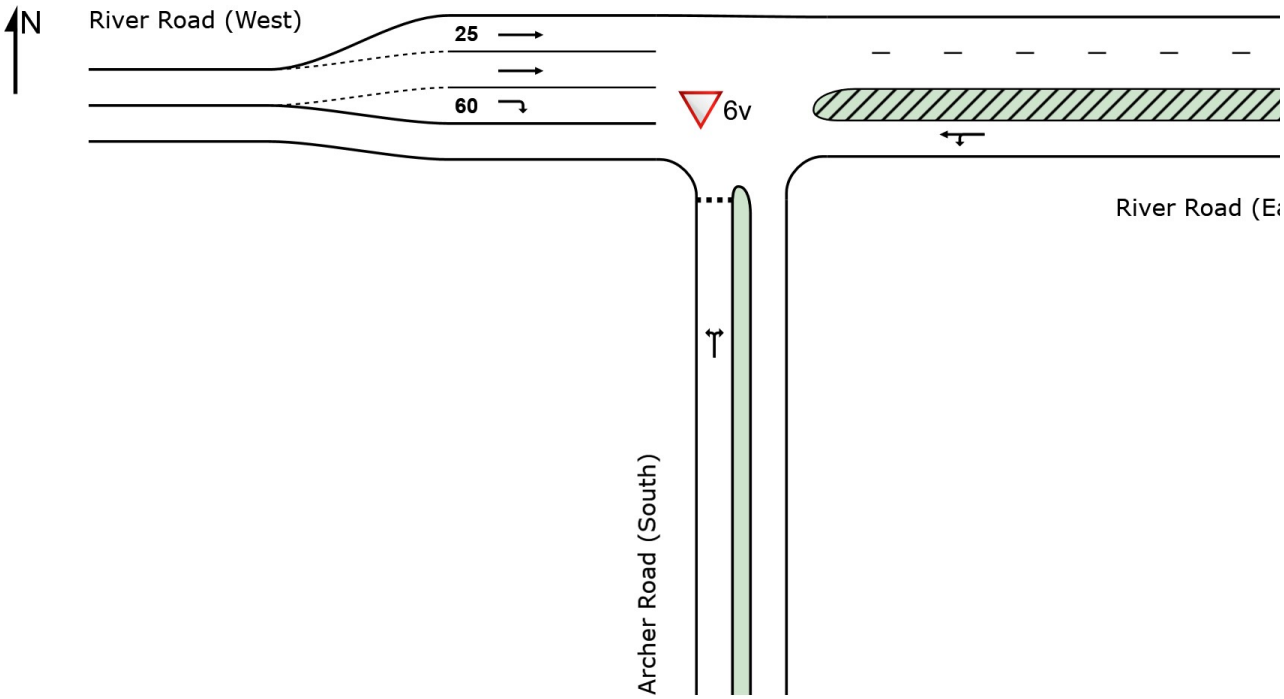
Site: 6v [6-PM-River Rd / Archer Rd - West - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Archer Rd / River Rd Roundabout
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Archer Road (South)															
Lane 1	43	9.3	43	9.3	327	0.131	100	15.5	LOS C	0.2	1.4	Full	500	0.0	0.0
Approach	43	9.3	43	9.3		0.131		15.5	LOS C	0.2	1.4				
East: River Road (East)															
Lane 1	483	9.9	483	9.9	1862	0.259	100	1.1	LOS A	0.0	0.0	Full	35	0.0	0.0
Approach	483	9.9	483	9.9		0.259		1.1	NA	0.0	0.0				
West: River Road (West)															
Lane 1	180	10.0	180	10.0	1897	0.095	100	0.0	LOS A	0.0	0.0	Short	25	0.0	NA
Lane 2	180	10.0	180	10.0	1897	0.095	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	1	0.0	1	0.0	1072	0.001	100	7.3	LOS A	0.0	0.0	Short	60	0.0	NA
Approach	360	10.0	360	10.0		0.095		0.0	NA	0.0	0.0				
Intersection	886	9.9	886	9.9		0.259		1.4	NA	0.2	1.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

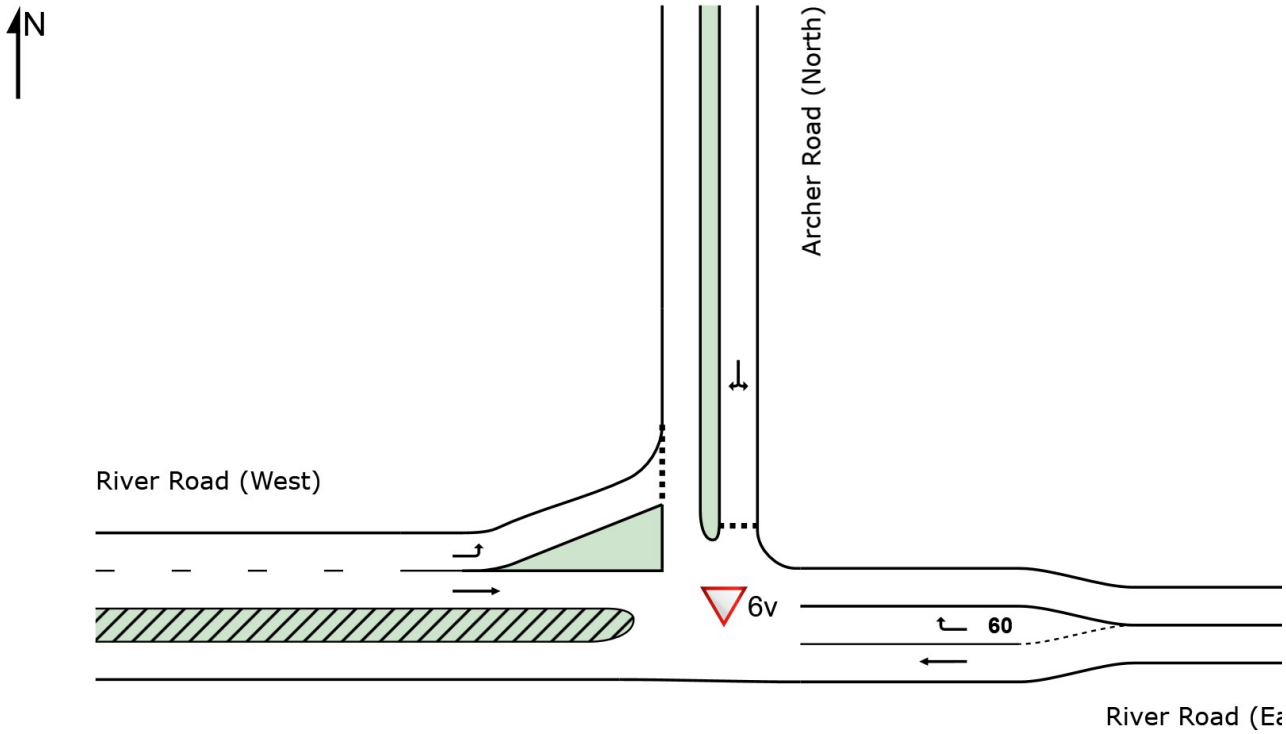
Site: 6v [6-PM-River Rd / Archer Rd - East - Adjusted volumes (Site Folder: General)]

Network: 16 [Network-PM - Roundabout - Mitigated - Adjusted Volumes (Network Folder: General)]

Archer Rd / River Rd Roundabout
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: River Road (East)															
Lane 1	343	9.9	343	9.9	1886	0.182	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	151	11.9	151	11.9	1267	0.119	100	6.8	LOS A	0.2	1.7	Short	60	0.0	NA
Approach	494	10.5	494	10.5		0.182		2.1	NA	0.2	1.7				
North: Archer Road (North)															
Lane 1	249	10.0	249	10.0	504	0.494	100	15.4	LOS C	1.2	8.9	Full	1000	0.0	0.0
Approach	249	10.0	249	10.0		0.494		15.4	LOS C	1.2	8.9				
West: River Road (West)															
Lane 1	119	10.1	119	10.1	1349	0.088	100	4.1	LOS A	0.1	1.1	Full	35	0.0	0.0
Lane 2	282	9.9	282	9.9	1898	0.149	100	0.0	LOS A	0.0	0.0	Full	35	0.0	0.0
Approach	401	10.0	401	10.0		0.149		1.2	LOS A	0.1	1.1				
Intersection	1144	10.2	1144	10.2		0.494		4.7	NA	1.2	8.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

GTAconsultants now Stantec

www.stantec.com