



APPENDIX N

TRAFFIC IMPACT ASSESSMENT

**CSR ADVANCED MANUFACTURING
HUB**

MODIFICATION 3

**235 MARTIN ROAD
BADGERYS CREEK**

**TRAFFIC ASSESSMENT REPORT
VOLUME 1**

Ref. 17179r Mod 3 Final

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EXECUTIVE SUMMARY

This report documents the traffic and transport assessment of the proposed Modification 3 at Badgerys Creek Brick Making Facility at 235 Martin Road, Badgerys Creek. This is the Volume 1 report.

The Brick Making Facility and its site is owned by CSR Building Products Limited (CSR).

The main features of the Modification 3 proposal relating to traffic and transport include;

- The recommencement of brick production from the site with new up to date Advance Manufacturing Brick Production facilities in an expanded building with updated office and research facilities (NATA accredited laboratory and Innovation centre), together with car parking, truck parking and storage areas;*
- The construction and operation of a new roof products manufacturing facility within the site, which will include its own car and truck parking.*
- Increase the importation of raw materials for use in both the brick making and roof products manufacturing facilities.*

The main findings of the traffic and transport impact assessment are as follows:

- 1) Vehicle access to the site will be from Martin Road via the Elizabeth Drive intersection, which is under priority (i.e. Give Way) control in Martin Road.*
- 2) While there are future major upgrades to the road network planned by the NSW government associated with Western Sydney Airport, these upgrades will not occur before Modifications 3 and 4 are operational in 2021.*
- 3) The proposed upgrades include the new M12 Motorway and widening and upgrading of Elizabeth Drive. However, the M12 Motorway will not be completed until the new airport opens in 2026 and there is no date for the upgrading of Elizabeth Drive.*
- 4) Weekdays will be the busiest days in terms of the traffic generation of the brick making facility with Modification 3 in place. A total of 1,008 vehicles trips a day (i.e. 504 inbound/504 outbound) will be generated on weekdays. Some 544 vehicle trips on a weekday (i.e. 272 inbound/272 outbound) will be heavy vehicle trips.*
- 5) The traffic generation of Modification 3 during the weekday AM and PM peak hours are estimated to be;*
 - 65 inbound trips and 40 outbound trips in the AM peak hour of which 33 inbound and 33 outbound trips will be heavy vehicles;*
 - 45 inbound trips and 120 outbound trips in the PM peak hour, of which 23 inbound and 23 outbound trips will be heavy vehicles.*
- 6) CSR are proposing to upgrade the intersection of Elizabeth Drive / Martin Road before Modification 3 is operational to ensure potential road safety is maintained at the intersection. The upgrade works will include additional lanes at the intersection and new traffic signals. The recommended geometric layout*

for the upgrade works with traffic signal control for Modification 3 is shown in Figure 9.

- 7) *Traffic modelling of the intersection's operation with the recommended upgrade works has found that the intersection will have a good operation with sufficient capacity up to and beyond 2026.*
- 8) *CSR will also;*
 - (i) *Upgrade and widen the section of Martin Road between the CSR site entrance and the Australian Nature Landscape (ANL) site.*
 - (ii) *Pay an annual road maintenance contribution to Liverpool Council for the upkeep of the road pavement in Martin Road.*
- 9) *An assessment of the parking provision has found that sufficient car and truck parking will be provided for the brick making facility and roof manufacturing facility to cater for the maximum parking demand.*
- 10) *All internal roads within the site will be designed and constructed to AS2890.2 standards and will cater for the largest heavy vehicles using the site.*
- 11) *Trucks entering and exiting the CSR site will include a range of heavy vehicles from rigid trucks up to 25 metre long B-doubles. All truck manoeuvring on the site will comply with AS2890.2 requirements.*
- 12) *Following approval of Modification 3 a Construction Traffic Management Plan CTMP will be prepared to manage the impacts of the Modification 3 construction impacts.*
- 13) *During the course of preparing the Modification Application, CSR held several meetings with representatives of the RMS concerning the Elizabeth Drive/Martin Road intersection. At a meeting on the 12/12/2018, the RMS advised CSR of a proposal by Mirvac to provide an access road to an industrial development on the northern side of Elizabeth Drive, opposite Martin Road. RMS also requested additional information on the proposed upgrade works to the Elizabeth Drive/Martin Road intersection, including the justification to provide traffic signals.*
- 14) *Following this meeting, additional investigations were undertaken and included*
 - *An independent road safety audit and safety review of the intersection;*
 - *An options report reviewing the available options to upgrade the traffic controls at the intersection; and*
 - *A traffic signal warrant report.*

These investigations are documented in the Volume 2 report and concluded the following;

- *The traffic controls needed to be upgraded due to the increased traffic volumes;*
- *The best option is traffic signals based on the suitable required geometry; and*
- *A traffic signal warrant for the provision of traffic signals is met for the intersection, based on the range of relevant factors and criteria normally taken into account, including future traffic volumes, vehicle delays, road safety and future planning.*

- 15) *Mirvac are proposing and industrial development on land opposite Martin Road and are proposing a new access road to create a cross junction intersection with Elizabeth Drive and Martin Road.*

Based on preliminary advice from Mirvac, the traffic generation of Stage 1 of this development will be 404 vehicles per hour in the AM and PM peak hours and for Stages 1 and 2, some 909 vehicles per hour. Stage 1 is planned to be operational in 2021 and Stages 1 and 2 in 2026.

Figures 10A-D shows a concept intersection design for the Elizabeth Drive/Martin Road/Mirvac Access Road, which will accommodate both the CSR Modifications as well as Stage 1 and 2 of the Mirvac development. Preliminary traffic modelling shows that the intersection will have sufficient capacity to 2026 and beyond. The intersection layout will be further refined by Mirvac in consultation with the RMS during Mirvac's finalisation of the development proposal.

1.0 INTRODUCTION

1.1 Background

In October 2016, CSR Building Products Limited (CSR) acquired Boral Bricks Pty Limited (Boral) brick business along the eastern seaboard of Australia and with it, the Badgerys Creek Brick Making Facility site ('the site'), which is strategically placed in the Western Sydney Priority Growth Area and borders on the proposed Western Sydney Airport precinct. **Figure 1** shows the location.

To realise the full potential of the Badgerys Creek site and to allow the site to meet the strategic needs of their brick, roof products and other building product manufacturing businesses, CSR requires modifications to the existing Project Approval (PA10_0014). CSR are proposing three separate modifications to their Project Approval as outlined in the following sections.

1.2 Modification 2

The existing Project Approval does not allow for the exportation of material extracted on-site. Due to recent and forecasted closure of many quarries in the region, reducing the availability of raw materials, CSR needs to be able to export raw material (clay) from the site. This is important for the sustainability of CSR's brick manufacturing business and to ensure an immediate and ongoing supply of raw material to other CSR brick factories.

Although the existing Project Approval allows for the storage of finished brick products in the hard stand storage yard, to the east of the brick factory, this storage area will not be used for the storage of bricks manufactured at the site, until planning approval has been granted for the upgrade of the existing brick factory and the upgrade has been completed (refer to Modification 3). In the interim, CSR urgently requires additional finished product storage capacity in the greater Sydney region and therefore wishes to make use of this valuable space for the temporary storage of finished building products from other CSR manufacturing facilities, e.g. autoclaved aerated concrete panels or roof products.

As the ability to export clay from the Badgerys Creek site and temporarily store finished building products is required as a matter of urgency, CSR has lodged a separate modification application under Section 75W of the *Environmental Planning & Assessment Act 1979* (EP&A Act) for these two activities.

CSR recently obtained planning approval for Modification 2 from the Department of Planning and Environment (DP&E) on 5 May, 2018.

1.3 Modification 3

CSR is now seeking to modify the Project Approval (10_0014) to permit or allow the following additional development or changes to the approved project:

1.3.1 Advanced Manufacturing – Brick Production

- Removal of most of the existing brick manufacturing equipment (Commons Plant) and replacement with new brick manufacturing equipment (High Grade Face Plant) in the existing Brick Making Facility;
- Increase in the building footprint of the existing Brick Making Facility;

- Increase in the building footprint of the existing administration building;
- A NATA (National Association of Testing Authorities) Accredited Advanced Testing Laboratory;
- Extension to the existing visitor's carpark;
- An innovation centre;
- A weighbridge;
- Factory staff parking;
- A new access road to the factory staff parking area and for bulk material deliveries and dispatch;
- A new rainwater tank; and
- A battery store.

1.3.2 Advanced Manufacturing – Roof Products Production

- Construction and operation of a Roof Manufacturing Facility on CSR owned land, outside the approved project boundary, immediately east of Pit 4;
- Modification to the approved project boundary to include the proposed Roof Manufacturing Facility, located on the adjacent property; and
- The processing of sandstone (overburden material not used in brick production) for use in the manufacture of roof products on-site.

1.3.3 General

- Re-commence operations at the site as approved in the Project Approval (PA10_0014), and expel the current mothballed status of the site;
- Amendment to the extent of Pit 5 to include a 200m buffer zone to neighbouring residential properties required under the *Mining Act 1992*;
- An increase in the importation of raw materials from off-site for use in both the brick making and roof products manufacturing facilities; and
- Modifications to the approved noise bunds.

1.4 Modification 4

CSR has also concurrently lodged a further separate modification application (Modification 4) to permit the following additional changes to the approved project:

- The dewatering of Pit 1;
- Continued extraction of clay material in Pit 1 to a depth of 35m;
- The importation of Virgin Excavated Natural Material (VENM) to backfill Pit 1 and potentially other pits, to rehabilitate the site and facilitate future development; and
- The establishment of a grid connected solar farm. This will allow energy security through a more diverse energy mix, initiate a clean renewable energy source on-site, reduce the greenhouse gas emissions that

contribute to global warming and improve the land utilisation on the eastern flank, outside of the approved project boundary.

The traffic and transport impacts of Modification 4 are documented in a separate Traffic and Transport Assessment Report prepared by Transport and Urban Planning Pty Ltd.

1.5 The Applicant

CSR Building Products Limited is the Applicant for the proposed modification. As CSR owns the land on which the modification to the existing Project Approval is proposed, landowner consent is not required.

CSR is an international building and construction materials group, headquartered in North Ryde, Australia. CSR's competitive position is underpinned by being a market leader in production and supply of building products for residential and commercial construction markets in Australia and New Zealand. Notable products produced by CSR include Gyprock plasterboard, Hebel, insulation, bricks and pavers, roof tiles and glass.

1.6 Site Description

As described in the *Environmental Assessment – Continuation of Operations – Quarry and Brick Making Facility, Badgerys Creek* (AECOM, 2010), the site is located at 235 Martin Road in the suburb of Badgerys Creek within Liverpool Local Government Area (LGA). Badgerys Creek is approximately 41km south west of Sydney and 17km west of Liverpool. Badgerys Creek is currently a small community comprising rural residences, agricultural activities, quarrying and industry. The locality supports many small rural residential holdings and a limited number of larger agricultural properties, agricultural enterprises (chicken farms, nurseries), composting and resource recovery facilities and market gardens. The region falls within the Western Sydney Priority Growth Area under the new Sydney Metropolitan Strategy *A Plan for Growing Sydney* (December 2014). The proposed Western Sydney Airport precinct lies to the west of the site. The regional context of the site is shown in **Figure 1**.

The site and surrounds are zoned RU1 - Primary Production zone under the Liverpool Local Environmental Plan (LEP) 2008.

The approximate 200-hectare (ha) site is bound by Badgerys Creek to the west, Ingham's Chicken to the south, South Creek to the east and Australian Native Landscapes and rural residential properties to the north (refer to the local context of the site in **Figure 2**).

Access to the site is via a private road off Martin Road which runs off Elizabeth Drive (a designated B-double route). The internal road network consists of several unsealed haul roads.

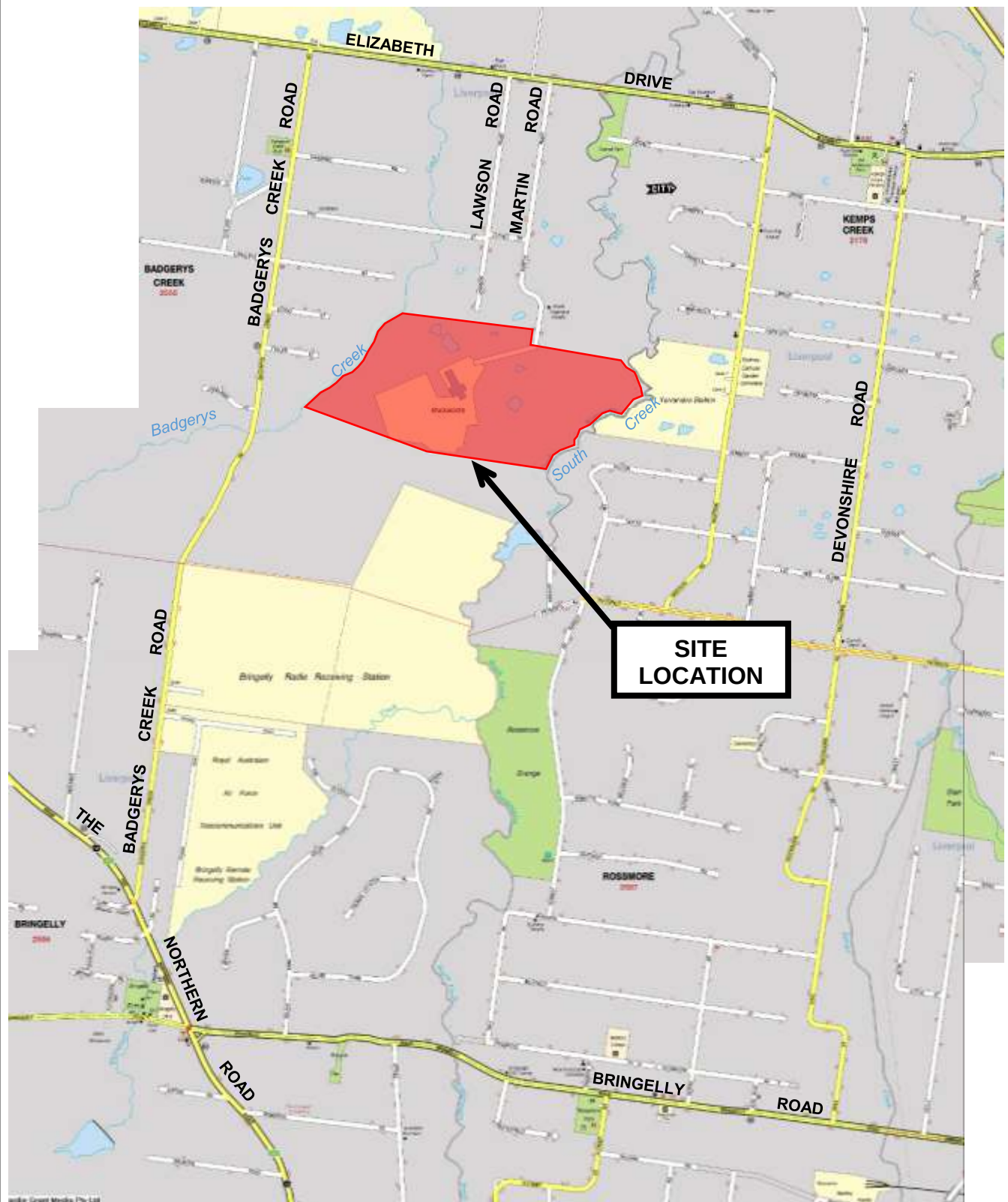
1.7 This Report and Authority Requirements

Introduction

This report has been prepared to assess the traffic impacts of the proposed Modification 3.

In this regard, the remaining sections of this report address the following:

- Section 2 outlines the existing operational and planning approval history.



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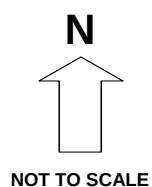


FIGURE 1
BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3
LOCATION
 JOB NO. 17179
 25/02/19



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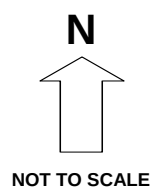


FIGURE 2
BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3
SITE
 JOB NO. 17179
 25/02/19

- Section 3 details the proposed modification to the Brick Making Facility and the Roof Manufacturing Facility.
- Section 4 examines the existing road network and traffic and transport conditions on the road network, adjacent the site; and
- Section 5 assesses the traffic and transport impacts of the proposal on the road network in the area, as well as addressing other matters.

Authority Requirements

As part of the preparation of the Traffic and Transport Assessment for Modification 3, consideration was given to the Secretary's Environmental Assessment Requirements (SEARs) from the Department of Planning and Environment, which includes requirements of relevant government agencies including any key issues identified by authorities.

The SEARs and RMS as well as Liverpool City Council's requirements for Traffic and Transport are shown in Table 1.1 together with the relevant section where the issue is addressed.

TABLE 1.1

SEARs, RMS AND LIVERPOOL COUNCIL's REQUIREMENTS FOR TRAFFIC ASSESSMENT

Authority	Requirement/Issue	Approach/Section Reference
NSW Department of Planning & Environment	No specific traffic issues other than the need to take into account issues raised by other authorities including RMS and Liverpool City Council.	All of report
NSW Roads & Maritime Services (RMS)	RMS require the following issues to be included in the traffic and transport impact assessment. 1. Daily peak and traffic movements likely to be generated by the proposed development including the impact on nearby intersections and the need/associated funding for upgrading or road improvement works (if required). The key intersections to be examined/modelled include: - Elizabeth Drive/Martin Road intersection 2. Details of the proposed accesses and the parking provisions associated with the proposed development including compliance with the requirements of the relevant Australian Standards (i.e.	Sections 5.4 & 5.5 Sections 5.4 and 5.5 Sections 5.8 and 5.9

Authority	Requirement/Issue	Approach/Section Reference
	turn paths, sight distance requirements, aisle widths etc). 3. Proposed number of car parking spaces and compliance with the appropriate parking codes. 4. Details of service vehicle movements (including vehicle type and likely arrival and departure times). 5. Roads and Maritime requires an assessment of the likely toxicity levels of loads transported on arterial and local roads to/from the site and, consequently, the preparation of an incident management strategy for crashes involving such loads, if relevant. 6. Roads and Maritime will require, in due course, the provision of a traffic management plan for all demolition/construction activities, detailing vehicle routes, number of trucks, hours of operation, access arrangements and traffic control measures.	Sections 3.1, 3.2 & 5.9 Section 5.4 This is addressed in the Environmental Assessment (EA) main report CTMP can be a Condition of Consent
Liverpool Council	1. As CSR's proposal involves expanded operations that will generate additional heavy vehicles, Council considers that Condition 28 of the original approval shall be carried over and amended as follows. <i>The proponent shall, prior to commencing, enter into a formal agreement with Council for the:</i> - <i>Upgrade and widening of Martin Road from the site entrance to the entrance of Australian Native Landscape;</i> - <i>Widening of Martin Road in the reverse curves; and</i> - <i>Annual road maintenance contributions to be paid to Council, based on the weight of all products and associated materials transported from and to the site, for the life of the project, to the satisfaction of the Director-General.</i> <i>If there is any dispute between the Proponent and Council, then either of</i>	CSR has agreed to LCC's proposed amendment to Condition 28. See Section 5.10 See above

Authority	Requirement/Issue	Approach/Section Reference
	<i>the parties may refer the matter to the Director-General for resolution.</i> 2. <u>Traffic and Transport Impact Assessment</u> A traffic and transport impact assessment is to be undertaken in accordance with Austroads Standards and the RMS Guide to Traffic Generating Development. The assessment should include the following (but not be limited to): • Estimated total daily and peak hour vehicle trips (both light and heavy vehicles) generated by the proposed modification(s) and other planned developments in the area; • Haulage routes and times proposed to be used by heavy vehicles transporting raw materials and manufactured materials to/from the subject site; • Cumulative traffic impacts of the proposed modification and other planned developments/modifications on the surrounding road network and intersections; • Intersection performance analysis of the Elizabeth Drive and Martin Road intersection; • Indicative layout of the Elizabeth Drive and Martin Road intersection (an upgrade, if warranted, in consultation with Council and the RMS); • Indicative future alignment, lane configuration and rehabilitation of Martin Road extension to be overlayed in the subject site; • Any proposed access arrangements on Martin Road to serve Badgerys Creek Brick Making Facility and the proposed roof products manufacturing Facility; • The number of parking spaces on-site for staff and trucks shall be detailed and should be consistent with Councils DCP and the RMS guide;	See above This assessment and report has been undertaken in accordance with these standards/guidelines Section 5.4 Sections 4.1 and 5.5 Sections 5.3 & 5.5 Sections 5.5 and 5.6 Sections 5.5 and 5.6 & Figures 9 and 10 Section 5.10 Section 5.8 Section 5.9

Authority	Requirement/Issue	Approach/Section Reference
	• Details of public transport services, including routes and service frequency; • The proposed walking and cycling access arrangements; • Details of bicycle parking provisions, including end of trip facilities, in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance; • The swept path of the longest vehicle entering and exiting the subject site(s), as well as manoeuvrability through the site, shall be in accordance with Austroads. In this regard a plan shall be submitted to Council for approval, which shows that the proposed development complies with this requirement. • Identification of infrastructure and funding mechanism required to ameliorate any impacts on traffic efficiency, pavement damage and road safety impacts associated with the proposed development. • Consultation should be undertaken with the Western Sydney Airport Authority (WSAA) about the traffic impact of the development and its interface with the WSA. 3. <u>Construction Traffic Impact Assessment</u> Including the following: • Assessment of cumulative impacts associated with other construction activities (if any) on the surrounding road network and intersection(s); • An assessment of road safety at key intersection and locations subject to heavy vehicle construction traffic movements; • Details of construction program detailing the anticipated construction duration and highlighting significant and milestone stages and events during the construction process;	Section 4.3 Section 4.4 Section 5.9 Section 5.8 And Figures 13 and 14 Section 5.5 EA consultant has undertaken consultation with all stakeholders including WSAA Section 5.7 Section 5.7 These details will be provided in the CTMP, which will be prepared

Authority	Requirement/Issue	Approach/Section Reference
	• Details of anticipated peak hour and daily construction vehicle movements to and from the site; • Details of on-site car parking and access arrangements of construction vehicles, construction workers to and from the site, emergency vehicles and service vehicles; • Haulage routes of construction vehicle	following development approval. Section 5.7 CTMP will provide these details. Section 5.7

This Report

This Traffic and Transport Assessment Report has been prepared in accordance with Austroads Guide to Traffic Management, Part 12, Traffic Impacts of Development and the RTA's (now RMS) Guide to Traffic Generating Developments, October 2002 and addresses all relevant issues as outlined in Table 2.1 of the RMS Guide.

Other relevant standards/guidelines adopted and used during the traffic and transport assessment include:

- Austroads Guide to Traffic Management;
- RTA (now RMS) Austroads Guide Supplements – Austroads Guide to Traffic Management;
- AS2890.1 (2004) – Parking Facilities. Part 1 Off street car parking; and
- AS2890.2 (2002) – Parking Facilities. Part 2 Off Street Commercial Vehicle facilities.

The traffic modelling undertaken as part of this assessment has used SIDRA 8 software, which is an RMS approved traffic model for intersection analysis.

This report is Volume 1 and documents the traffic and transport assessment for Modification 3.

A separate report, Volume 2, documents additional investigations undertaken for the proposed upgrade works at the intersection of Elizabeth Drive/Martin Road. Volume 2 contains a road safety audit and safety review report, an options report assessing the intersection upgrade options and a traffic signal warrant report.

2.0 EXISTING OPERATIONS

2.1 Operational and Planning Approval History

Boral Bricks Pty Limited (Boral) owned and operated the Badgerys Creek Quarry and Brick Making Facility at Badgerys Creek for over 30 years.

On 27 September 2011, project approval was issued under Section 75J of the EP&A Act for the ongoing production of bricks and the expansion of the existing quarrying operations at the Badgerys Creek site.

Due to uncertain economic conditions and a downturn in residential housing activity, Boral reviewed its bricks production capacity in NSW. Following this review, Boral determined to 'mothball' its operations at Badgerys Creek effective from 30 March 2012. Shutting down the site gave Boral the option to review its commercial position at a future stage and, if market conditions and business needs allow, recommence production. During the shutdown period, the Boral Bringelly Brick Making Facility (now owned by CSR) supplied the Sydney market.

Because of the shutdown, Boral was unable to comply with the conditions of approval and applied to modify the Project Approval under Section 75W of the EP&A Act.

Modification application (10_0014 Mod 1) requested that post-March 2012 activities be limited to:

- Minor maintenance and inspection (e.g. water management, equipment testing);
- Operation of the retail display facility; and
- Irregular and occasional dispatch of bricks from the inventory remaining on-site.

In 2015, Boral and CSR formed a joint venture brick business called Boral CSR Bricks Pty Ltd. The assets held by the respective companies were transferred into the joint venture. At the end of October 2016, CSR acquired Boral's share of the brick business and with it, the Badgerys Creek Brick Making Facility.

2.2 Approved Project

The approved quarrying and brick making activities, outlined in the Project Approval are to:

- Extract 420,000 tonnes of clay per calendar year;
- Produce 252,000 tonnes of bricks per calendar year;
- Extract any clay shale or carry out any work in the extraction area no deeper than 35 metres below the pre-existing natural surface of the ground;
- Receive 20,000 tonnes of raw material for brick making per calendar year; and
- Dispatch more than 275,000 tonnes of raw materials from the site in any calendar year.

Product from the quarry and Brick Making Facility is approved for transport entirely by road. The Project Approval limits the number of truckloads/heavy vehicle movements that can exit the site per day to:

- A maximum of 60 laden brick trucks (i.e. 120 movements), Monday to Friday; and
- A maximum of 20 laden brick trucks (i.e. 40 movements) on Saturdays.

The approved project is shown in **Figure 3**.

Quarry Activities

2.2.5 Operating Hours and Workforce

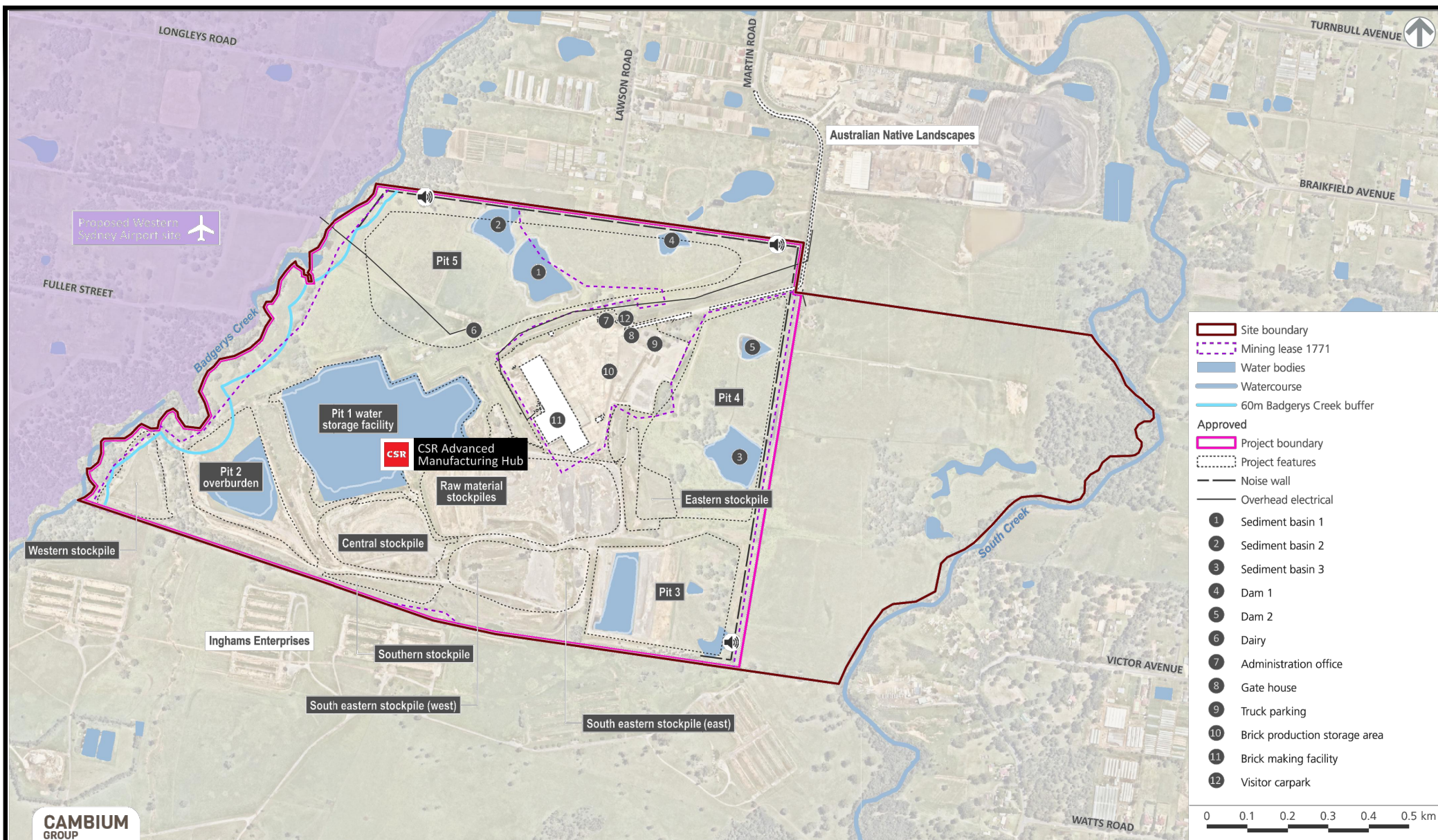
Approved operating hours for the site are outlined in detail in **Table 2.1**.

TABLE 2.1

APPROVED OPERATING HOURS

ACTIVITY	DAY	TIME
Quarrying operations (excluding removal of overburden, truck arrival, loading and dispatch)	Monday-Saturday	7:00am to 6:00pm
	Sunday and public holidays	None
Removal of overburden and construction of noise bunds	Monday-Friday	7:00am to 6:00pm
	Saturday	8:00am to 1:00pm
	Sunday and public holidays	None
Brick Making Facility and storage yard	Monday-Sunday	24 hours
Truck arrival and dispatch (excluding finished building products)	Monday-Friday	6:00am to 10:00pm
	Saturday	6:00am to 6:00pm
	Sunday and public holidays	None
Truck arrival and dispatch (finished building products only)	Monday-Saturday	7:00am to 10:00pm
	Sunday and public holidays	None
Maintenance	At any time, provided that these activities are not audible at any privately-owned residence outside of permissible hours for quarrying operations	

At the height of previous operations, there were 56 people employed in the Brick Making Facility and 20 in the administration/sales office. Up to ten contractors worked two to four months per annum on a campaign basis to complete the quarrying activities.



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FIGURE 3 BADGERYS CREEK BRICK MAKING FACILITY MODIFICATION 3

APPROVED PROJECT

3.0 PROPOSED MODIFICATIONS

3.1 Brick Making Facility

Under this Modification 3 to the Project Approval (10_0014), CSR is seeking permission to allow the following additional development or changes to the approved project:

3.3.1 Reconstruction and Expansion of Brick Manufacturing Facility

The existing brick manufacturing facility is designed to produce what is referred to as 'commons' or common utility bricks, which is a red brick that is predominantly used for internal walls, for supporting structures, or can be used externally when rendered or painted. The recent progression in alternative building methodologies and products and an increase in multi dwelling residential developments, has resulted in a significant decrease in the demand for common bricks. As face bricks are now more sought after and are likely to continue to be for aesthetic applications, CSR needs to ensure its brick making facilities can manufacture face bricks.

Due to the age of the Badgerys Creek brick manufacturing facility and its inability to produce face bricks, CSR are proposing to replace the existing manufacturing equipment in the brick manufacturing facility and retain the existing building.

CSR are also proposing to extend the existing brick manufacturing building to the north and east with an additional footprint of 10,600 m².

CSR are also proposing an increase in brick production from the approved 252,000 tonnes to 300,000 tonnes per calendar year. At an average weight of approximately 3kg per brick, CSR will produce up to 100 million single brick units per calendar year.

3.1.2 Administration Offices

An approximately 515m² westward extension of the existing administration building is proposed to support all administration functions required at the site. The building extension will be located on existing concrete hardstand that forms part of the brick product storage yard.

3.1.3 NATA Laboratory

An approximately 450m² NATA Accredited Advanced Testing Laboratory is proposed adjacent the administration offices. Activities likely to be undertaken in the laboratory include brick and clay testing involving fixing and firing of clay samples, and measurements of brick dimensions and other properties. Firing will be within a small 1-2 m³ electric fired kiln. Brick sawing may also take place in laboratory building. The NATA laboratory will be located immediately west of the administration offices on existing concrete hardstand that forms part of the brick product storage yard.

3.1.4 Innovation Centre

CSR's Velocity Business has an innovation work stream, which is proposing an external test structure on an approximately 30m x 30m site (900m²) immediately east of the truck drivers parking and gatehouse. CSR are looking for a mechanism to rapidly experiment with structural and external systems so that CSR can offer better whole of house solutions to builders.

3.1.5 Parking

Parking of heavy and light vehicles at the Brick Making Facility will be accommodated in the following existing and proposed parking areas:

- Visitors parking: The proposed extension to the existing visitor's carpark to the east of the display centre and north of the gatehouse, will provide 50 light vehicle parking spaces;
- Truck drivers parking: 20 spaces for truck parking is provided in the existing truck drivers parking area immediately east of the gatehouse; and
- Factory staff parking: 60 light vehicle parking spaces for staff working in the Brick Making Facility are proposed in a formalised light vehicle carpark adjacent (east) of the brick manufacturing facility on existing concrete hardstand that forms part of the brick product storage yard.

3.1.6 New Access Road

A new access road is proposed to the south of the Brick Making Facility. This new access road branches off the existing access road (driveway) prior to the truck drivers parking and gatehouse and will be used by light vehicles accessing the factory staff parking area and heavy vehicles delivering or dispatching bulk raw material.

3.1.7 Weighbridge

A weighbridge is proposed on the existing access road and will be used to check tonnages of bulk material trucks and finished brick product delivery trucks.

3.1.8 Rain Water Tank

Rainwater tanks are proposed to the west of the brick manufacturing building adjacent to the existing waste water process tanks. Captured rainwater from the roof of the brick manufacturing building will be used to supplement the brick facility water demand.

Associated infrastructure including the brick product storage area, and the display centre are likely to remain unchanged.

3.1.9 Capital Investment and Workforce

The reconstruction of the brick manufacturing facility and establishment of all other associated buildings and infrastructure would cost approximately \$140 million.

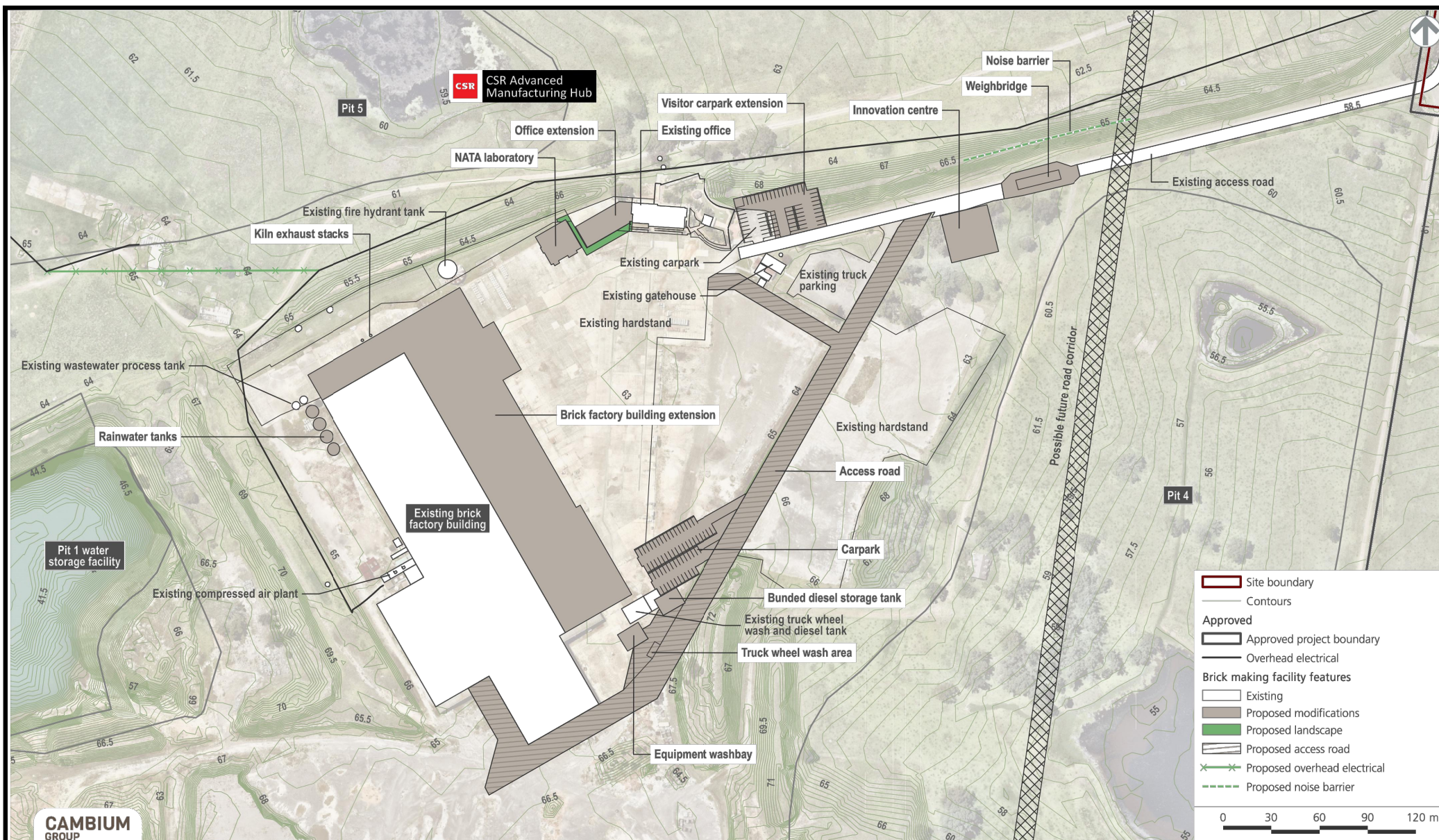
The Brick Making Facility will employ approximately 70 personnel.

3.2 Roof Manufacturing Facility

CSR currently manufactures roof products at their Monier facility at 10 Grand Ave, Rosehill, NSW.

Due to surrounding urban development pressure, CSR need to move their Sydney roof tile manufacturing operations and have identified their Badgerys Creek site as an ideal location.

CSR propose to construct and operate the Roof Manufacturing Facility on CSR owned land, outside the approved project boundary, immediately east of Pit 4. **Figures 4A and 4B** show the proposed project for Modification 3 including the location of the Roof Manufacturing Facility.



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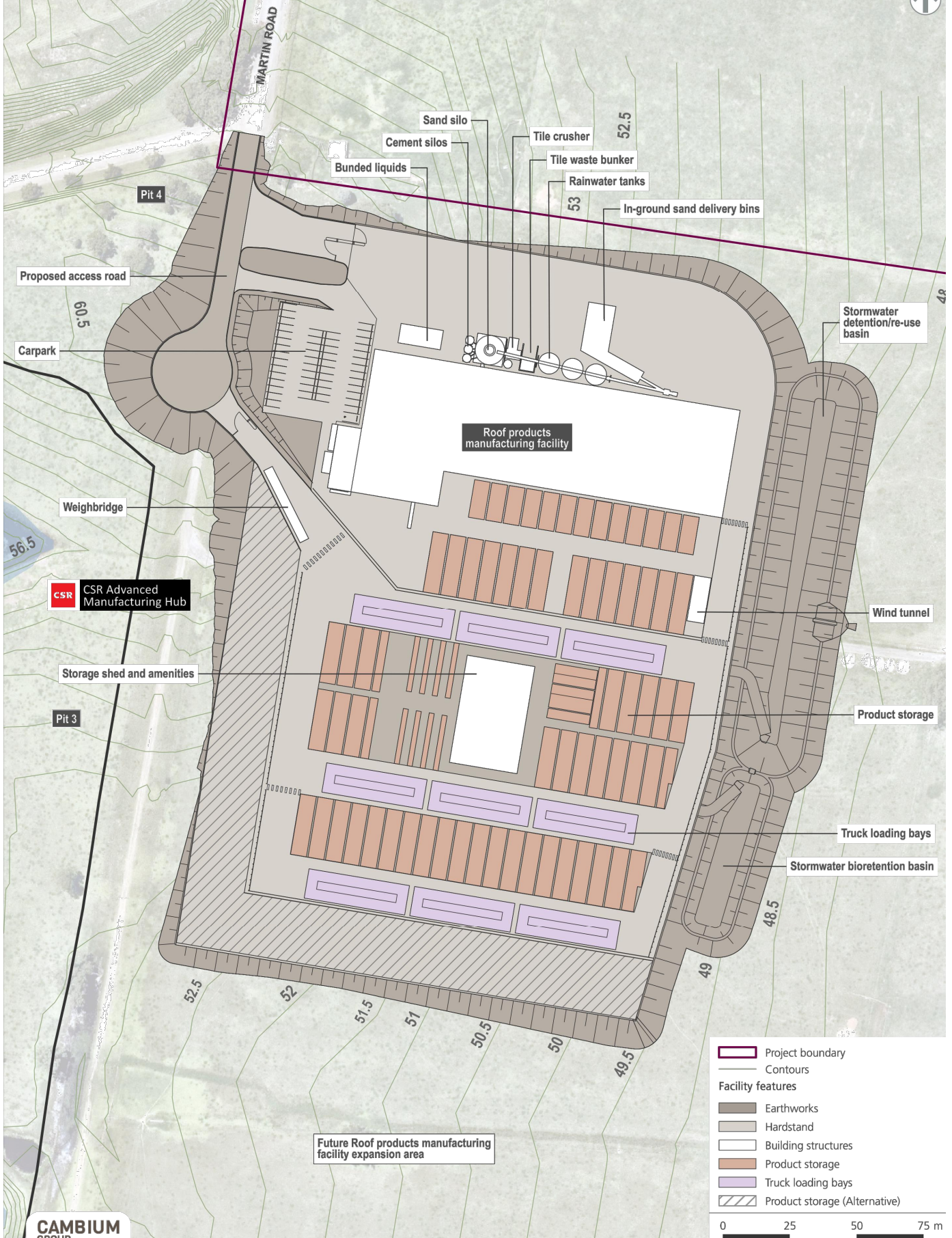
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FIGURE 4A

BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3

MODIFICATIONS TO BRICK MAKING FACILITY

Source: Element Environment



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FIGURE 4B

BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3

PROPOSED MONIER ROOF PRODUCTS MANUFACTURING FACILITY

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The new Roof Manufacturing Facility and associated infrastructure would cover a total site area of 45,275m², which would include:

- Approximately 5810m² factory for housing the roof products manufacturing facility including the storage of raw materials (e.g. sand, cement, flyash and liquid additives). An administration office, control room, technical centre, laboratory and workshop is also proposed within the factory building;
- Approximately 42,890m² concrete hardstand area for the storage of finished products;
- Yard/batten storage shed footprint of approximately 1,000m²;
- Guardhouse of approximately 75m²;
- Storage Shed and Drivers Amenities of approximately 1000m²;
- Wind tunnel of approximately 100m²;
- Two 100,000 litre rainwater tanks;
- 49 light vehicle car parking spaces;
- Weighbridge; and
- Access road (1,821m² bitumen sealed).

The new Roof Products Manufacturing Facility would produce up to 132,000 tonnes of roof products per annum and would cost approximately \$45 million to construct.

Monier's Sydney operations will employ 53 personnel over a full weekday and 30 personnel on a Saturday, with a maximum of 38-40 on site at any time.

A detailed description of the roof products manufacturing process is included in the Modification 3 Environmental Assessment (Element Environment, 2018).

3.3 Increase in Importation of Raw Materials

The site is approved to receive 20,000 tonnes of raw material for brick making per calendar year. CSR propose to increase the importation of raw materials for brick production to 215,000 tonnes per calendar year.

CSR also propose the importation of 124,000 tonnes of raw materials for roof product production per calendar year.

3.4 Comparison Against Approved Project

A comparison of the approved operations at the site and the proposed modification to the approved project is set out in **Table 3.1**.

TABLE 3.1**COMPARISON OF APPROVED PROJECT AND PROPOSED MODIFICATIONS**

Activity	Existing Project Approval	Proposed Modification	Variance to Approved Project
Brick Production	252,000 tonnes of bricks per calendar year	300,000 tonnes of bricks per calendar year	48,000 tonnes of bricks per calendar year
Roof Products Production	Nil	132,000 tonnes of roof products per calendar year	Increased production of 132,000 roof products per calendar year
Quarrying	Extract 420,000 tonnes of clay shale per calendar year	No change	Nil
Receival of raw materials	Receive 20,000 tonnes of raw materials for brick production per calendar year	Importation of 215,000 tonnes of raw materials for brick production and 124,000 tonnes for roof product production per calendar year	Increase of 319,000 tonnes of imported raw materials for brick and roof product production per calendar year
Dispatching of raw materials	Dispatch more than 275,000 tonnes of raw materials from the site per calendar year	No change	Nil
Truck Movements	Maximum of 60 laden brick trucks (i.e. 120 vehicle movements) exiting the site per day Monday to Friday	Maximum of 272 heavy vehicles exiting the site per day Monday to Friday	Increase of 212 heavy vehicles exiting the site per day Monday to Friday
	Maximum of 20 laden brick trucks (i.e. 40 vehicle movements) exiting the site per day on Saturday	Maximum of 79 heavy vehicles exiting the site per day on Saturday	Increase of 59 heavy vehicles exiting the site per day on Saturday
Duration of Project Approval	27 September 2031	30 years from date of approval of Modification 3	As the quarry and Brick Making Facility would have been in a mothballed state over the first six years of the Project Approval and the Project Approval is only for a 20 year period, CSR wishes to include an extension of the Project Approval duration to 30 years and requests that the 30 years commences from the date of the approval of Modification 3

TABLE 3.1 Continued**COMPARISON OF APPROVED PROJECT AND PROPOSED MODIFICATIONS**

Activity	Existing Project Approval	Proposed Modification	Variance to Approved Project
Quarrying operations (excluding removal of overburden, truck arrival, loading and dispatch)	Monday-Saturday 7:00am to 6:00pm Sunday and public holidays None		No change
Removal of overburden and construction of noise bunds	Monday-Friday 7:00am to 6:00pm Saturday 8:00am to 1:00pm Sunday and public holidays None		No change
Brick Making Facility and storage yard	Monday-Sunday 24 hours		No change
Roof Manufacturing Facility and storage yard	Nil	Monday-Sunday 24 hours	Roof Manufacturing Facility and storage yard to operate 24 hours Monday-Sunday
Truck arrival and dispatch (excluding finished building products i.e. raw materials)	Monday-Friday 6:00am to 10:00pm Saturday 6:00am to 6:00pm Sunday and public holidays None	Monday-Friday 6:00am to 10:00pm Saturday 6:00am to 6:00pm Sunday and public holidays None	No change
Truck arrival and dispatch (finished building products only)	Monday-Saturday 7:00am to 10:00pm Sunday and public holidays None	Monday-Friday 5:00am to 10:00pm Saturday 6:00am to 6:00pm Sunday and public holidays None	Deliveries and dispatch to be extended by one hour earlier in the morning to allow finished product trucks to arrive at site at 5:00am, load, and be ready for dispatch at 6:00am

TABLE 3.1 Continued**COMPARISON OF APPROVED PROJECT AND PROPOSED MODIFICATIONS**

Activity	Existing Project Approval	Proposed Modification	Variance to Approved Project
Sales Selection/Cash Sales	Nil	Monday-Saturday 6:00am to 6:00pm Sunday and public holidays None	Additional operating hours for sales selection and cash sales activities for finished brick products
Customer Display Centre	Nil	Monday-Sunday 8:00am to 5:00pm Public Holidays None	Additional operating hours for finished brick products customer display centre

4.0 EXISTING TRANSPORT CONDITIONS AND FUTURE PROPOSALS

4.1 Existing Road Network

The principal road network that provides access to the CSR site is Martin Road and Elizabeth Drive.

Martin Road is a two lane north south local road under the control of Liverpool City Council that intersects with Elizabeth Drive at its northern end and is a dead end at its southern end at the CSR vehicle entrance.

Martin Road is approximately 2.1km in length and has an S shaped bend in the road alignment approximately 400 metres, north of the CSR vehicle entrance.

It has a sealed road pavement of variable road width between 8-10 metres with additional pavement width at its intersection with Elizabeth Drive.

No kerb and guttering is provided and it generally has a 20 metre road reserve.

Martin Road provides vehicle access to the rural and other uses that have frontages to Martin Road.

Elizabeth Drive is an east west state arterial road that runs between the Hume Highway at Liverpool and the Northern Road at Bringelly. Major roads that intersect/connect with Elizabeth Drive include Cowpasture Road, the M7 and Mamre Road.

At Badgerys Creek, Elizabeth Drive is generally a two lane rural road with sealed shoulders, centerline and edgeline markings and an 80km/h speed limit.

Intersection treatments in the two lane section of Elizabeth Drive, vary between basic treatments and channelized treatments that include turning lanes.

A number of intersections have channelized intersection treatments including Martin Road, Lawson Road and the Access Road to Kemps Creek Waste Facility, which is adjacent to Martin Road.

4.1.2 Elizabeth Drive and Martin Road Intersection

The intersection of Elizabeth Drive and Martin Road (**Figure 5**) is a channelized T-junction intersection which includes:

- Single eastbound and westbound through lanes in Elizabeth Drive;
- A left turn deceleration lane (100 metres long plus taper) in eastern approach of Elizabeth Drive (CHL treatment);
- A right turn auxiliary lane in the western leg of Elizabeth Drive (275 metres long including taper) to facilitate the left turn out of Martin Road; and
- Flaring at the intersection in Martin Road that can accommodate a single left and right turn vehicle in Martin Road, at the holding line.

Martin Road is subject to give way control and the speed limit in Elizabeth Drive is 80km/h and in Martin Road 60km/h.



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FIGURE 5

BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3

ELIZABETH DRIVE/MARTIN ROAD EXISTING INTERSECTION

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The Martin Road intersection is located approximately 120 metres east of the Suez Access Road to Kemps Creek Waste Facility. This intersection is also a T-junction intersection with a right turn bay (CHL treatment) lane in Elizabeth Drive.

Sight distance at the intersection of Elizabeth Drive/Martin Road to and from the east is good and easily meets Austroad requirements for Safe Intersection Sight Distance for 80km/h design speed which is 181 metres. There is a crest in Elizabeth Drive, west of Martin Road which limits sight distance in the western approach to approximately 185 metres, which is consistent with Safe Intersection Sight Distance. However, the presence of trucks in the right turn bay in Elizabeth Drive waiting to turn into the Suez Access Road does impede the sight distance of eastbound vehicles in the western approach of Elizabeth Drive, as well as for vehicles turning right out of Martin Road.

4.2 Existing Traffic Conditions

4.2.1 Traffic Volumes

Traffic volumes collected as part of this assessment included automatic vehicle volume and classification counts in Martin Road, as well as a weekday AM and PM intersection count at the Elizabeth Drive/Martin Road intersection. These counts were undertaken in May 2018.

The RMS also collect traffic volumes on the state road network. The closest counting station in Elizabeth Drive is located at Cecil Hills (Station 64022) which is east of the M7 and approximately 8.4km east of Martin Road.

Daily Volumes in Martin Road

Daily volumes in Martin Road are derived from counts undertaken south of Elizabeth Drive in the week between 3-9 May 2018.

Table 4.1 shows the average weekday volumes (i.e. 5 days average) by hour in Martin Road. Table 4.2 shows Saturday hourly volumes as recorded in the traffic counts.

Reference to Tables 4.1 shows that two way volumes on an average weekday number 877 vehicles. Heavy vehicles (Austroad Class 3-12) number 361 vehicles per day, which represents 41.2% of total weekday vehicles.

Reference to Table 4.2 shows that total daily volumes on Saturdays are lower and number 555 vehicles per day. Heavy vehicles (Austroad Class 3-12) number 126 vehicles per day which represents 22.7% of the total Saturday volumes.

TABLE 4.1**AVERAGE WEEKDAY HOURLY VOLUMES IN MARTIN ROAD**

Time	North	South	Total *
Midnight – 1am	1	1	2
1am – 2am	1	1	2
2am – 3am	1	3	4
3am – 4am	3	4	6
4am – 5am	4	5	10
5am – 6am	9	49	58
6am – 7am	22	35	57
7am – 8am	22	28	50
8am – 9am	33	30	63
9am – 10am	35	36	71
10am -11am	31	30	61
11am – Midday	33	33	65
Midday – 1pm	28	30	58
1pm – 2pm	34	34	68
2pm – 3pm	34	26	59
3pm – 4pm	26	31	57
4pm – 5pm	34	25	60
5pm – 6pm	51	13	64
6pm – 7pm	13	7	20
7pm – 8pm	6	4	10
8pm – 9pm	5	5	9
9pm -10pm	5	5	10
10pm – 11pm	4	4	8
11pm – Midnight	1	2	3
Total	437	440	877
% of Heavy Vehicles	40.9%	41.6%	41.2%

Heavy Vehicles – Austroads Class 3-12 Vehicles

Source: Traffic Counts 3-9 May 2018

* Variations in totals are due to rounding of vehicle numbers when calculating average weekday volumes.

TABLE 4.2**SATURDAY HOURLY VOLUMES IN MARTIN ROAD**

Time	North	South	Total *
Midnight – 1am	0	1	1
1am – 2am	1	4	5
2am – 3am	0	1	1
3am – 4am	4	3	7
4am – 5am	2	1	3
5am – 6am	3	29	32
6am – 7am	10	29	39
7am – 8am	16	16	32
8am – 9am	20	17	37
9am – 10am	15	15	30
10am -11am	15	16	31
11am – Midday	19	13	32
Midday – 1pm	25	24	49
1pm – 2pm	26	27	53
2pm – 3pm	45	13	58
3pm – 4pm	11	11	22
4pm – 5pm	10	11	21
5pm – 6pm	10	14	24
6pm – 7pm	12	13	25
7pm – 8pm	6	4	10
8pm – 9pm	4	3	7
9pm -10pm	6	6	12
10pm – 11pm	11	7	18
11pm – Midnight	2	4	6
Total	273	282	555
% of Heavy Vehicles	24.2%	21.3%	22.7%

Heavy Vehicles – Austroads Class 3-12 Vehicles

Source: Traffic Counts 3-9 May 2018

* Variations in totals are due to rounding of vehicle numbers when calculating average weekday volumes.

Peak Hour Intersection Volumes

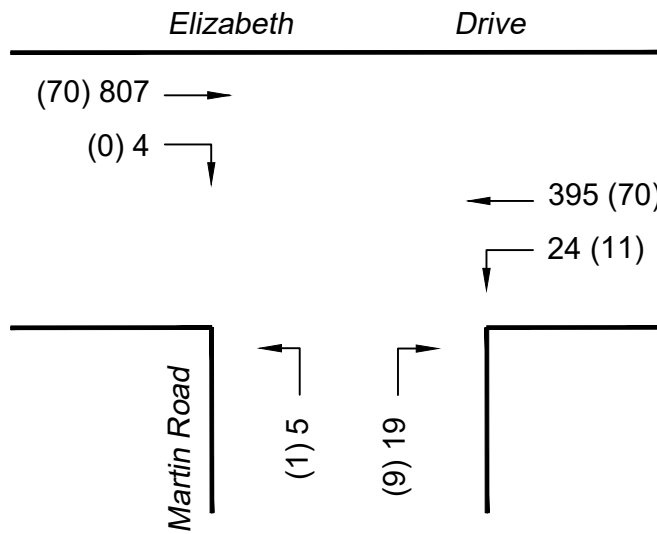
The 2018 AM and PM peak hour traffic volumes for Elizabeth Drive/Martin Road intersection are derived from traffic counts undertaken on Tuesday 15 May 2018.

Figure 6 shows the AM and PM peak traffic volumes using the intersection during the 7.00am – 8.00am and the 4.15pm – 5.15pm peak hours.

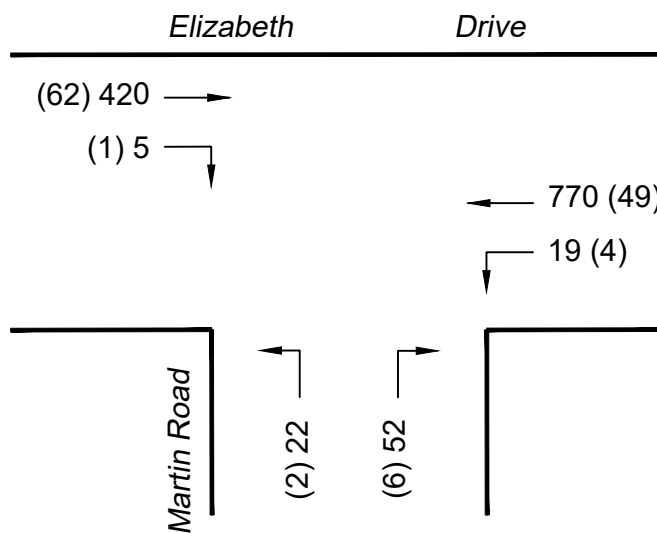
Reference to **Figure 6** shows that traffic volumes in Elizabeth Drive are tidal with the eastbound direction being the peak direction in the AM peak hour and the westbound direction the peak direction in the PM peak hour.

Traffic volumes in Elizabeth Drive number 807vph eastbound and 395vph westbound in the AM peak hour and 420vph eastbound and 770vph westbound in the PM peak hour.

However two way traffic volumes in Elizabeth Drive at Martin Road are consistently high during the three hour AM and PM periods between 6.30am – 9.30am and 3.30pm to 6.30pm respectively as shown in Table 4.3.



AM PEAK HOUR
0700 - 0800



PM PEAK HOUR
1645 - 1745

KEY

344 TOTAL VEHICLES
(27) HEAVY VEHICLES

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FIGURE 6

BADGERYS CREEK BRICK MAKING FACILITY
MODIFICATION 3

**EXISTING WEEKDAY AM & PM PEAK HOUR
TRAFFIC VOLUMES**

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TABLE 4.3

**TWO WAY TRAFFIC VOLUMES IN ELIZABETH DRIVE AT MARTIN ROAD
DURING 6.30AM – 9.30AM AND 3.30PM – 6.30PM PERIOD ON A WEEKDAY**

AM		PM	
Time Period	Two Way Traffic Volumes	Time Period	Two Way Traffic Volumes
6.30am – 7.30am	1172	3.30pm – 4.30pm	1186
7.00am – 8.00am	1230	4.00pm – 5.00pm	1176
7.30am – 8.30am	1151	4.30pm – 5.30pm	1204
8.00am – 9.00am	979	5.00pm – 6.00pm	1082
8.30am – 9.30am	896	5.30pm – 6.30pm	925

Source: Traffic Counts Tuesday 15 May 2018

Vehicles currently using Martin Road reflect its local road status. Vehicles turning out of Martin Road into Elizabeth Drive numbered 24vph in the AM peak hour and 74vph in the PM peak hour.

The right turn out of Martin Road, which experiences the longest delays, is the major turning movement in Martin Road. This right turn numbers 19vph in the AM peak hour and 52vph in the PM peak hour.

Traffic volumes using the intersection have increased since previous traffic counts were undertaken in November 2016 with large increases in the westbound through movement in Elizabeth Drive in the AM and PM peak hours and increases in the number of vehicles turning right out of Martin Road in the PM peak hour.

4.2.2 Existing Conditions at Elizabeth Drive/Martin Road Intersection

The software package SIDRA 8 was used to examine the operational capacity of the Elizabeth Drive/Martin Road intersection.

SIDRA assess the operational performance of intersections under traffic signal, roundabout or sign control. The best criteria for assessing intersections controlled by traffic signals are Level of Service (LS), Degree of Saturation (DS) and Average Vehicle Delay (AVD). Table 4.4 shows the Level of Service Criteria for intersections as reproduced from the RTA's Guide to Traffic Generating Developments. The desirable design criteria for intersections is a Level of Service D or better (i.e. A, B, C or D).

For intersections controlled by Give Way/Stop signs, the Level of Service of the intersection is determined by the movement with the highest average vehicle delay and not the average vehicle delay for all vehicles using the intersection.

TABLE 4.4**LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS**

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

Source: Table 4.2 Guide to Traffic Generating Developments October 2002. Roads and Traffic Authority

The AM and PM SIDRA models were calibrated from observed traffic conditions at the intersection.

The results of the traffic modelling are summarised in Table 4.5.

Reference to Table 4.5 shows that the intersection currently has Level of Service B operation with the average vehicle delay for the right turn out of Martin Road ranging between 20.7 seconds to 27.8 seconds per vehicle.

Appendix 1 contains the SIDRA modelling outputs for the existing conditions.

TABLE 4.5**SIDRA RESULTS FOR EXISTING CONDITIONS IN WEEKDAY AM AND PM PEAK HOURS AT INTERSECTION OF ELIZABETH DRIVE AND MARTIN ROAD**

Criteria	AM Peak	PM Peak
LS	B	B
DS	0.437	0.411
HMD	27.8	20.7

Where: LS - Level of Service
DS - Degree of Saturation
HMD - Highest Movement Delay in seconds which is right turn out of Martin Road

4.3 Existing Public Transport

Transit systems operates the 801 bus service between Liverpool Station and Badgerys Creek Road, Badgerys Creek.

The bus service operates between Monday to Friday with two services in the AM period and one (1) service in the PM period between Badgerys Creek and Liverpool. Three (3) bus services operate in the PM period between Liverpool and Badgerys Creek in the PM period.

The bus services operate along Elizabeth Drive with some services travelling via Martin Road, Cuthell Road and Lawson Road.

Bus stops are located in Elizabeth Drive opposite Martin Road and Lawson Road as well as in Cuthell Road between Lawson Road and Martin Road. While bus services in the Badgerys Creek area are expected to be upgraded as part of the transport improvements for Western Sydney Airport, no details are available of the future upgrades at this time.

Appendix 2 shows the existing bus route in the Badgerys Creek area.

4.4 Bicycle Routes

There are no formal bicycle routes at Badgerys Creek near the site.

The M7, which is located to the east, has an off road cycleway that follows the M7 between Prestons, and Old Windsor Road at Baulkham Hills. This cycleway passes through Cecil Hills and links to the local road system.

It is expected that new cycleways will be developed with the road upgrades associated with the M12 and Western Sydney Airport. However, no details of the future cycleways are available at this time.

Appendix 2 contains a map of existing bicycle routes in the area.

4.5 Future Roads and Development

The Western Sydney Airport is being planned and constructed at Badgerys Creek by the Australian Government and is set to open in 2026. As part of the Western Sydney Airport, the Western Sydney Aerotropolis Stage 1 Plan has been developed for the future development of land adjacent the Airport. The land adjacent Elizabeth Drive/Martin Road intersection, as well as the precinct area defined by Martin Road and Lawson Road is identified as flexible employment land. A copy of the (Western Sydney Aerotropolis Stage 1 Structure Plan) showing the future land uses at Badgerys Creek and in the adjacent areas is included in Appendix 2.

The Australian and NSW Governments are proposing to build a new motorway (M12) as part of the Western Sydney Infrastructure Plan to service the new airport and cater for the planned growth in Western Sydney.

The new motorway will provide direct access to the Western Sydney Airport at Badgerys Creek and will connect to Sydney's motorway network.

A preliminary design identifies the route corridor between the M7 at Cecil Hills and the Northern Road at Luddenham, Interchanges will be provided at;

- The M7;
- The Access Road to Western Sydney Airport; and
- The Northern Road (at grade intersection).

Provision will be made for a future grade separated interchange and a link road between Devonshire Road and Mamre Road.

A plan that shows the current proposed route and interchange details of the M12 is contained in Appendix 2.

The EIS for the M12 is expected to be completed in 2019 and construction to commence in the early 2020's and be completed before Western Sydney Airport opens in 2026.

Other planned transport projects in the area will be taken into account during the design development of the M12.

As part of these projects, widening of Elizabeth Drive from a two lane road to a four lane road with provision for six lanes is expected to occur to cater for future development associated with the Airport. But no details are currently available as to the timing or the concept design of the road.

5.0 ASSESSMENT OF TRAFFIC AND TRANSPORT IMPACTS

5.1 Timing of Modification 3 and Implications

Modification 3, if approved, is expected to be operational in 2021.

For the purpose of this assessment, 2021 has been adopted as the assessment year.

CSR have held discussions with representatives of the RMS about the restart of quarrying and brick manufacturing at the site and the proposed modifications, as well as the likely future traffic conditions at the Elizabeth Drive/Martin Road intersection.

The RMS agrees that Elizabeth Drive will need to be upgraded with additional lanes, due to Western Sydney Airport and the associated development and that traffic signals will be required at the Elizabeth Drive/Martin Road intersection.

However the RMS have not completed their investigation of the future widening requirements in Elizabeth Drive, due to the airport and associated developments and as there are no details available at this time of the future intersection requirements, the RMS have advised CSR that the intersection configuration for traffic signals should have sufficient capacity for the known development and future likely traffic levels that will use the intersection in 2020/2021, under traffic signal control.

5.2 Other Known Developments

There are several other approved and proposed developments that will impact on the traffic volumes using the Elizabeth Drive/Martin Road intersection in 2021. These include:

- Construction traffic associated with the construction of Western Sydney Airport;
- Approved/proposed developments at 25 Martin Road and 55 Martin Road, which are small resource recovery facilities.

It is also likely that construction traffic associated with the construction of the M12 will use Elizabeth Drive in the Badgerys Creek area in 2021, however, no details are available of the level of this traffic at this time.

For the purpose of this assessment, it has been assumed that this construction traffic will be relatively small, and as such, is included as part of the background traffic growth in Elizabeth Drive between 2018 and 2021.

5.3 Future Traffic Volumes in 2021

Construction Traffic of Western Sydney Airport

Volume 2 of the EIS for Western Sydney Airport identified that 80% of the construction traffic will arrive and depart from the east along Elizabeth Drive.

For the peak year identified in the EIS which will be 2021, this will result in the following peak hour volumes using Elizabeth Drive at Martin Road;

- AM peak hour;
 - 20 heavy vehicles travelling eastbound and a total of 231 vehicles travelling westbound which includes 20 heavy vehicles;

- PM peak hour;
 - A total of 205 vehicles travelling eastbound which includes 29 heavy vehicles and 29 heavy vehicles travelling westbound.

The EIS does not identify peak hour volumes of the construction traffic, for other years of construction and for the purpose of the CSR Modification 3 traffic assessment, the above volumes have been adopted for 2020 and 2021.

Martin Road Developments

The approved development at 25 Martin Road will generate;

- A total of 7 inbound trips including 2 heavy vehicle trips and 2 heavy vehicle outbound trips in the AM peak hour; and
- Two (2) heavy vehicle inbound trips and a total of 7 outbound trips including 2 heavy vehicle trips in the PM peak hour.

The proposed development at 55 Martin Road will generate a total of 5 light vehicle inbound trips in the AM peak hour and 5 outbound trips in the PM peak hour.

These have been assigned at the intersection of Elizabeth Drive/Martin Road with 75% of arrivals/departures to and from the east and 25% of arrivals/departures to and from the west.

Future Background Traffic Growth in Elizabeth Drive

A comparison of weekday peak hour traffic counts undertaken in 2009 and the most recent 2018 traffic count at the intersection of Elizabeth Drive/Martin Road has found that lineal growth in traffic volumes in Elizabeth Drive during that 9 year period has been 3.0% per year in the AM peak hour and 3.2% per year in the PM peak hour.

Adopting this lineal growth for the two year period between 2018 and 2021 indicates that background traffic growth in Elizabeth Drive in 2021 is estimated to be:

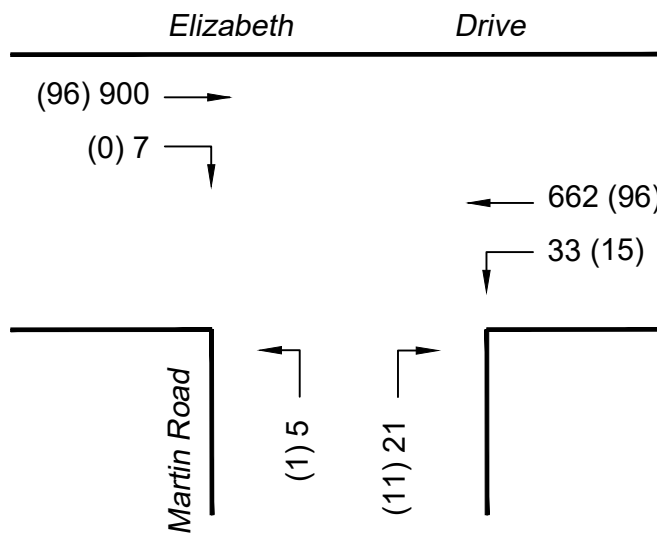
- AM peak hour;
 - 73 vehicles travelling eastbound including 6 heavy vehicles; and
 - 36 vehicles westbound, including 6 heavy vehicles.
- PM peak hour;
 - 38 vehicles eastbound including 6 heavy vehicles; and
 - 70 vehicles westbound including 4 heavy vehicles.

Figure 7 shows the estimated AM and PM peak hour 2021 traffic volumes at the Elizabeth Drive intersection based on the above assumptions.

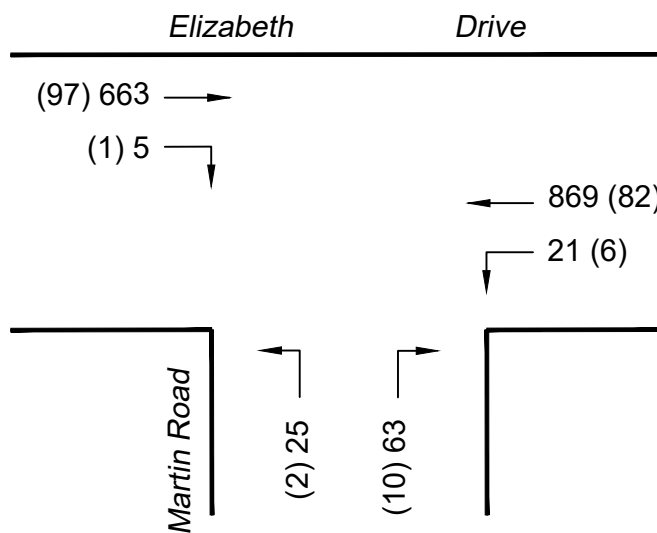
Proposed Mirvac Development

Mirvac are proposing an industrial development on land located on the northern side of Elizabeth drive opposite Martin Road. At the time of preparing this report, Mirvac have not submitted a DA for this proposal.

In discussion with the RMS concerning access to Elizabeth Drive, the RMS suggested/advised Mirvac to locate the Access Road to the subdivision opposite Martin Road at Elizabeth Drive, which would create a cross junction intersection.



AM PEAK HOUR



PM PEAK HOUR

KEY

344 TOTAL VEHICLES
(27) HEAVY VEHICLES

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FIGURE 7

BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3

ESTIMATED FUTURE BASE 2021

WEEKDAY AM & PM PEAK HOUR TRAFFIC VOLUMES
AT ELIZABETH DR/MARTIN RD INTERSECTION

JOB NO.17179

25/02/19

Mirvac are proposing two stages with Stage 1 for 193, 530m² GFA to be operational by 2021 and full development of Stages 1 and 2 for a total of 450,000m² GFA, which is expected to be operational by 2026.

Mirvac has provided preliminary traffic generation volumes of 404vph in the weekday AM and PM peak for the Stage 1 development and 909vph for the same periods for the Stages 1 and 2 development.

Intersection impacts associated with the proposed Mirvac development, if this development is approved, are outlined in Section 5.6.

Other Unknown Development

As noted in Section 4.5, the land in the precinct area served by Martin Road and Lawson Road is identified as Flexible Employment Land in the Western Sydney Aerotropolis Stage 1 Plan.

It is highly likely that some of this land will be developed between 2019 and 2026, however, no future traffic generation for this has been included in this traffic assessment.

5.4 Traffic Generation of Modification 3 in Operational Phase

5.4.1 Daily

Weekdays will have the highest traffic generation.

Light vehicle trips will include employees and visitors. Based on one vehicle trip per employee, employees will generate 123 inbound and 123 outbound trips on a weekday.

Visitors associated with the operation of businesses (i.e. not customers) are expected to number 20 people per weekday, (i.e. .20 inbound and 20 outbound trips).

Cash sales are expected to be 49 customers per weekday and on a Saturday (i.e. 49 inbound/49 outbound). These cash sales are customer pick ups in utes, cars and trailers and small trucks. (i.e. mix of light and small heavy vehicles).

Visitors to the Display Centre number around 40 on a weekday (i.e. 40 inbound and 40 outbound trips) and up to 60 on a Saturday and Sunday (i.e. 60 inbound/60 outbound trips).

Heavy vehicles (i.e. Austroad Class 3 to 10) will number 272 laden trucks on weekdays (i.e. 272 inbound/272 outbound) and 79 laden trucks on Saturdays (i.e. 79 in/79 out).

Total vehicle trips on a weekday associated with Modification 3 are estimated to be 504 inbound trips and 504 outbound trips including 272 inbound trips and 272 outbound trips which are heavy vehicles.

Total vehicle trips on a Saturday are estimated to be 267 inbound trips and 267 outbound trips of which 79 inbound trips and 79 outbound trips will be heavy vehicles.

5.4.2 Peak Hour

Traffic volume generated by the site will consist of light vehicles (employees, visitors, cash sales) and heavy vehicles.

For the peak one hour in Modification 3, heavy vehicle traffic generation is calculated to be 33 laden trucks (i.e. 33 inbound/33 outbound) in the AM peak hour and 23 laden trucks (i.e. 23 inbound/23 outbound) in the PM peak hour.

For those times that coincide with the weekday AM and PM peak hours, which occur between 7am and 9am and 4pm to 6.30pm, light vehicle trips are calculated to be;

- Visitor trips as follows;
 - AM peak hour – 5 inbound trips
 - PM peak hour – 5 outbound trips
- Employee trips based on the proposed shift times;
 - AM peak hour – 20 inbound trips
 - PM peak hour – 15 inbound trips / 85 outbound trips
- Cash Sales
 - AM peak hour – 7 inbound / 7 outbound trips
 - PM peak hour – 7 inbound / 7 outbound trips

Based on the above, the total traffic generation during the weekday AM and PM peak hour is estimated to be:

- 65 inbound trips and 40 outbound trips in the AM peak hour of which 33 inbound trips and 33 outbound trips will be heavy vehicles; and
- 45 inbound trips and 120 outbound trips in the PM peak hour of which 23 inbound trips and 23 outbound trips will be heavy vehicles.

Based on information provided by CSR, heavy vehicle origins and destinations to the site are expected to be:

- 75% to and from the east along Elizabeth Drive towards M7; and
- 25% to and from the west along Elizabeth Drive to and from The Northern Road.

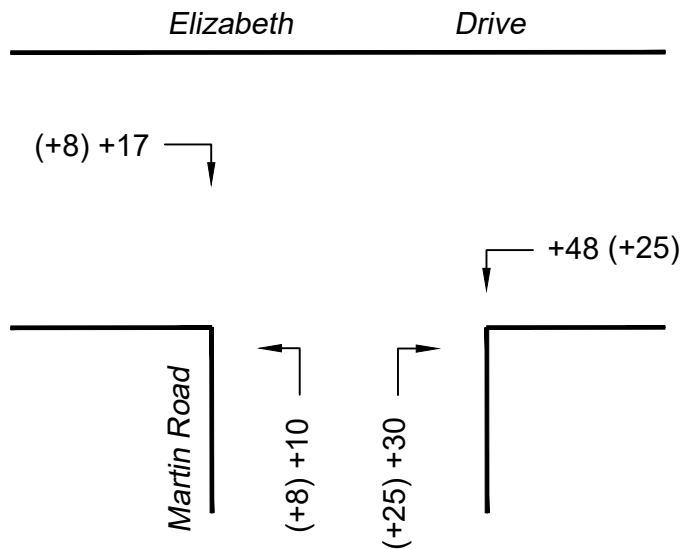
Cash sales, visitors and employee trips are expected to have the same origins and destinations as this, with 75% of trips to and from the east and 25% of trips to and from the west.

5.5 Traffic Impacts of Modification 3 in Operational Phase

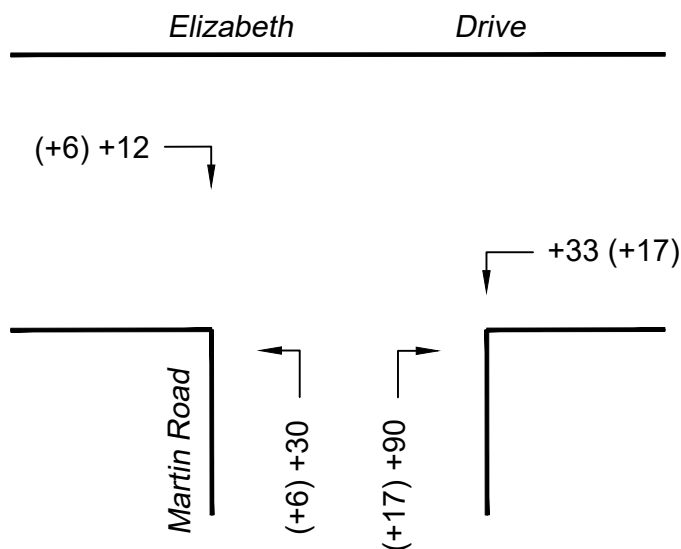
5.5.1 Current Intersection Arrangements

Figure 8 shows the additional traffic from Modification 3 assigned to the Elizabeth Drive/Martin Road intersection in the AM and PM peak hours based on the assumptions outlined in Section 5.4.2 above.

To assess the impacts of Modification 3 as well as the increases in background traffic using the intersection of Elizabeth Drive/Martin Road in the weekday AM and PM peak hours traffic modelling using the Software package SIDRA 8 has been undertaken.



AM PEAK HOUR



PM PEAK HOUR

KEY

+344 ADDITIONAL TOTAL VEHICLES

(+27) ADDITIONAL HEAVY VEHICLES

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FIGURE 8

BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
**MODIFICATION 3 ADDITIONAL OPERATIONAL TRAFFIC
IN WEEKDAY AM & PM PEAK HOURS
AT ELIZABETH DR/MARTIN RD INTERSECTION**

JOB NO.17179

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The modelling has been undertaken for the base 2021 AM and PM peak hour traffic volumes using the intersection as shown in **Figure 7** as well as with the additional peak hour volumes shown in **Figure 8** for Modification 3.

The modelling for the scenarios is based on the existing Give Way Control in Martin Road and traffic management at the intersection.

The results of the modelling are shown in Table 5.1. Reference to Table 5.1 shows that:

- Under the base conditions in 2021, the intersection would have a Level of Service C/D operation with vehicle delays to the right turn out of Martin Road in the order of 36.7 to 45.3 seconds per vehicle. This indicates conditions are satisfactory although the delays for the right turn out of Martin Road have increased when compared to existing 2018 traffic volumes.
- With the additional traffic from Modification 3, the intersection would have a Level of Service E/F operation in the AM and PM peak hour periods with vehicle delays to the right turn out of Martin Road in the order of 68.9 seconds to 167.4 seconds.

The level of delay in Martin Road would result in unsafe traffic conditions at the intersection with large heavy vehicles forcing their way into Elizabeth Drive due to the level of vehicle delay. To address these unsafe traffic conditions, traffic signal control of the intersection would be required, in conjunction with Modification 3.

TABLE 5.1

SIDRA RESULTS FOR 2021 BASE CONDITIONS AND WITH MODIFICATION 3 IN WEEKDAY AM AND PM PEAK HOURS AT INTERSECTION OF ELIZABETH DRIVE AND MARTIN ROAD

Criteria	2021 Base		2021 With Modification 3	
	AM Peak	PM Peak	AM Peak	PM Peak
LS	D	C	E	F
DS	0.494	0.473	0.497	0.983
HMD	45.3	36.7	68.9	167.4

Where: LS - Level of Service
DS - Degree of Saturation
HMD - Highest Movement Delay in seconds which is right turn out of Martin Road

Appendix 1 contains the SIDRA modelling outputs for the above scenarios.

5.5.2 Proposed Upgrade to Traffic Controls at the Intersection of Elizabeth Drive and Martin Road

Following the initial discussions with the RMS concerning the Elizabeth Drive/Martin Road intersection, a follow up meeting was held with the RMS on the 12 December 2018 to discuss the future intersection controls. As a result of this meeting, additional investigations were undertaken to determine the most appropriate type of traffic control for the intersection, given the increase in traffic volumes forecasted to use the intersection. The intersection upgrade would be an interim measure, until the ultimate widening of Elizabeth Drive was undertaken by the RMS.

These investigations included;

- An independent road safety audit and safety review of the intersection, with regard to the future traffic volume increases;
- An options report reviewing the available options to upgrade the intersection's traffic controls; and
- A traffic signal warrant report.

These investigations included the future traffic volumes forecasted to use the Elizabeth Drive/Martin Road intersection including the CSR Modification proposals, as well as the Mirvac future proposal, background traffic growth and Western Sydney Airport Construction traffic in 2021 and 2026 (prior to the opening of the M12 and the Airport).

The independent road safety audit and safety review concluded that the existing give way controls at the intersection would be unsafe and should be upgraded having regard to the increased volumes including the large number of heavy vehicles using the intersection, as well as the increased vehicle delays.

The auditors noted that a future roundabout or traffic signal control may be suitable options.

The options report found that due to increased volumes associated with the future growth, including the Mirvac proposal, that a new roundabout would need to be two lanes and would require a large road reserve footprint of 67.6 metres to accommodate the roundabout. However even a two lane roundabout would have limited capacity and traffic modelling showed that during the 2026 AM peak the very large right turn movement into the Mirvac Access Road would cause extensive delays and queueing in the western approach of Elizabeth Drive, consistent with a Level of Service F operation for this approach. Other disadvantages included the non provision of safe pedestrian crossing facilities and conflict for cyclists using the roundabout due to high levels of heavy vehicles and circulating traffic.

The options report ruled out a roundabout and concluded that traffic signals would be the better option. Traffic signals will/can provide safe pedestrian crossing facilities, result in less conflict with cyclists, can provide sufficient capacity at the intersection based on a smaller land footprint and are relatively simple to keep operating, when future road upgrading occurs in Elizabeth Drive.

The traffic signal warrant report concluded on the range of relevant factors and criteria that are taken into consideration in a decision on traffic signals, including traffic volumes, vehicle delays, road safety and future planning that a warrant is met for the provision of traffic signals for the CSR Modifications, as well as for the future Mirvac development.

These separate reports are contained in Volume 2, which is a separate stand alone document.

5.5.3 Traffic Signal Control of Elizabeth Drive and Martin Road for Modification 3 Proposal

Geometric Changes

SIDRA modelling was undertaken to determine the required geometry for the intersection under traffic signal control.

Western Sydney Airport and the M12 Motorway are currently planned to be constructed by 2026 and this year was adopted as the ultimate design year for the intersection. SIDRA modelling was undertaken for 2021 with Modification 3 and for 2026 with Modification 3 to test the required geometry for the intersection.

The 2026 intersection traffic volumes included background traffic growth in Elizabeth Drive and the construction traffic associated with the Western Sydney Airport but not for the M12. Martin Road traffic volumes included approved development as well as Modification 3.

Figure 9 shows the conceptual layout for the intersection under traffic signal control which will have adequate intersection capacity to and beyond year 2026 with Modification 3.

The intersection layout includes:

- two approach lanes in Martin Road with the left turn lane 60 metres long plus taper. This will require additional pavement road widening in the road reserve.
- two approach lanes in the eastern approach of Elizabeth Drive together with two departure lanes, for westbound traffic. The kerbside lane in the eastern approach will need to be increased to 130 metres long plus taper and the lane used as a shared left turn and through vehicle lane. This will require additional pavement widening in this approach in the road reserve.
- Retain the three approach lanes in the western approach of Elizabeth Drive with two through lanes and a right turn bay. The existing right turn bay length which will be approximately 90 metres in length under signal control will be sufficient to store the right turn volume so no additional lane works will be required in this approach.
- On the departure side for eastbound traffic, the kerbside lane which ends just east of the intersection should be increased to a length of 100 metres plus taper to allow sufficient merge length for vehicles using the kerbside lane. This will require additional pavement widening on the departure side in the road reserve.

SIDRA Modelling of Traffic Signal Control in 2021 and 2026

Tables 5.2 and 5.3 shows the results of the SIDRA modelling for 2021 (Table 5.2) and 2026 (Table 5.3) with Modification 3 under traffic signal control.

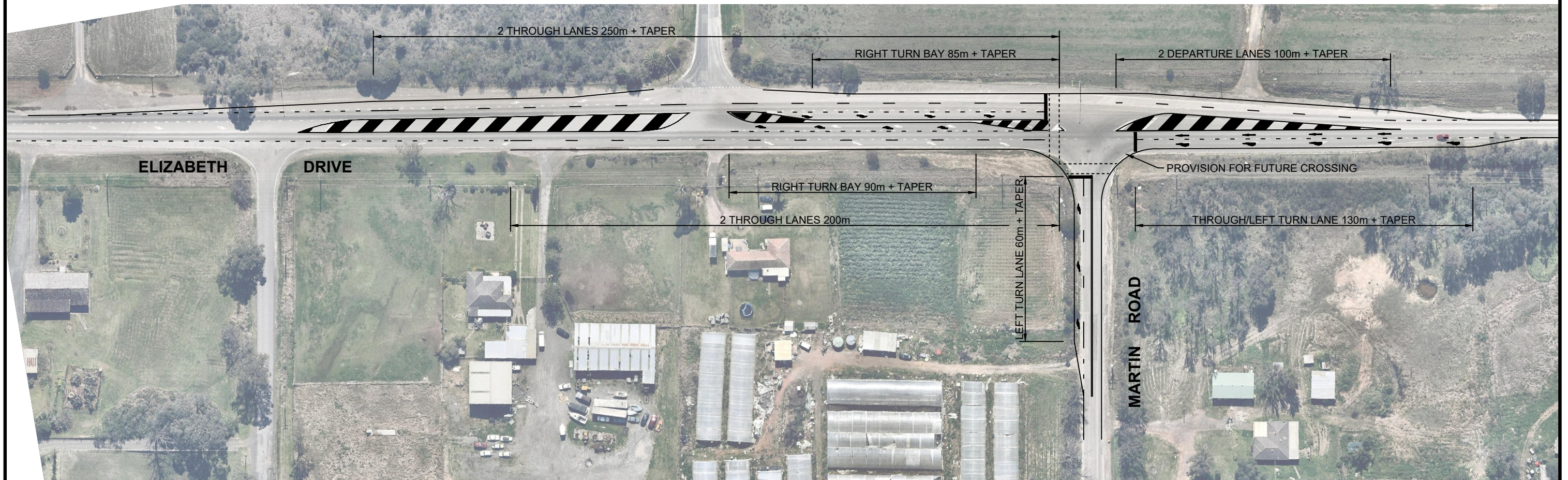
The modelling has adopted the geometry described above for the intersection.

The initial modelling runs showed that a cycle length of 80 seconds would be adequate based on a 3 phase operation which included a right turn phase (green arrow) from Elizabeth Drive for the right turn into Martin Road.

The modelling also adopted no right turn filtering for this movement during the through traffic phase (i.e. all right turns occur on the green arrow).

Pedestrian crossings were included on all approaches, however there is likely to be very few, if any, pedestrians crossing at this intersection in the foreseeable future.

Reference to Tables 5.2 and 5.3 show that the intersection will have a Level of Service A operation during the peak hours in 2021 and 2026 will relatively low vehicle delays



NOT TO SCALE

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FIGURE 9
BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
RECOMMENDED INTERSECTION LAYOUT
AT ELIZABETH DRIVE & MARTIN ROAD
INTERSECTION FOR TRAFFIC SIGNAL CONTROL
T-JUNCTION INTERSECTION
JOB NO.17179 25/02/19

in order of 11.8 to 13.7 seconds. This represents a very good operation and shows the intersection has plenty of spare capacity.

In addition the 95thtile queue lengths for the various traffic movements can be contained within the proposed lane lengths outlined in geometric changes and as shown on **Figure 9**.

Appendix 1 contains the SIDRA modelling outputs for the above operation with traffic signals.

In summary, traffic signal control of the Elizabeth Drive/Martin Road intersection will address the safety concerns of additional cars and trucks turning out of Martin Road associated with future traffic growth and Modification 3. Based on the geometry shown in **Figure 9** the intersection will have a good operation in terms of capacity and safety.

TABLE 5.2

SIDRA RESULTS FOR 2021 WITH MODIFICATION 3 IN WEEKDAY AM AND PM PEAK HOURS AT INTERSECTION OF ELIZABETH DRIVE AND MARTIN ROAD UNDER TRAFFIC SIGNAL CONTROL

	AM Peak Hour				PM Peak Hour			
	DS	AVD	LS	95% Queue	DS	AVD	LS	95% Queue
South: Martin Road								
Left	0.035	26.2	B	6.4	0.095	25.2	B	12.7
Right	0.235	39.2	C	27.8	0.495	38.4	C	53.7
East: Elizabeth Drive								
Left	0.430	21.5	B	81.4	0.503	21.4	B	95.3
Through	0.430	13.7	A	98.2	0.503	13.8	A	112.3
West: Elizabeth Drive								
Through	0.480	6.7	A	95.6	0.362	6.1	A	67.5
Right	0.213	48.2	D	10.9	0.190	48.5	D	11.0
All Vehicles	0.480	11.8	A	98.2	0.503	12.3	A	112.3

Where: DS - Degree of Saturation
 AVD - Average Vehicle Delay seconds
 LS - Level of Service
 95th% Queue 95th% Queue length in metres

TABLE 5.3

**SIDRA RESULTS FOR 2026 WITH MODIFICATION 3 IN WEEKDAY AM AND PM
PEAK HOURS AT INTERSECTION OF ELIZABETH DRIVE AND MARTIN ROAD
UNDER TRAFFIC SIGNAL CONTROL**

	AM Peak Hour				PM Peak Hour			
	DS	AVD	LS	95% Queue	DS	AVD	LS	95% Queue
South: Martin Road								
Left	0.035	26.2	B	6.4	0.098	26.0	B	13.0
Right	0.235	39.2	C	27.8	0.530	39.5	C	54.7
East: Elizabeth Drive								
Left	0.464	21.8	B	89.2	0.556	21.3	B	109.6
Through	0.464	14.0	A	109.2	0.556	13.7	A	129.5
West: Elizabeth Drive								
Through	0.544	7.1	A	115.3	0.393	5.8	A	74.3
Right	0.213	48.3	D	11.5	0.190	48.5	D	11.0
All Vehicles	0.544	11.8	A	115.3	0.556	13.7	A	129.5

Where: DS - Degree of Saturation
 AVD - Average Vehicle Delay seconds
 LS - Level of Service
 95th% Queue 95th% Queue length in metres

5.5.4 Impacts in Martin Road and on Wider Road Network

Modification 3 will increase the number of vehicles using Martin Road between Elizabeth Drive and the site entrance by an estimated 1,008 vehicles on weekdays (504 in/504 out) and 534 vehicles on Saturdays (267 in/267 out).

Heavy vehicles will number 544 vehicles on weekdays (272 in/272 out) and 158 vehicles on Saturdays (79 in/79 out).

The increase will not affect the capacity or safety of the midblock sections of Martin Road or at the Cuthell Road intersection.

As noted in Section 5.9 Martin Road will be improved between the CSR site entrance and the Australian Native Landscape site entrance in accordance with Condition 28 of the Project Approval. The CSR site entrance will also be upgraded to accommodate the new access road to the Roof Products Manufacturing Facility (See Section 5.8).

The increase in heavy vehicles using Martin Road due to Modification 3 will increase pavement deterioration. CSR will pay towards the upgrade and widening of certain sections of Martin Road and will pay annual road maintenance contributions in accordance with Condition 28 of the Project Approval.

The impacts of Modification 3 on the wider road network will be relatively minor. Elizabeth Drive is a state arterial road and is expected to be used by regional traffic including heavy vehicles. The NSW Government is proposing to upgrade sections of the state road network around Badgerys Creek including the construction of the M12 and upgrading works to Elizabeth Drive to cater for future urban growth and the proposed Western Sydney Airport.

The additional traffic generated by Modification 3 will have relatively minor impacts on the existing and future state road network in Badgerys Creek.

5.6 Intersection Requirements and Operation with Future Mirvac Development

The Mirvac Development propose a new access road opposite Martin Road forming a cross junction intersection with Elizabeth Drive.

Based on preliminary traffic volume numbers provided by Mirvac, Stage 1 will generate 404vph in the weekday AM and PM peak hours and Stages 1 and 2, some 909vph. Stage 1 is expected to be operational in 2021 and Stages 1 and 2 by 2026.

Figures 10A-D show a conceptual cross junction intersection layout for the Elizabeth Drive/Martin Road/Mirvac Access Road intersection for traffic signal control.

Figure 11 shows the future 2026 AM and PM intersection volumes with a proposed Stages 1 and 2 of the Mirvac Development as well as the CSR Modifications and other traffic volumes in Elizabeth Drive, due to airport construction traffic and other background traffic growth.

Preliminary traffic modelling for 2026 with Stages 1 and 2 of Mirvac as well as CSR's Modifications and other predicted future traffic growth in Elizabeth Drive shows that this intersection would have a satisfactory operation with a Level of Service C operation.

Several traffic signal phasing options were modelling and the extracts of the SIDRA Modelling outputs for these scenarios are contained in Appendix 1.

The intersection layout will be further refined when Mirvac finalises their development proposal.

The final intersection layout accommodating the Mirvac development will involve further discussions and consultation with the RMS by Mirvac.

5.7 Construction Impacts

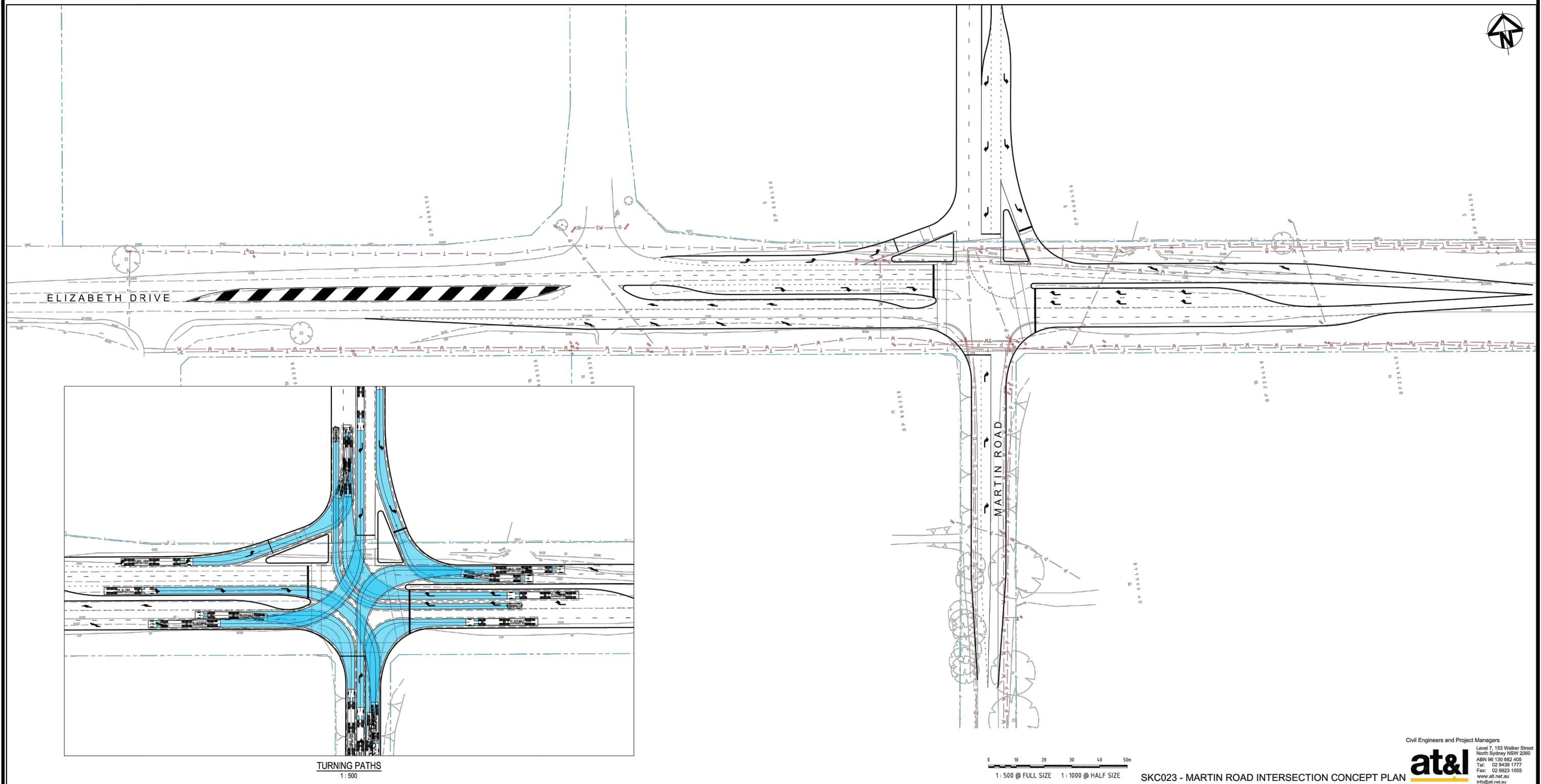
All construction traffic associated with Modification 3 will access the site via Martin Road from Elizabeth Drive.

It is expected that 75% of this traffic will have origins to and from the east in Elizabeth Drive with 25% of construction traffic to and from the west to Old Northern Road.

The construction workforce for the Brick Making Facility and Roof Products Manufacturing Facility are expected to number up to a total of 80 workers a day (i.e. 40 workers for the Brick Making Facility and 40 workers for the Roof Products Manufacturing Facility).

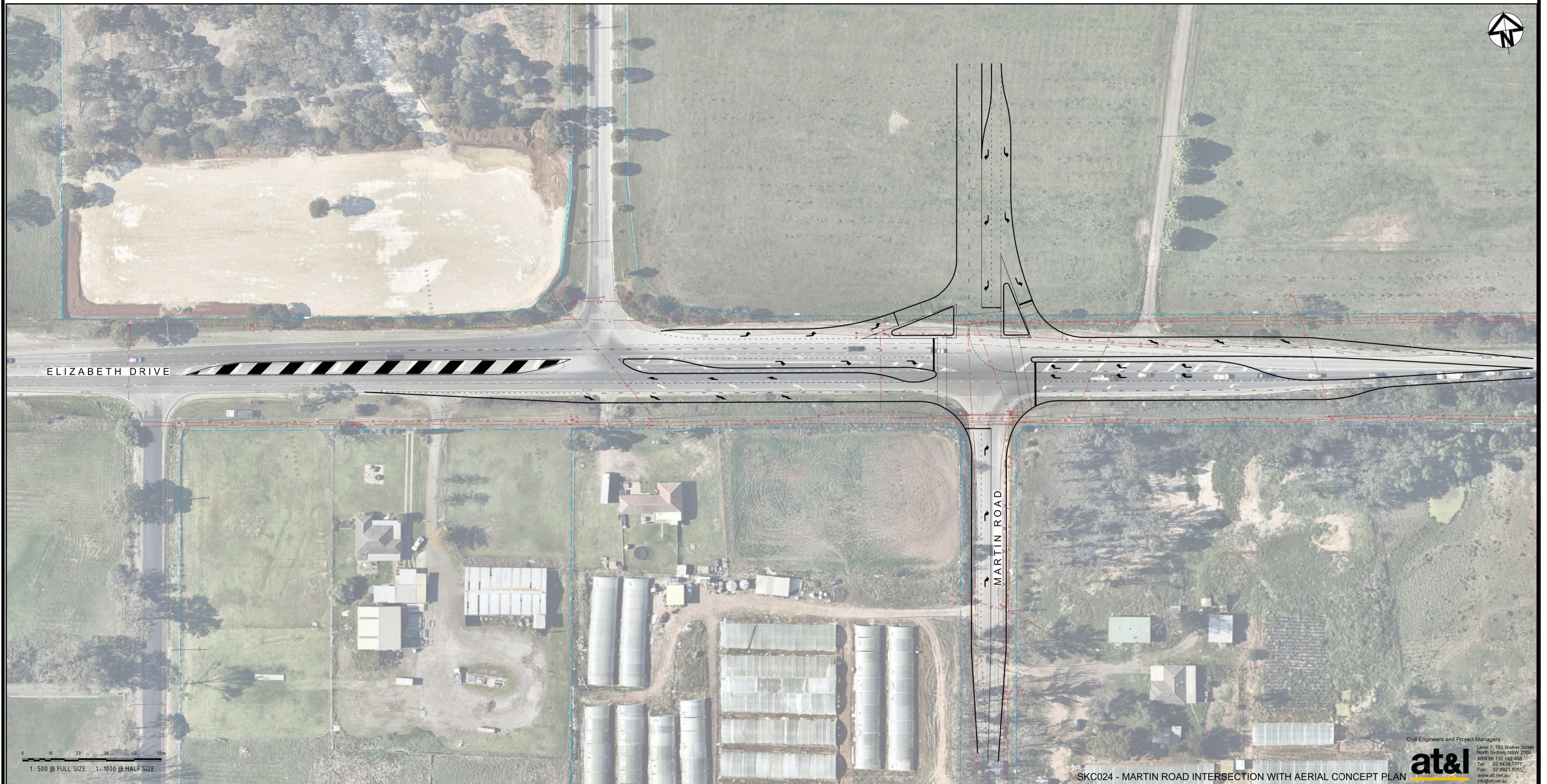
This will result in 80 light vehicles per day entering and exiting the site (i.e. 80 in/80 out). A total of up to 40 heavy vehicles a day may access the site associated with deliveries etc (i.e. 40 in/40 out).

Construction hours are expected to be 7am to 6pm on weekdays and 8am to 1pm on Saturdays. Construction is expected to commence in late 2019/early 2020 and be completed in 2021.



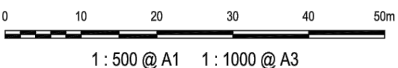
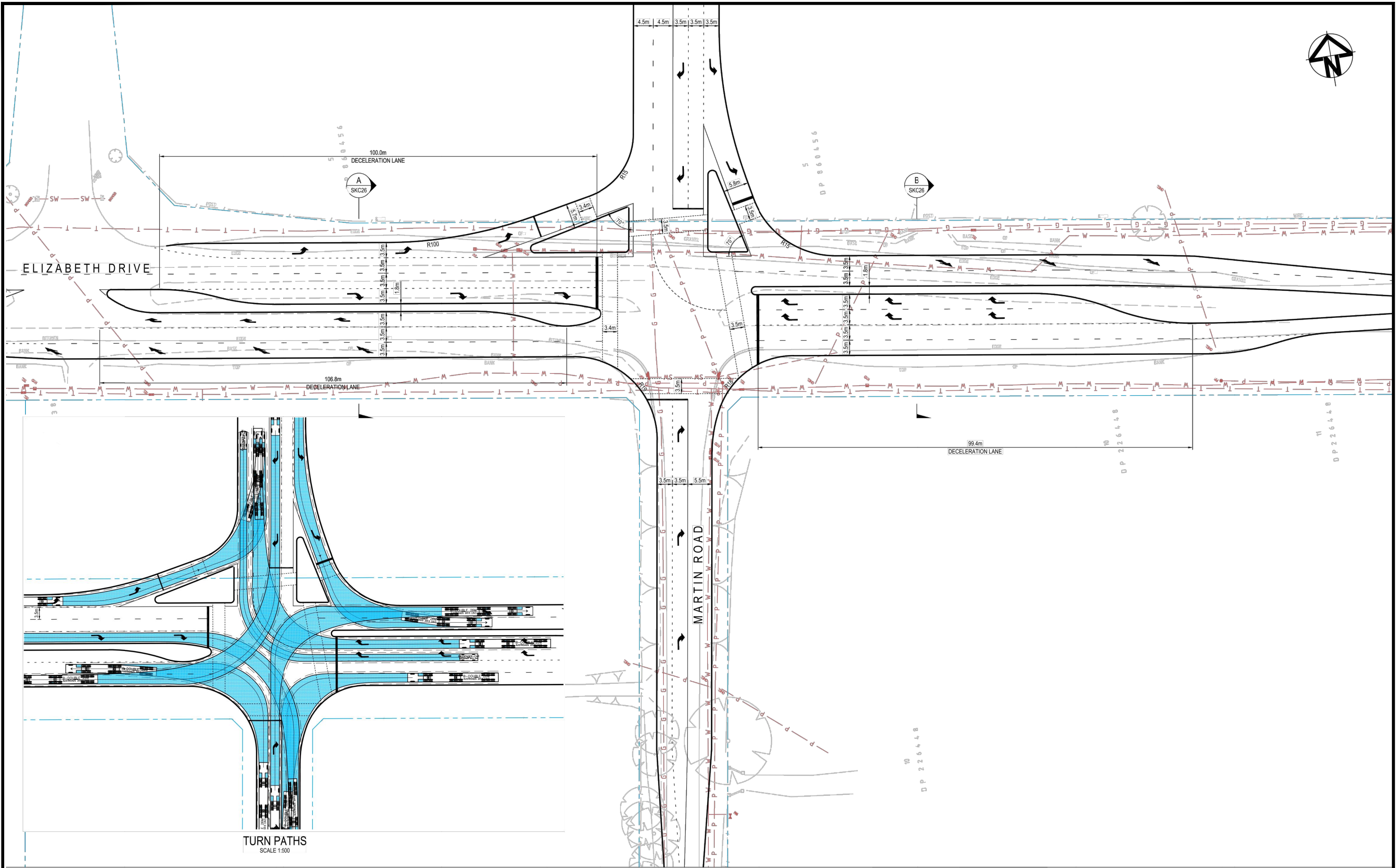
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FIGURE 10A
 BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
CONCEPT INTERSECTION LAYOUT AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL
 JOB NO.17179 25/02/19



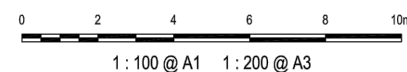
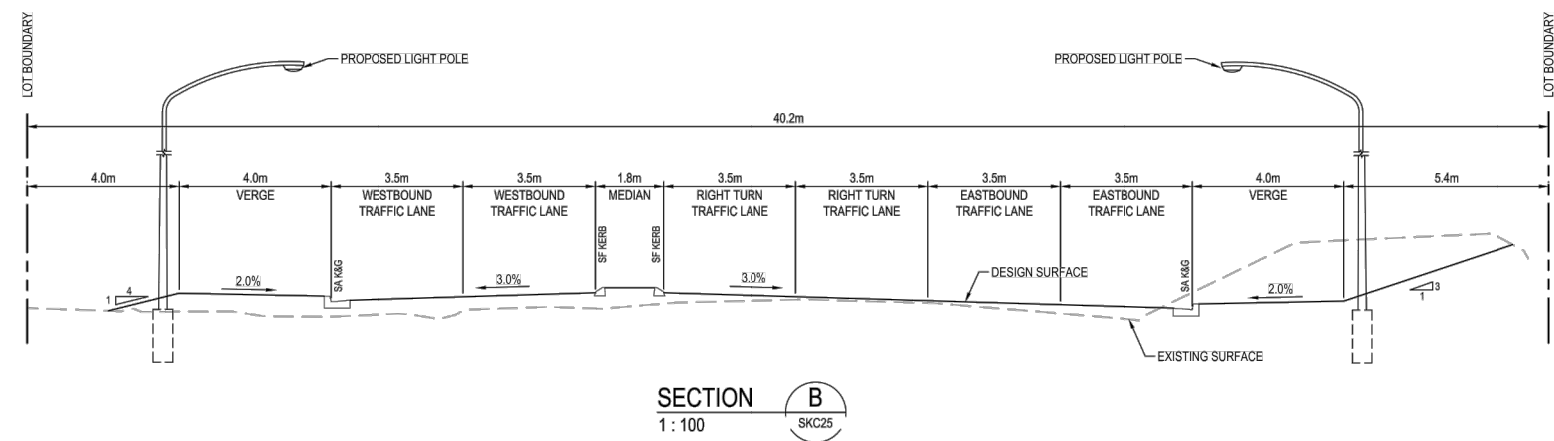
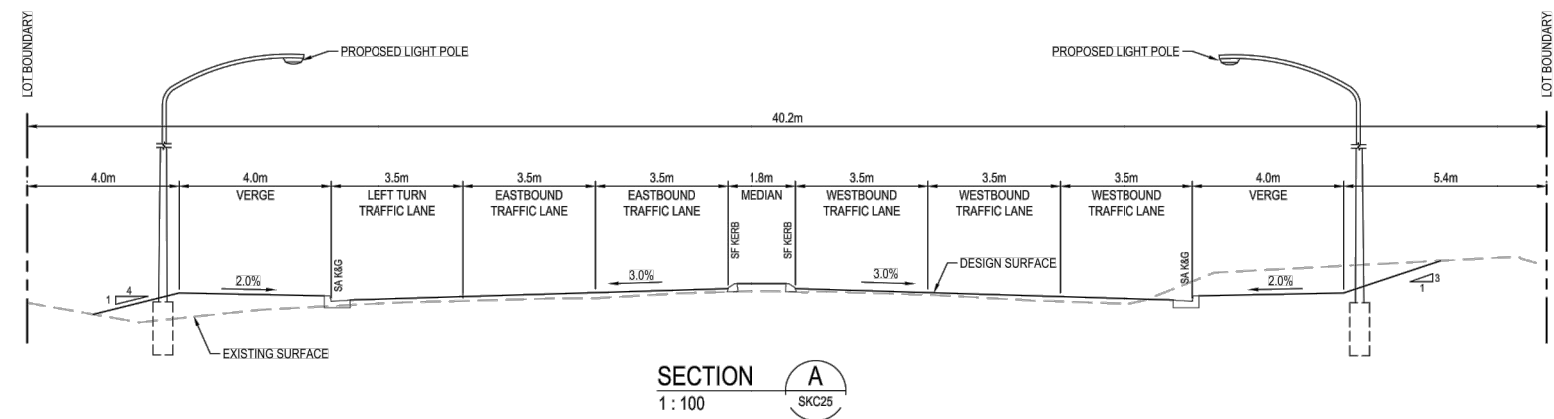
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FIGURE 10B
 BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
CONCEPT INTERSECTION LAYOUT WITH AERIAL AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL
 JOB NO.17179 25/02/19



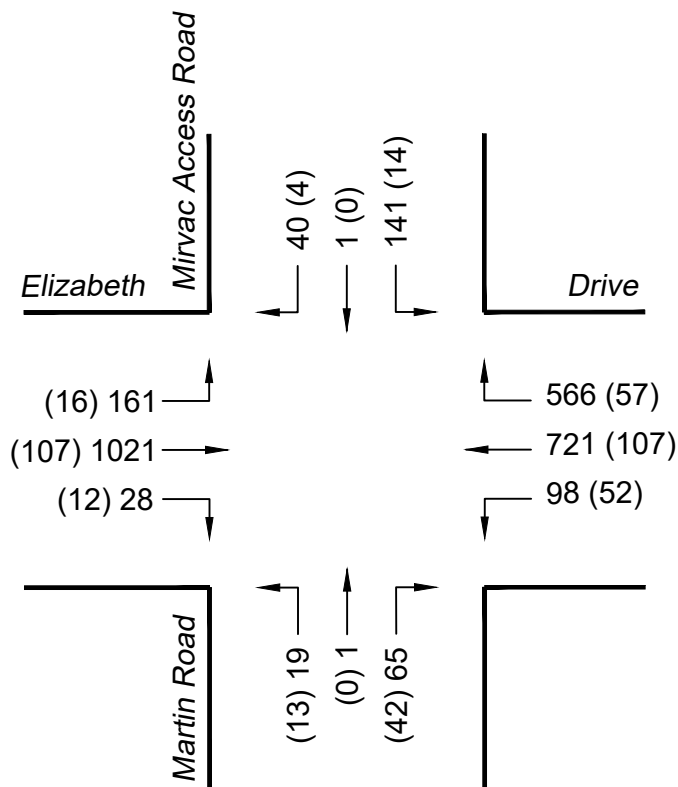
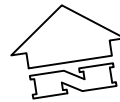
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FIGURE 10C
 BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
CONCEPT INTERSECTION LAYOUT AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL
SITE WORKS
 JOB NO.17179 25/02/19

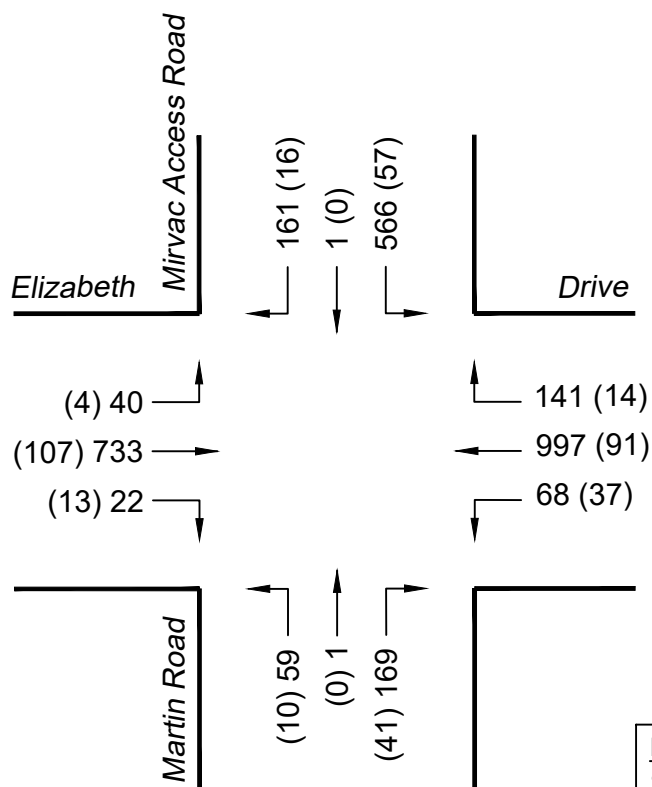


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FIGURE 10C
 BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
CONCEPT INTERSECTION LAYOUT AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL
TYPICAL SECTIONS
 JOB NO.17179 25/02/19



AM PEAK HOUR



PM PEAK HOUR

KEY

344 TOTAL VEHICLES
(27) HEAVY VEHICLES

INCLUDES:

- CSR Advanced Manufacturing
- HUB Modifications 3 & 4
- Mirvac Development Stages 1 & 2

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FIGURE 11

BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
**FUTURE 2026 WEEKDAY AM & PM INTERSECTION
DESIGN VOLUMES FOR CROSS JUNCTION
INTERSECTION WITH PROPOSED MIRVAC
DEVELOPMENT**

JOB NO.17179

25/02/19

Construction impacts have been assessed for the year 2020.

The most significant traffic impact will occur at the Elizabeth Drive/Martin Road intersection.

For the purpose of this assessment, it is assumed that 60% of the workforce will arrive and depart in the AM and PM peak hours respectively and up to 6 heavy vehicles per hour will also enter and exit the site in the AM and PM peak hours.

The additional traffic associated with Modification 3 construction that will use the Elizabeth Drive/Martin Road intersection during the weekday AM and PM peak hours based on the above assumptions is included in **Figure 12**.

Additional other traffic using the intersection in 2020 include the other proposed and approved developments in Martin Road, background traffic growth and construction traffic associated with Western Sydney Airport, which is assumed to be at its peak level.

Figure 12 shows the estimated AM and PM peak hour volumes at the Elizabeth Drive/Martin Road intersection in 2020 with the construction traffic from Modification 3 and the other traffic.

To examine the operating conditions at the intersection during the weekday AM and PM peak hours SIDRA traffic modelling has been undertaken for the 2020 base case as well as with the construction traffic associated with Modification 3.

The results of the modelling are shown in Table 5.4. Reference to Table 5.4 shows that the intersection will have a Level of Service D operation with the construction traffic with average vehicle delays in the order of 44.5 seconds to 50.7 seconds for vehicle turning right out of Martin Road.

While a Level of Service D is generally considered to represent satisfactory traffic conditions, there will be an increase in vehicle delay for the right turn out of Martin Road. Based on Give Way control of Martin Road the Level of Service represents conditions close to capacity for the right turn movement out of Martin Road. The construction impacts will need to be managed through a Construction Traffic Management Plan.

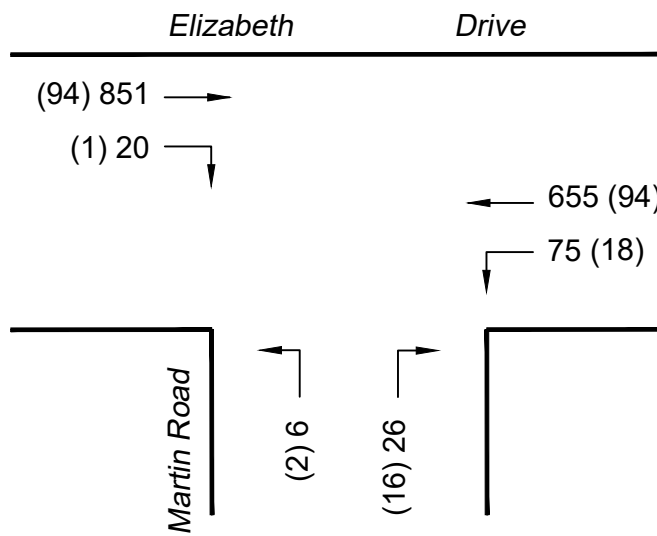
TABLE 5.4

SIDRA RESULTS FOR 2020 BASE CONDITIONS AND WITH CONSTRUCTION TRAFFIC FROM MODIFICATION 3 IN WEEKDAY AM AND PM PEAK HOURS AT INTERSECTION OF ELIZABETH DRIVE AND MARTIN ROAD

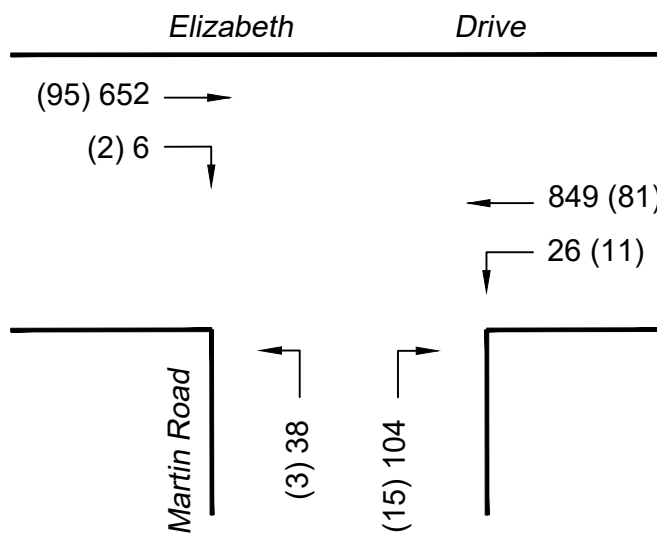
Criteria	2020 Base		2020 With Construction Traffic	
	AM Peak	PM Peak	AM Peak	PM Peak
LS	C	C	D	D
DS	0.468	0.462	0.468	0.552
HMD	41.2	34.9	50.7	44.5

Where: LS - Level of Service
DS - Degree of Saturation
HMD - Highest Movement Delay in seconds which is right turn out of Martin Road

Appendix 1 contains the SIDRA modelling outputs for the construction impacts in 2020.



AM PEAK HOUR



PM PEAK HOUR

KEY

344 TOTAL VEHICLES
(27) HEAVY VEHICLES

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FIGURE 12

BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3
**2020 AM & PM PEAK HOUR TRAFFIC VOLUMES WITH
CONSTRUCTION TRAFFIC FROM MOD 3
USING ELIZABETH DR/MARTIN RD INTERSECTION**

JOB NO.17179

25/02/19

Following approval of the Modification 3 application, CSR will prepare a Construction Traffic Management Plan (CTMP).

The CTMP will manage the traffic impacts of construction activities associated with the construction of Modification 3.

5.8 Vehicle Access and Internal Circulation

Vehicle access to the site is located at the southern end of Martin Road (i.e. at the end of Martin Road).

The vehicle access road to the Brick Making Facility is a sealed two way internal road 7.5m to 8.0m wide. This internal vehicle access road is approximately 400m long between Martin Road and the gatehouse of the Brick Making Facility.

The vehicle access to the proposed Roof Products Manufacturing Facility will be via a new internal road located south of the end of Martin Road, immediately south of the entry to the Brick Making Facility. This will be designed and constructed to AS2890.2 Standards for use by B Doubles. Any changes required to the existing Brick Making Facility site access road in Martin Road will be included in this work.

All existing and proposed internal roads on the Brick Making Facility site and Roof Products Manufacturing Facility site do and will comply with AS2890.2 requirements with regard to road widths and vehicle manoeuvring.

Both the Brick Making Facility and the Roof Products Manufacturing Facility will have a range of heavy vehicles visiting the site from small and heavy rigid vehicles up to articulated vehicles including 25 metre long B-doubles.

Figures 13 and 14 show truck manoeuvring for 25 metre long B doubles within the Roof Products Manufacturing Facility Site and the Brick Making Site. Reference to **Figures 13 and 14** show that this manoeuvring is in accordance with AS2890.2.

5.9 Parking Assessment

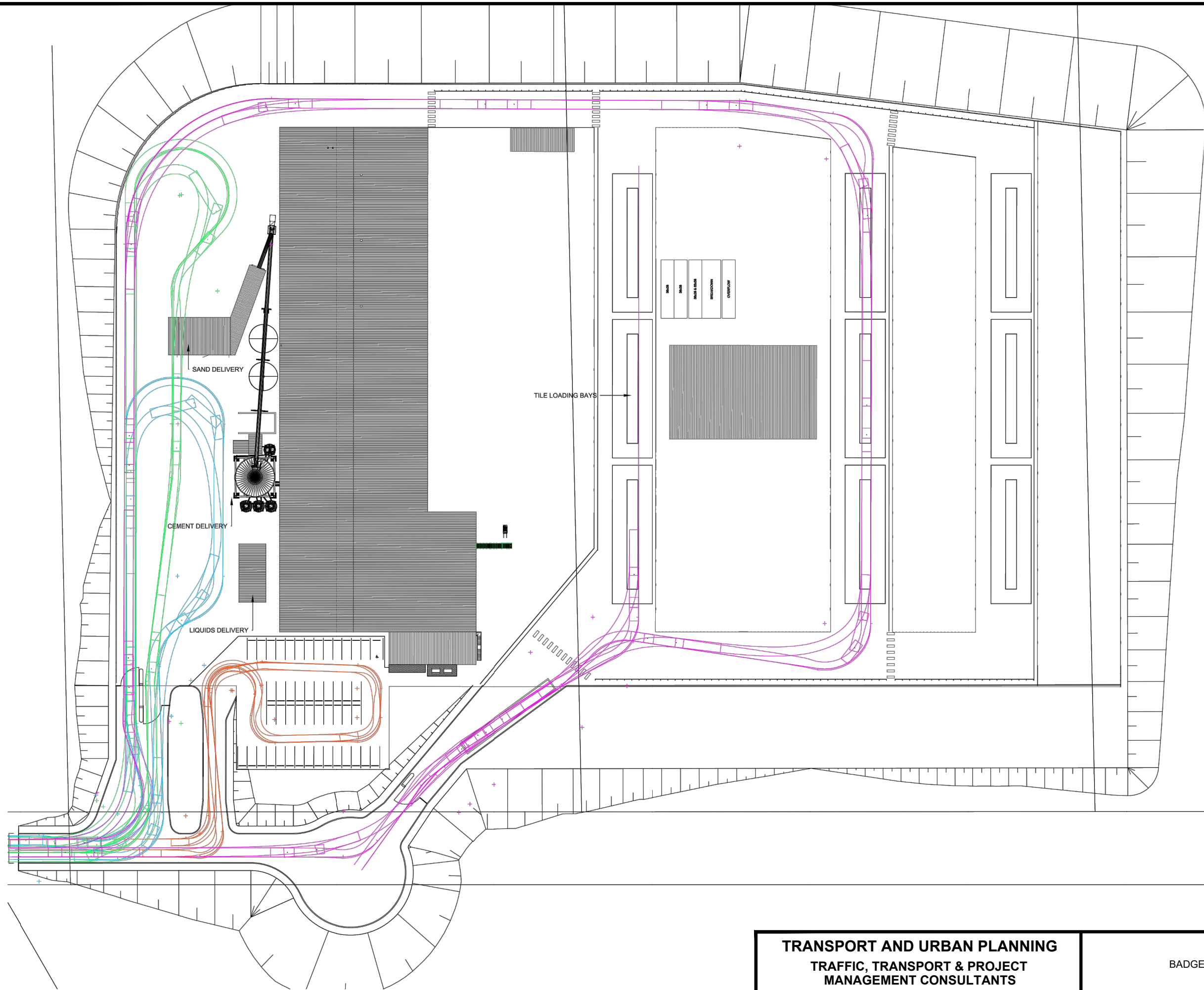
Liverpool DCP 2008 provides car parking rates for different types of land uses, but neither the Brick Making Facility nor the Roof Products Manufacturing Facility fit neatly to the type of land uses such as factory, warehousing and or extractive industries, where parking rates are specified in the DCP.

The proposed facilities require relatively large areas for production and storage during the production process, as well as storage on site, which is not representative of the number of employees and or visitors on site at any time.

Therefore the car parking provision for both facilities is based on employee and visitor numbers that will be on either site at the same time. This merits assessment of the required parking provision and is based on the experience of both PGH and Monier operating such facilities in the Sydney Region over a number of years.

Brick Making Facility

Proposed parking provision at the Brick Making Facility will include;



TRAFFIC STATISTICS

-  BODY SAND DELIVERIES
SHOWN AS 25m B-DOUBLE, 12.5m RADIUS.
-  CEMENT/FLYASH DELIVERIES
SHOWN AS 25m B-DOUBLE, 12.5m RADIUS.
-  TILE LOADING
SHOWN AS 25m B-DOUBLE, 12.5m RADIUS.
-  EMPLOYEE CARS
SHOWN AS 5.2m B99 CAR, 6.3m RADIUS.

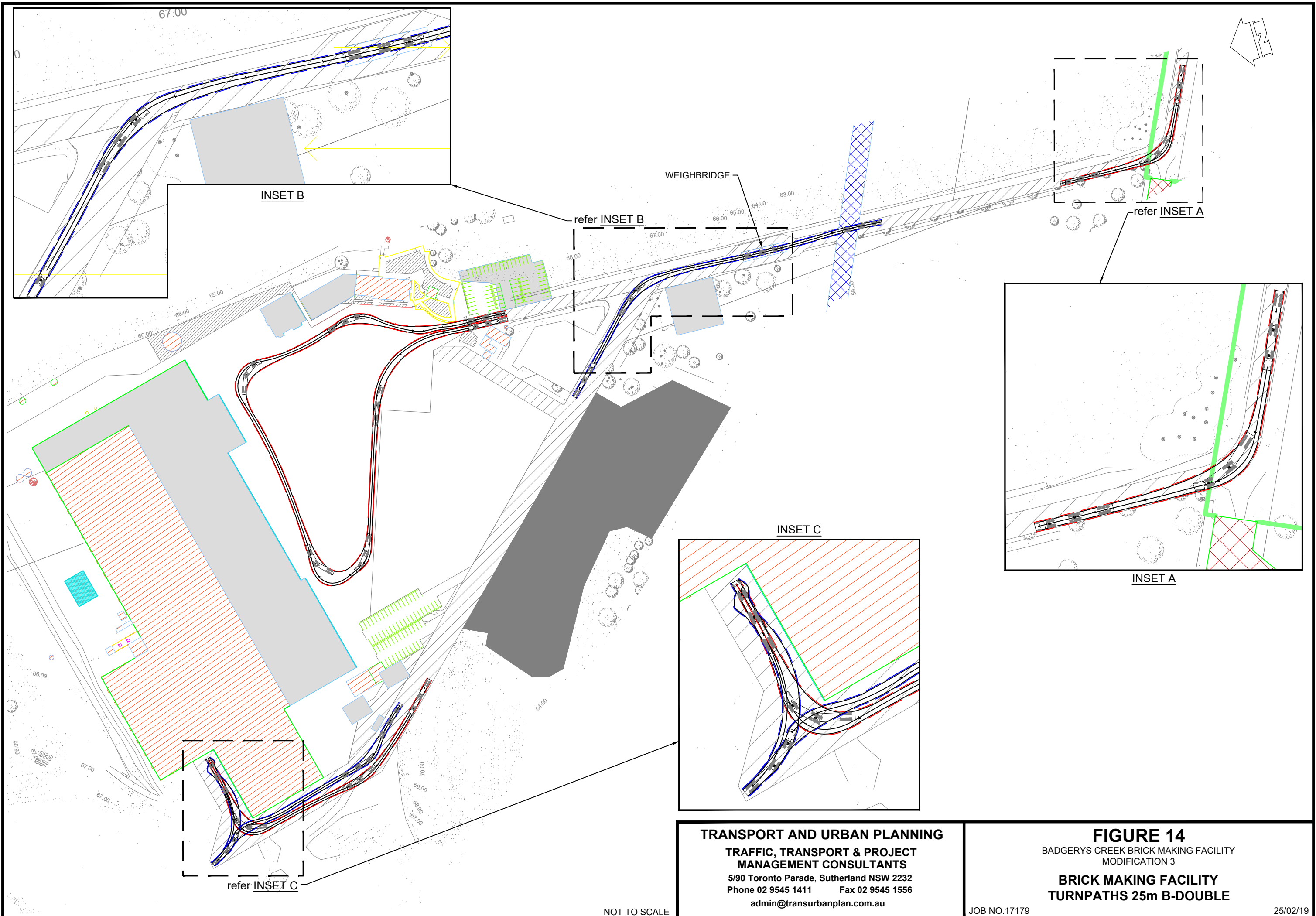
TRANSPORT AND URBAN PLANNING
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FIGURE 13
 BADGERYS CREEK BRICK MAKING FACILITY
 MODIFICATION 3
ROOF MANUFACTURING SITE
TURNPATHS 25m B-DOUBLE

NOT TO SCALE

JOB NO.17179

25/02/19



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FIGURE 14
 BADGERYS CREEK BRICK MAKING FACILITY
 MODIFICATION 3
BRICK MAKING FACILITY
TURNPATHS 25m B-DOUBLE

JOB NO.17179

25/02/19

- 50 visitor and employee car parking spaces which will be accommodated, east of the display centre and north of the gate house. This will accommodate office and sales staff, as well as visitor parking.
- 60 car parking spaces for the manufacturing staff of the facility which will be located adjacent to and east of the brick manufacturing facility.

In addition 20 truck parking spaces will be provided in the truck parking area east of the gatehouse.

The total employee numbers of the facility over a full day are 70 people with some 55 people on site at the same time. This will include administration/sales technical/staff and workers in the Brick Making Facility, and other areas, whose parking will be accommodated in the two parking areas. There will be some 40-45 parking spaces available to visitors, for cash sales and other visitors to the site.

The truck parking of 20 spaces will be adequate for the facility. The proposed 110 car spaces will be sufficient to cater for the maximum parking demand at the Brick Making Facility.

Roof Manufacturing Facility

The Roof Manufacturing Facility will incorporate:

- A car park for 49 cars for employees and visitors;

The Roof Manufacturing Facility will employ 53 people over a full weekday, with a maximum of 38-40 people on site at any time. Visitor parking demand is expected to be 1-2 cars at the same time.

The proposed car parking provision of 49 car spaces will be adequate to accommodate the employee and visitor parking requirements of the facility.

Trucks will be stored overnight in the loading bays or on the hard stand along the boundary fence. Up to 15 large B double trucks can be stored in these areas, which will be adequate for the truck fleet operated by the Roof Manufacturing Facility.

Car Parking Layout

The car parking layouts will be designed to fully comply with AS2890.1 in terms of space size, aisle widths, grades etc.

Accessible Parking

Liverpool DCP 2008 requires one (1) accessible car parking space per 100 spaces for industrial type uses. Based on this, two (2) accessible parking spaces would be required for the proposed 159 car parking spaces.

One (1) accessible car parking space will be provided at both the Brick Making Facility and Roof Manufacturing Facility (i.e. total of two car spaces) which will comply with the DCP Requirements.

The accessible parking spaces will be designed to comply with AS2890.6.

Bicycle Parking

Liverpool Council's DCP does not include a parking provision rate for bicycle parking for manufacturing facilities.

Bicycle parking and associated facilities will be provided at both the Brick Making facility and Roof Manufacturing Facility in accordance with Australian Standard AS2890.3.

5.10 Other Matters

Condition 28 of the Project Approval for the site requires the applicant to:

- Upgrade and widen the section of Martin Road between the site entrance to the entry of the Australian Native Landscape (ANL) site; and
- Pay an annual road maintenance contribution to Council based on the weight of brick products and associated materials transported to and from the site for the life of the project, to the satisfaction of the Director General.

Liverpool Council has requested that as CSR's proposal involves expanded operations that will generate additional heavy vehicles, Council considers that Condition 28 of the original approval shall be carried over and amended as follows:

"The proponent shall, prior to commencing, enter into a formal agreement with Council for the:

- *Upgrade and widening of Martin Road from the site entrance to the entrance of Australian Native Landscape;*
- *Widening of Martin Road in the reserve curves; and*
- *Annual road maintenance contributions to be paid to Council, based on the weight of all products and associated materials transported from and to the site, for the life of the project, to the satisfaction of the Director-General.*

If there is any dispute between the Proponent and Council, then either the parties may refer the matter to the Director-General for resolution."

CSR has agreed to Liverpool Council's proposed amendment to Condition 28 and this amended condition can be included in the Conditions of Approval for Modification 3. CSR has already provided a draft agreement to Council addressing all matters outlined in Condition 28 and the agreement will be executed prior to commencement of works under Modification 3.

APPENDIX 1

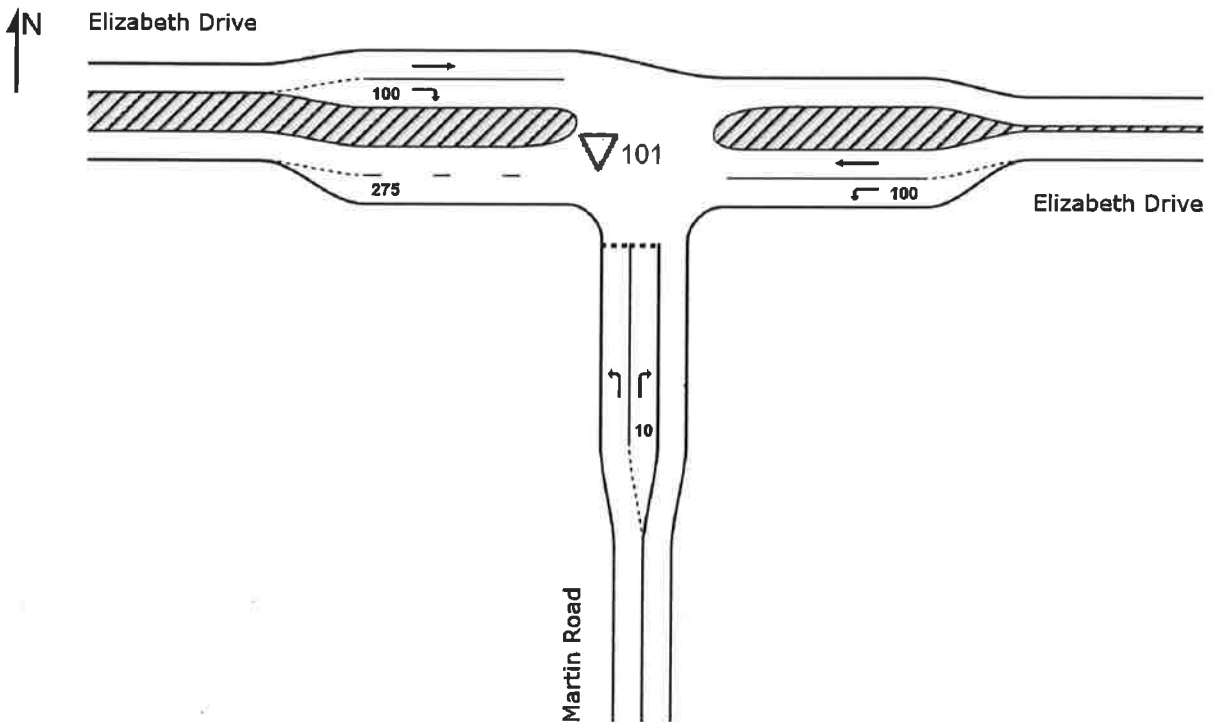
SITE LAYOUT

▽ Site: 101 [Elizabeth Drive & Martin Rd - Ex 2018 AM]

Ex 2018 AM

Site Category: (None)

Giveway / Yield (Two-Way)



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Project: C:\Users\Terry\Documents\17179 Badgerys Creek.sip8

MOVEMENT SUMMARY

▽ Site: 101 [Elizabeth Drive & Martin Rd - Ex 2018 AM]

Ex 2018 AM

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	5	20.0	0.006	8.8	LOS A	0.0	0.4	0.52	0.54	0.52	50.6
3	R2	19	47.4	0.100	27.8	LOS B	0.4	5.8	0.80	0.92	0.80	39.3
Approach		24	41.7	0.100	23.8	LOS B	0.4	5.8	0.74	0.84	0.74	41.3
East: Elizabeth Drive												
4	L2	24	45.8	0.017	7.8	LOS A	0.0	0.0	0.00	0.63	0.00	52.7
5	T1	395	17.7	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		419	19.3	0.226	0.5	NA	0.0	0.0	0.00	0.04	0.00	77.6
West: Elizabeth Drive												
11	T1	807	8.7	0.437	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	4	0.0	0.005	9.7	LOS A	0.0	0.2	0.35	0.59	0.35	56.5
Approach		811	8.6	0.437	0.1	NA	0.0	0.2	0.00	0.00	0.00	79.6
All Vehicles		1254	12.8	0.437	0.7	NA	0.4	5.8	0.02	0.03	0.02	77.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Elizabeth Drive & Martin Rd - Ex 2018 PM]

Ex 2018 PM

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	22	9.1	0.042	12.9	LOS A	0.2	1.9	0.69	0.71	0.69	48.1
3	R2	52	11.5	0.186	20.7	LOS B	0.8	7.3	0.77	0.90	0.77	43.4
Approach		74	10.8	0.186	18.4	LOS B	0.8	7.3	0.75	0.85	0.75	44.7
East: Elizabeth Drive												
4	L2	19	21.1	0.012	7.3	LOS A	0.0	0.0	0.00	0.63	0.00	58.9
5	T1	770	6.4	0.411	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		789	6.7	0.411	0.2	NA	0.0	0.0	0.00	0.02	0.00	79.1
West: Elizabeth Drive												
11	T1	420	14.8	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	5	20.0	0.012	15.6	LOS B	0.0	0.5	0.61	0.68	0.61	51.3
Approach		425	14.8	0.236	0.2	NA	0.0	0.5	0.01	0.01	0.01	79.4
All Vehicles		1288	9.6	0.411	1.3	NA	0.8	7.3	0.05	0.06	0.05	75.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Elizabeth Drive & Martin Rd - 2021 AM Base]

2021 AM Base

Site Category: (None)

Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	5	20.0	0.009	12.0	LOS A	0.0	0.5	0.66	0.62	0.66	48.4
3	R2	21	52.4	0.187	45.3	LOS D	0.7	10.7	0.89	0.96	0.91	33.0
Approach		26	46.2	0.187	38.9	LOS C	0.7	10.7	0.85	0.90	0.86	35.2
East: Elizabeth Drive												
4	L2	34	38.2	0.023	7.6	LOS A	0.0	0.0	0.00	0.63	0.00	54.4
5	T1	662	14.5	0.371	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		696	15.7	0.371	0.4	NA	0.0	0.0	0.00	0.03	0.00	78.0
West: Elizabeth Drive												
11	T1	900	10.7	0.494	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
12	R2	7	0.0	0.013	12.8	LOS A	0.1	0.4	0.54	0.65	0.54	54.0
Approach		907	10.6	0.494	0.2	NA	0.1	0.4	0.00	0.01	0.00	79.4
All Vehicles		1629	13.3	0.494	0.9	NA	0.7	10.7	0.02	0.03	0.02	77.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Elizabeth Drive & Martin Rd - 2021 PM Base]

2021 PM Base
Site Category: (None)
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate	Aver No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	25	8.0	0.056	15.0	LOS B	0.3	2.4	0.73	0.77	0.73	46.9
3	R2	63	15.9	0.352	36.7	LOS C	1.7	16.0	0.88	1.02	1.09	36.4
Approach		88	13.6	0.352	30.5	LOS C	1.7	16.0	0.84	0.95	0.99	38.9
East: Elizabeth Drive												
4	L2	21	28.6	0.014	7.5	LOS A	0.0	0.0	0.00	0.63	0.00	56.8
5	T1	869	9.4	0.473	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		890	9.9	0.473	0.3	NA	0.0	0.0	0.00	0.01	0.00	79.0
West: Elizabeth Drive												
11	T1	663	14.6	0.372	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	5	20.0	0.014	18.1	LOS B	0.1	0.6	0.68	0.72	0.68	49.6
Approach		668	14.7	0.372	0.2	NA	0.1	0.6	0.01	0.01	0.01	79.5
All Vehicles		1646	12.0	0.473	1.8	NA	1.7	16.0	0.05	0.06	0.06	75.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Elizabeth Drive & Martin Rd - 2021 AM Mod 3]

2021 AM with Mod 3
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	15	60.0	0.036	15.0	LOS B	0.2	2.9	0.68	0.71	0.68	45.6
3	R2	51	54.9	0.492	68.9	LOS E	2.3	35.4	0.93	1.11	1.30	27.2
Approach		66	56.1	0.492	56.7	LOS E	2.3	35.4	0.88	1.02	1.16	29.9
East: Elizabeth Drive												
4	L2	81	46.9	0.058	7.8	LOS A	0.0	0.0	0.00	0.63	0.00	52.4
5	T1	662	14.5	0.371	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		743	18.0	0.371	0.9	NA	0.0	0.0	0.00	0.07	0.00	75.5
West: Elizabeth Drive												
11	T1	900	10.7	0.497	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
12	R2	24	33.3	0.059	16.3	LOS B	0.2	2.8	0.62	0.77	0.62	50.5
Approach		924	11.3	0.497	0.5	NA	0.2	2.8	0.02	0.02	0.02	78.5
All Vehicles		1733	15.9	0.497	2.8	NA	2.3	35.4	0.04	0.08	0.05	72.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Elizabeth Drive & Martin Rd - 2021 PM Mod 3]

2021 PM with Mod 3
Site Category: (None)
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	55	10.9	0.125	15.7	LOS B	0.7	5.7	0.75	0.83	0.75	46.4
3	R2	153	17.6	0.983	167.4	LOS F	15.4	148.7	0.98	2.28	5.01	15.8
Approach		208	15.9	0.983	127.3	LOS F	15.4	148.7	0.92	1.89	3.88	19.1
East: Elizabeth Drive												
4	L2	62	37.1	0.042	7.6	LOS A	0.0	0.0	0.00	0.63	0.00	54.7
5	T1	869	9.4	0.473	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		931	11.3	0.473	0.6	NA	0.0	0.0	0.00	0.04	0.00	77.4
West: Elizabeth Drive												
11	T1	663	14.6	0.375	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	20	45.0	0.072	22.3	LOS B	0.3	3.7	0.73	0.86	0.73	46.4
Approach		683	15.5	0.375	0.7	NA	0.3	3.7	0.02	0.03	0.02	78.2
All Vehicles		1822	13.4	0.983	15.1	NA	15.4	148.7	0.11	0.25	0.45	57.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

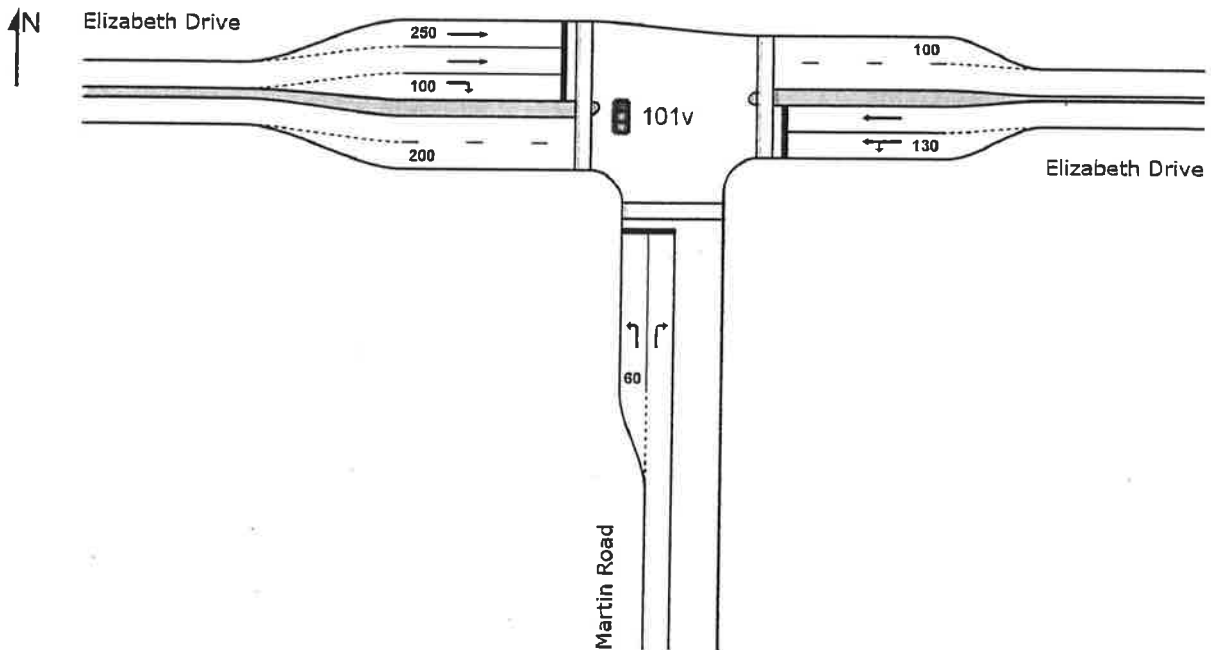
SITE LAYOUT

 Site: 101v [Elizabeth Drive & Martin Rd - 2021 AM Mod 3 TCS]

2021 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2021 AM Mod 3 TCS]

2021 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No Cycles	Average Speed km/h
South: Martin Road												
1	L2	15	60.0	0.035	26.2	LOS B	0.4	6.4	0.71	0.68	0.71	40.0
3	R2	51	54.9	0.235	39.2	LOS C	1.8	27.8	0.91	0.74	0.91	35.2
Approach		66	56.1	0.235	36.2	LOS C	1.8	27.8	0.86	0.73	0.86	36.2
East: Elizabeth Drive												
4	L2	81	46.9	0.430	21.5	LOS B	9.6	81.4	0.68	0.64	0.68	50.8
5	T1	662	14.5	0.430	13.7	LOS A	9.6	81.4	0.68	0.61	0.68	61.1
Approach		743	18.0	0.430	14.6	LOS B	9.6	98.2	0.68	0.62	0.68	59.8
West: Elizabeth Drive												
11	T1	900	10.7	0.480	6.7	LOS A	11.1	95.6	0.50	0.44	0.50	69.8
12	R2	24	33.3	0.213	48.2	LOS D	1.0	11.5	0.97	0.71	0.97	35.2
Approach		924	11.3	0.480	7.8	LOS A	11.1	95.6	0.51	0.45	0.51	68.0
All Vehicles		1733	15.9	0.480	11.8	LOS A	11.1	98.2	0.60	0.53	0.60	62.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	15.7	LOS B	0.1	0.1	0.63	0.63	
P2	East Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
P4	West Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
All Pedestrians		150	26.3	LOS C			0.80	0.80	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2021 AM Mod 3 TCS]

2021 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: 3 phase with Trailing Right Turn

Reference Phase: Phase A

Input Phase Sequence: A, B, C

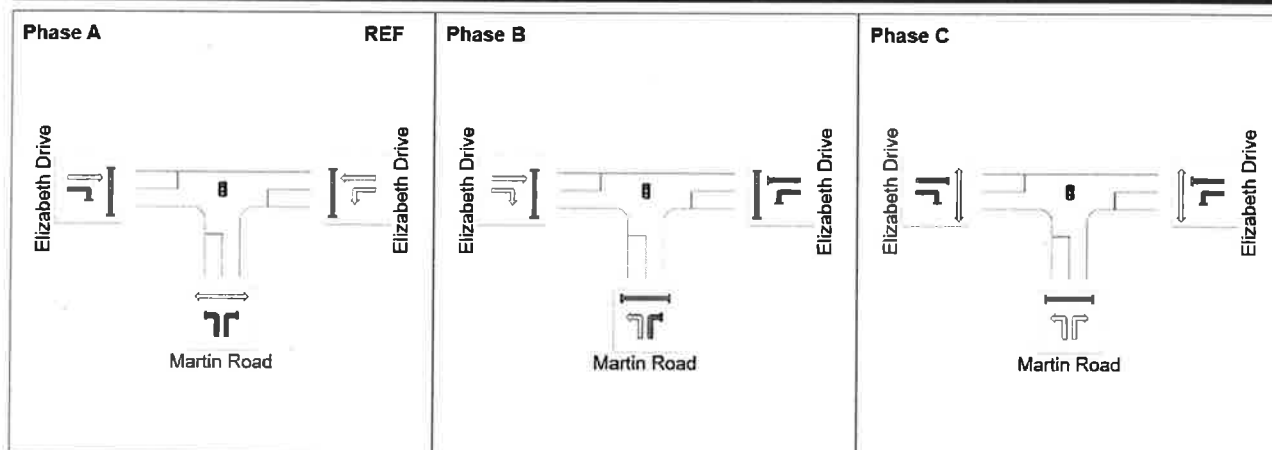
Output Phase Sequence: A, B, C

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	47	60
Green Time (sec)	40	6	13
Phase Time (sec)	47	13	20
Phase Split	59%	16%	25%

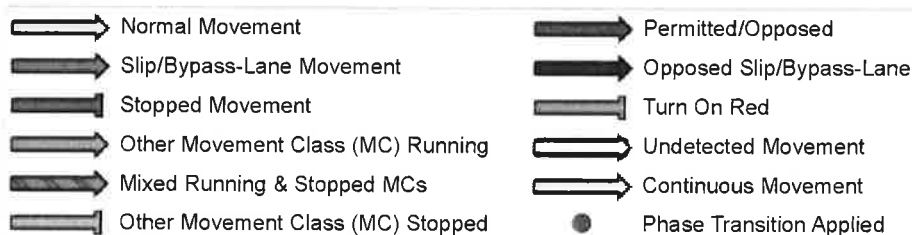
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2021 PM Mod 3 TCS]

2021 PM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	55	10.9	0.095	25.2	LOS B	1.5	12.7	0.72	0.71	0.72	41.4
3	R2	153	17.6	0.495	38.4	LOS C	5.6	53.7	0.94	0.80	0.94	36.0
Approach		208	15.9	0.495	34.9	LOS C	5.6	53.7	0.88	0.78	0.88	37.3
East: Elizabeth Drive												
4	L2	62	37.1	0.503	21.4	LOS B	12.3	95.3	0.70	0.65	0.70	51.3
5	T1	869	9.4	0.503	13.8	LOS A	12.3	95.3	0.70	0.63	0.70	61.2
Approach		931	11.3	0.503	14.3	LOS A	12.3	112.3	0.70	0.63	0.70	60.4
West: Elizabeth Drive												
11	T1	663	14.6	0.362	6.1	LOS A	7.3	67.5	0.45	0.40	0.45	70.6
12	R2	20	45.0	0.190	48.5	LOS D	0.8	11.0	0.97	0.71	0.97	34.9
Approach		683	15.5	0.362	7.4	LOS A	7.3	67.5	0.47	0.41	0.47	68.5
All Vehicles		1822	13.4	0.503	14.0	LOS A	12.3	112.3	0.64	0.56	0.64	58.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	15.0	LOS B	0.1	0.1	0.61	0.61	
P2	East Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
P4	West Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
All Pedestrians		150	26.1	LOS C			0.80	0.80	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2021 PM Mod 3 TCS]

2021 PM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: 3 Phase with Trailing Turn

Reference Phase: Phase B

Input Phase Sequence: A, B, C

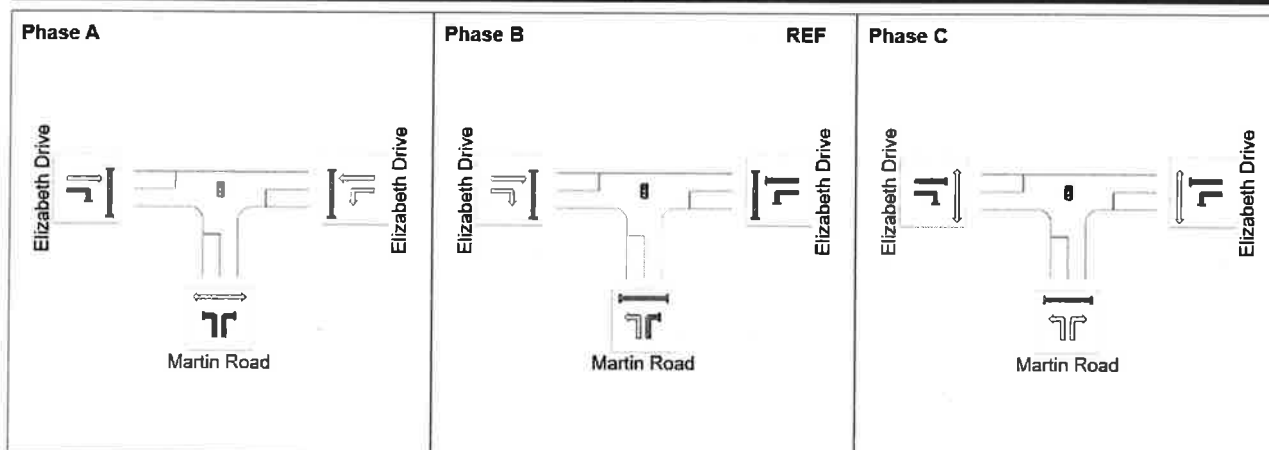
Output Phase Sequence: A, B, C

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	33	0	12
Green Time (sec)	41	6	15
Phase Time (sec)	47	12	21
Phase Split	59%	15%	26%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



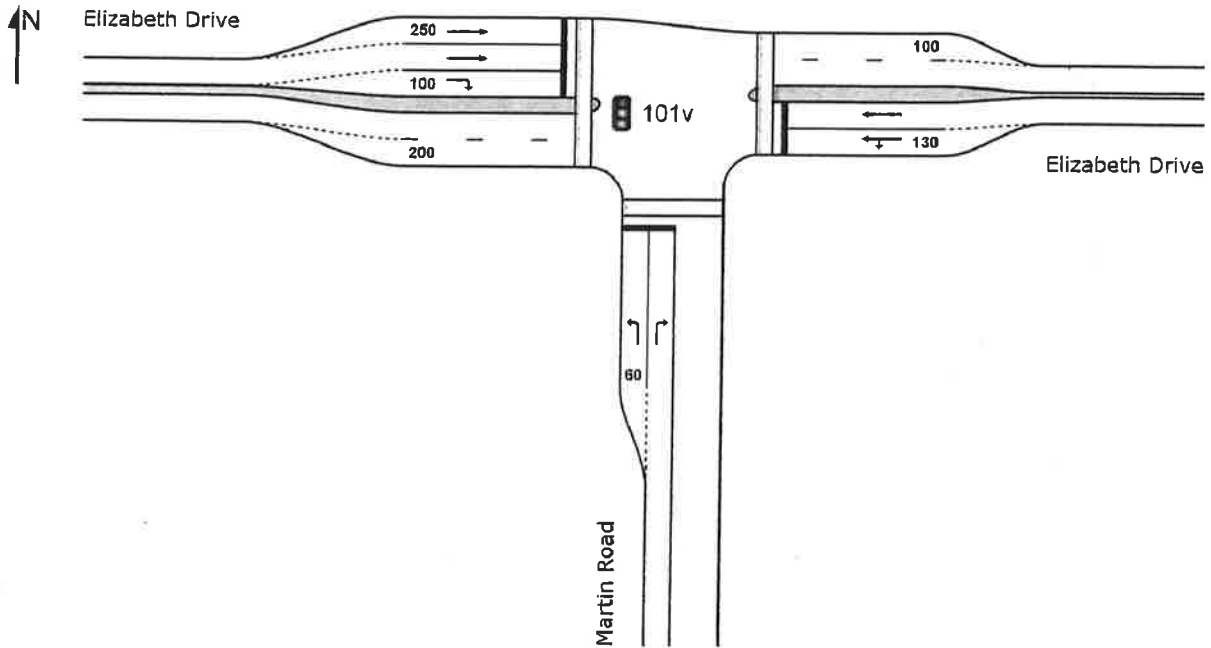
SITE LAYOUT

 Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mod 3 TCS]

2026 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mod 3 TCS]

2026 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	15	60.0	0.035	26.2	LOS B	0.4	6.4	0.71	0.68	0.71	40.0
3	R2	51	54.9	0.235	39.2	LOS C	1.8	27.8	0.91	0.74	0.91	35.2
Approach		66	56.1	0.235	36.2	LOS C	1.8	27.8	0.86	0.73	0.86	36.2
East: Elizabeth Drive												
4	L2	81	46.9	0.464	21.8	LOS B	10.7	89.2	0.70	0.65	0.70	50.6
5	T1	721	14.8	0.464	14.0	LOS A	10.7	89.2	0.70	0.63	0.70	60.8
Approach		802	18.1	0.464	14.8	LOS B	10.7	109.2	0.70	0.63	0.70	59.6
West: Elizabeth Drive												
11	T1	1021	10.5	0.544	7.1	LOS A	13.5	115.3	0.53	0.47	0.53	69.3
12	R2	24	33.3	0.213	48.2	LOS D	1.0	11.5	0.97	0.71	0.97	35.2
Approach		1045	11.0	0.544	8.0	LOS A	13.5	115.3	0.54	0.48	0.54	67.8
All Vehicles		1913	15.5	0.544	11.8	LOS A	13.5	115.3	0.62	0.55	0.62	62.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	15.7	LOS B	0.1	0.1	0.63	0.63	
P2	East Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
P4	West Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89	
All Pedestrians		150	26.3	LOS C			0.80	0.80	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mod 3 TCS]

2026 AM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: 3 phase with Trailing Right Turn

Reference Phase: Phase A

Input Phase Sequence: A, B, C

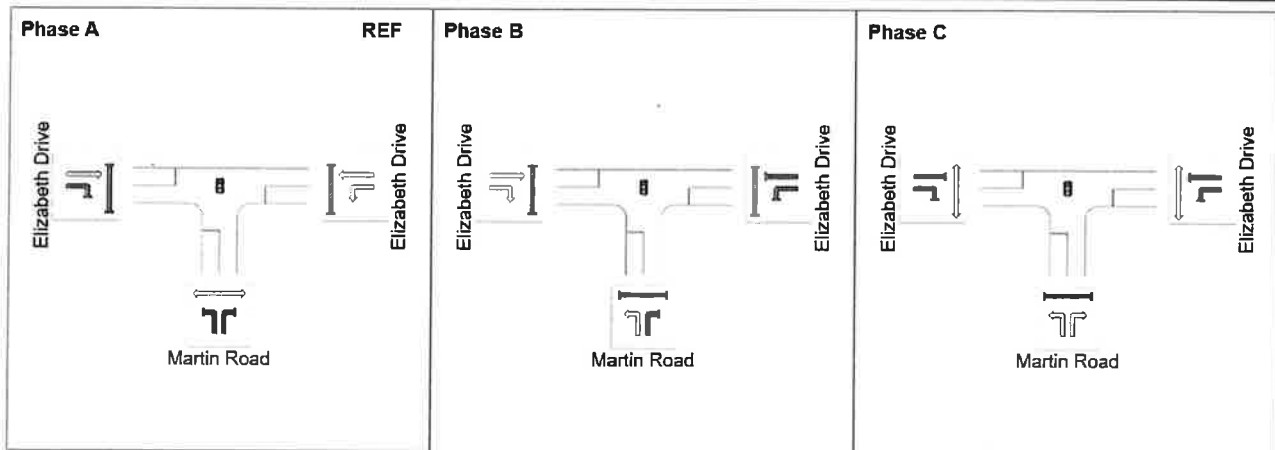
Output Phase Sequence: A, B, C

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	47	60
Green Time (sec)	40	6	13
Phase Time (sec)	47	13	20
Phase Split	59%	16%	25%

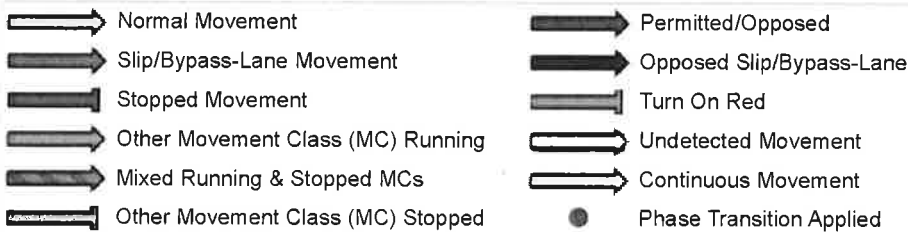
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



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Organisation: TRANSPORT AND URBAN PLANNING PTY LTD | Processed: Thursday, 15 November 2018 6:17:47 PM

Project: C:\Users\Terry\Documents\17179 Badgerys Creek.sip8

MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mod 3 TCS]

2026 PM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	55	10.9	0.098	26.0	LOS B	1.5	13.0	0.73	0.72	0.73	41.0
3	R2	153	17.6	0.530	39.5	LOS C	5.7	54.7	0.96	0.80	0.96	35.6
Approach		208	15.9	0.530	35.9	LOS C	5.7	54.7	0.90	0.78	0.90	36.9
East: Elizabeth Drive												
4	L2	62	37.1	0.556	21.3	LOS B	14.4	109.6	0.72	0.66	0.72	51.4
5	T1	997	9.1	0.556	13.7	LOS A	14.4	109.6	0.72	0.65	0.72	61.3
Approach		1059	10.8	0.556	14.2	LOS A	14.4	129.5	0.72	0.65	0.72	60.6
West: Elizabeth Drive												
11	T1	733	14.6	0.393	5.8	LOS A	8.1	74.3	0.45	0.40	0.45	71.0
12	R2	20	45.0	0.190	48.5	LOS D	0.8	11.0	0.97	0.71	0.97	34.9
Approach		753	15.4	0.393	7.0	LOS A	8.1	74.3	0.46	0.40	0.46	69.1
All Vehicles		2020	13.0	0.556	13.7	LOS A	14.4	129.5	0.64	0.57	0.64	59.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	14.4	LOS B	0.1	0.1	0.60	0.60
P2	East Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89
All Pedestrians		150	25.9	LOS C			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mod 3 TCS]

2026 PM with Mod 3 & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: 3 Phase with Trailing Turn

Reference Phase: Phase B

Input Phase Sequence: A, B, C

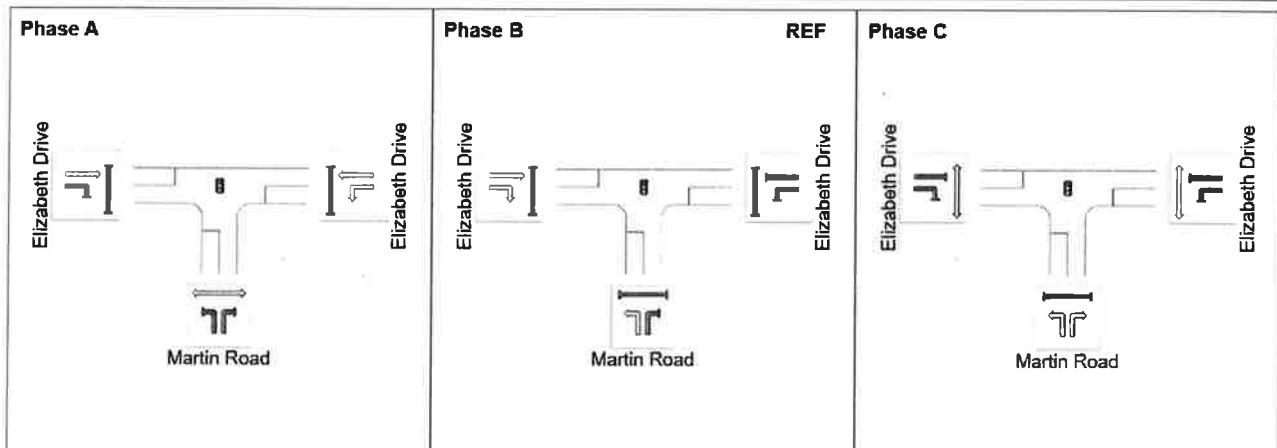
Output Phase Sequence: A, B, C

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	32	0	12
Green Time (sec)	42	6	14
Phase Time (sec)	48	12	20
Phase Split	60%	15%	25%

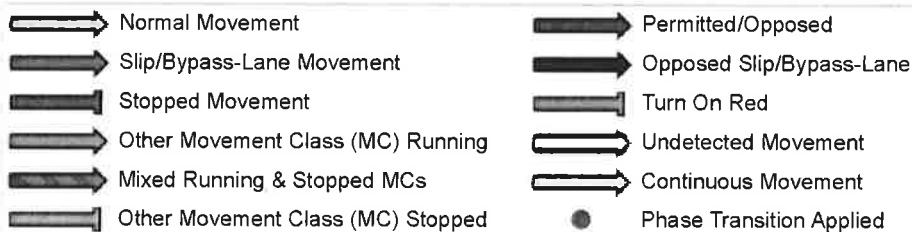
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



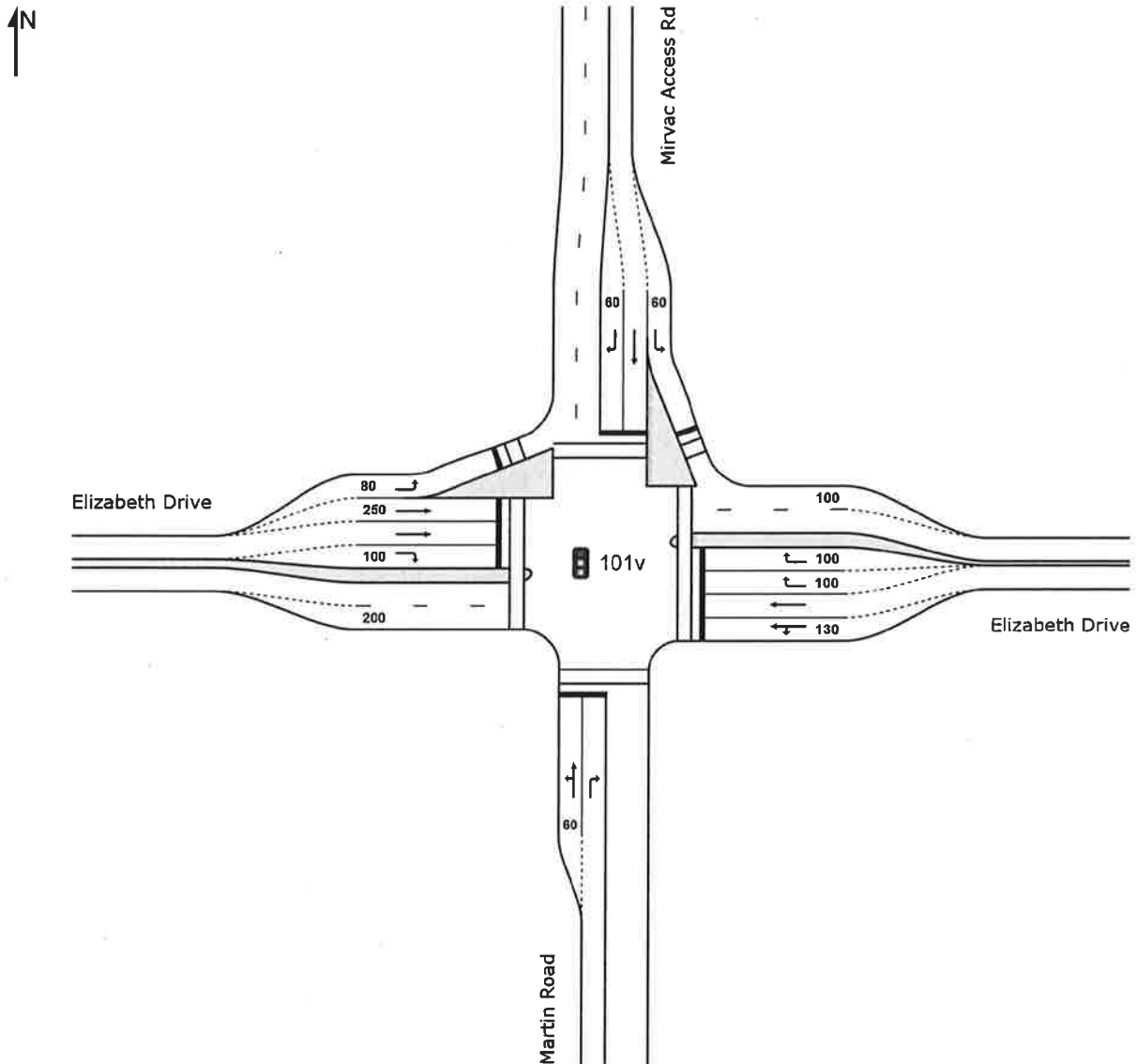
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.060	43.4	LOS D	0.9	15.3	0.78	0.69	0.78	33.8
2	T1	1	0.0	0.060	37.1	LOS C	0.9	15.3	0.78	0.69	0.78	35.6
3	R2	65	64.6	0.334	58.2	LOS E	3.6	60.8	0.93	0.77	0.93	29.9
Approach		85	64.7	0.334	54.7	LOS D	3.6	60.8	0.89	0.75	0.89	30.8
East: Elizabeth Drive												
4	L2	98	53.1	0.388	20.7	LOS B	12.8	112.9	0.54	0.55	0.54	51.2
5	T1	721	14.8	0.388	12.8	LOS A	12.8	112.9	0.54	0.51	0.54	62.1
6	R2	566	10.1	0.851	45.6	LOS D	13.2	97.7	1.00	0.91	1.22	36.4
Approach		1385	15.6	0.851	26.8	LOS B	13.2	132.6	0.73	0.68	0.82	47.7
North: Mirvac Access Rd												
7	L2	141	9.9	0.423	33.3	LOS C	5.2	44.0	0.92	0.78	0.92	38.4
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	40	10.0	0.181	56.6	LOS E	2.2	18.5	0.91	0.74	0.91	30.8
Approach		182	9.9	0.423	38.5	LOS C	5.2	44.0	0.92	0.77	0.92	36.4
West: Elizabeth Drive												
10	L2	161	9.9	0.215	31.1	LOS C	6.1	51.5	0.66	0.76	0.66	42.9
11	T1	1021	10.5	0.841	34.0	LOS C	36.8	315.7	0.88	0.82	0.92	46.0
12	R2	28	42.9	0.308	72.2	LOS F	1.7	23.4	0.99	0.73	0.99	28.5
Approach		1210	11.2	0.841	34.5	LOS C	36.8	315.7	0.85	0.81	0.89	44.9
All Vehicles		2862	14.8	0.851	31.6	LOS C	36.8	315.7	0.80	0.74	0.86	44.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	13.5	LOS B	0.1	0.1	0.46	0.46	
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	56.8	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	19.6	LOS B	0.1	0.1	0.56	0.56	
All Pedestrians		300	42.9	LOS E			0.80	0.80	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

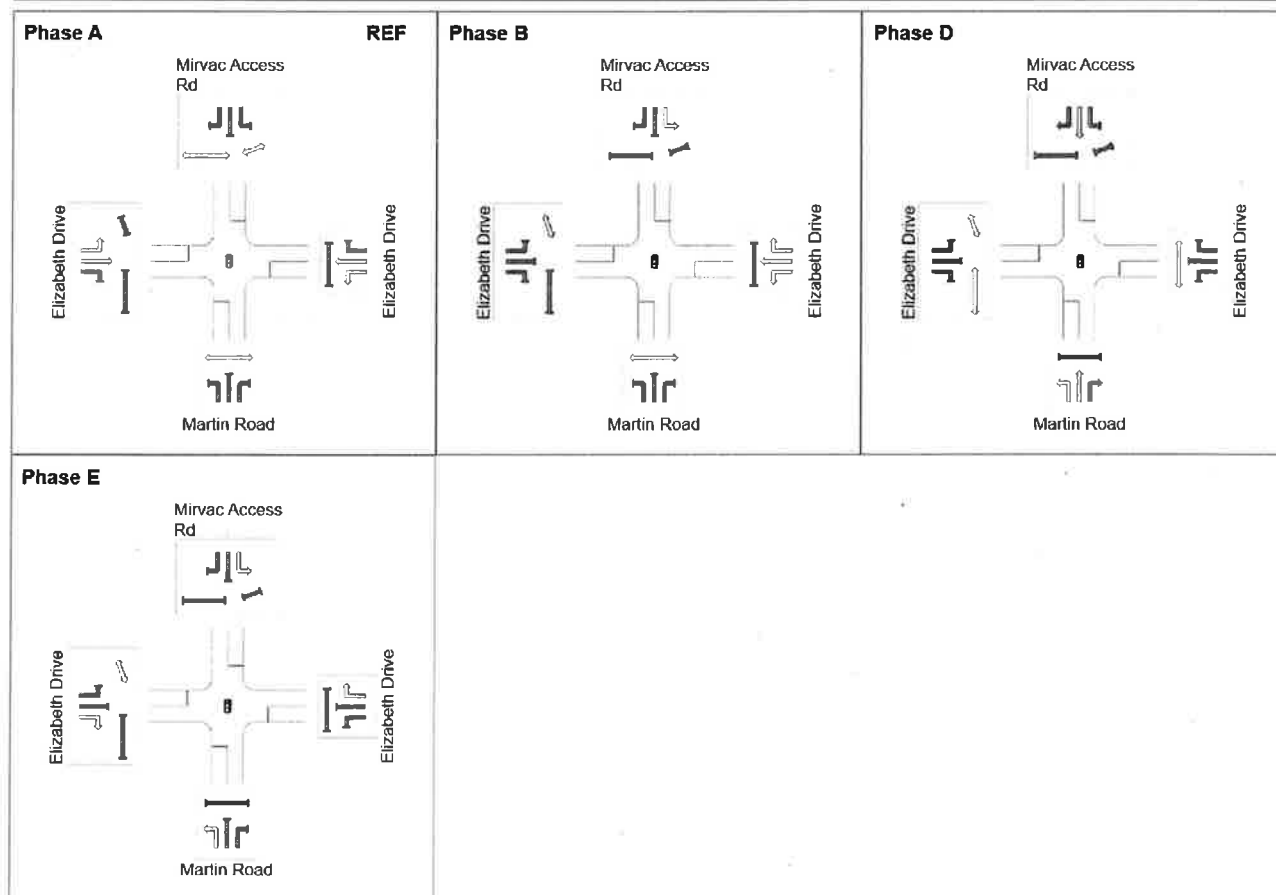
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	60	83	110
Green Time (sec)	54	16	20	8
Phase Time (sec)	61	23	27	14
Phase Split	49%	18%	22%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCS]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.151	48.7	LOS D	3.1	29.4	0.82	0.74	0.82	32.6
2	T1	1	0.0	0.151	43.0	LOS D	3.1	29.4	0.82	0.74	0.82	33.4
3	R2	169	24.3	0.833	75.4	LOS F	12.1	128.7	1.00	0.95	1.27	26.5
Approach		229	22.3	0.833	68.4	LOS E	12.1	128.7	0.95	0.89	1.15	27.9
East: Elizabeth Drive												
4	L2	68	54.4	0.449	19.7	LOS B	17.0	136.6	0.52	0.51	0.52	52.3
5	T1	997	9.1	0.449	11.7	LOS A	17.0	136.6	0.52	0.49	0.52	63.5
6	R2	141	9.9	0.114	23.8	LOS B	1.9	16.2	0.70	0.73	0.70	46.4
Approach		1206	11.8	0.449	13.6	LOS A	17.0	155.9	0.54	0.52	0.54	60.2
North: Mirvac Access Rd												
7	L2	566	10.1	0.919	50.2	LOS D	30.8	262.4	1.00	1.00	1.26	32.7
8	T1	1	0.0	0.003	51.8	LOS D	0.1	0.4	0.87	0.52	0.87	32.5
9	R2	161	9.9	0.910	88.7	LOS F	12.7	108.3	1.00	1.06	1.52	24.3
Approach		728	10.0	0.919	58.7	LOS E	30.8	262.4	1.00	1.01	1.31	30.3
West: Elizabeth Drive												
10	L2	40	10.0	0.078	43.8	LOS D	1.9	15.9	0.75	0.72	0.75	37.4
11	T1	733	14.6	0.899	56.0	LOS D	34.3	315.0	0.96	0.94	1.11	36.0
12	R2	22	59.1	0.379	82.1	LOS F	1.5	24.5	1.00	0.72	1.00	26.4
Approach		795	15.6	0.899	56.1	LOS D	34.3	315.0	0.95	0.92	1.09	35.7
All Vehicles		2958	13.2	0.919	40.4	LOS C	34.3	315.0	0.80	0.78	0.93	39.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P2	East Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	61.8	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
All Pedestrians		300	61.0	LOS F			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCS]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

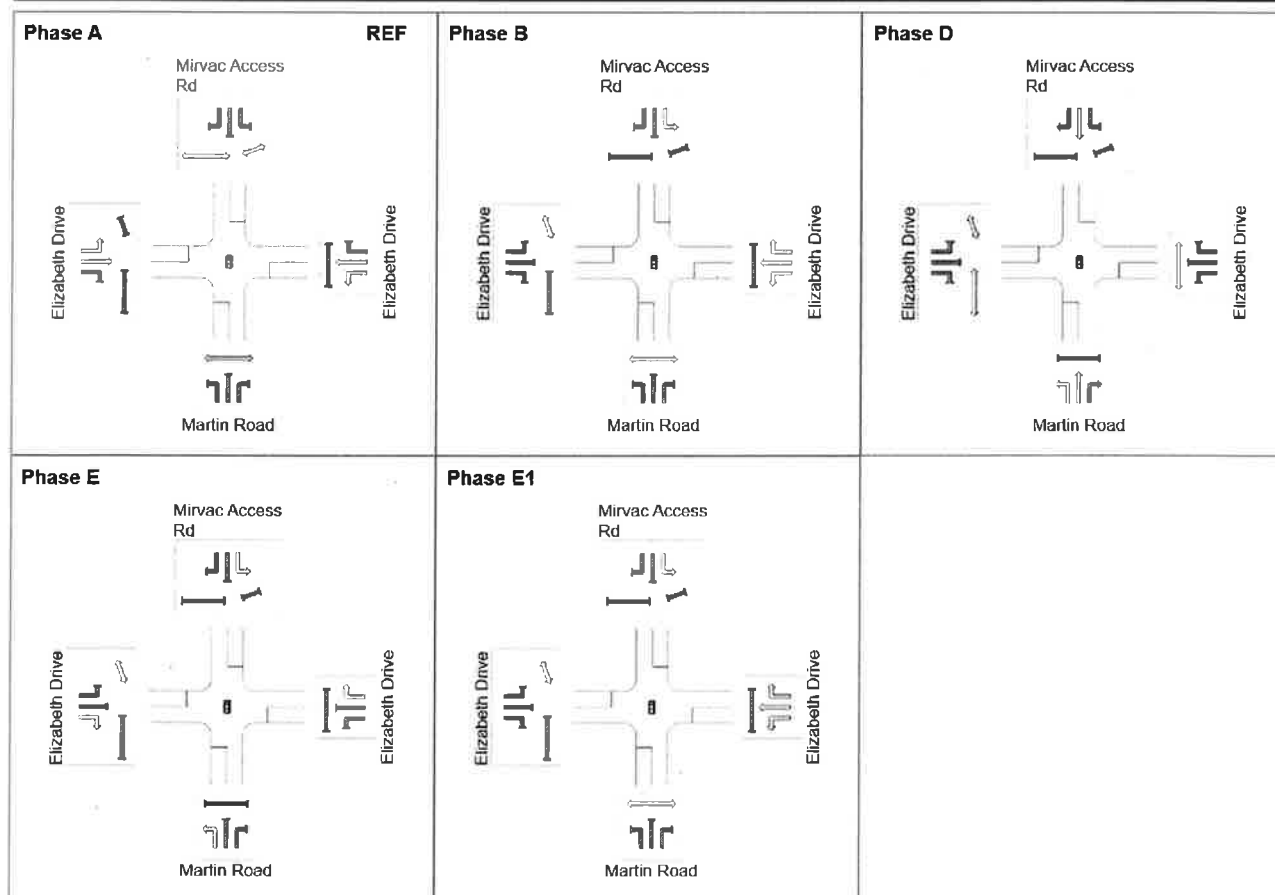
Output Phase Sequence: A, B, D, E, E1

Phase Timing Summary

Phase	A	B	D	E	E1
Phase Change Time (sec)	0	46	79	106	119
Green Time (sec)	40	26	20	6	10
Phase Time (sec)	47	33	27	12	16
Phase Split	35%	24%	20%	9%	12%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



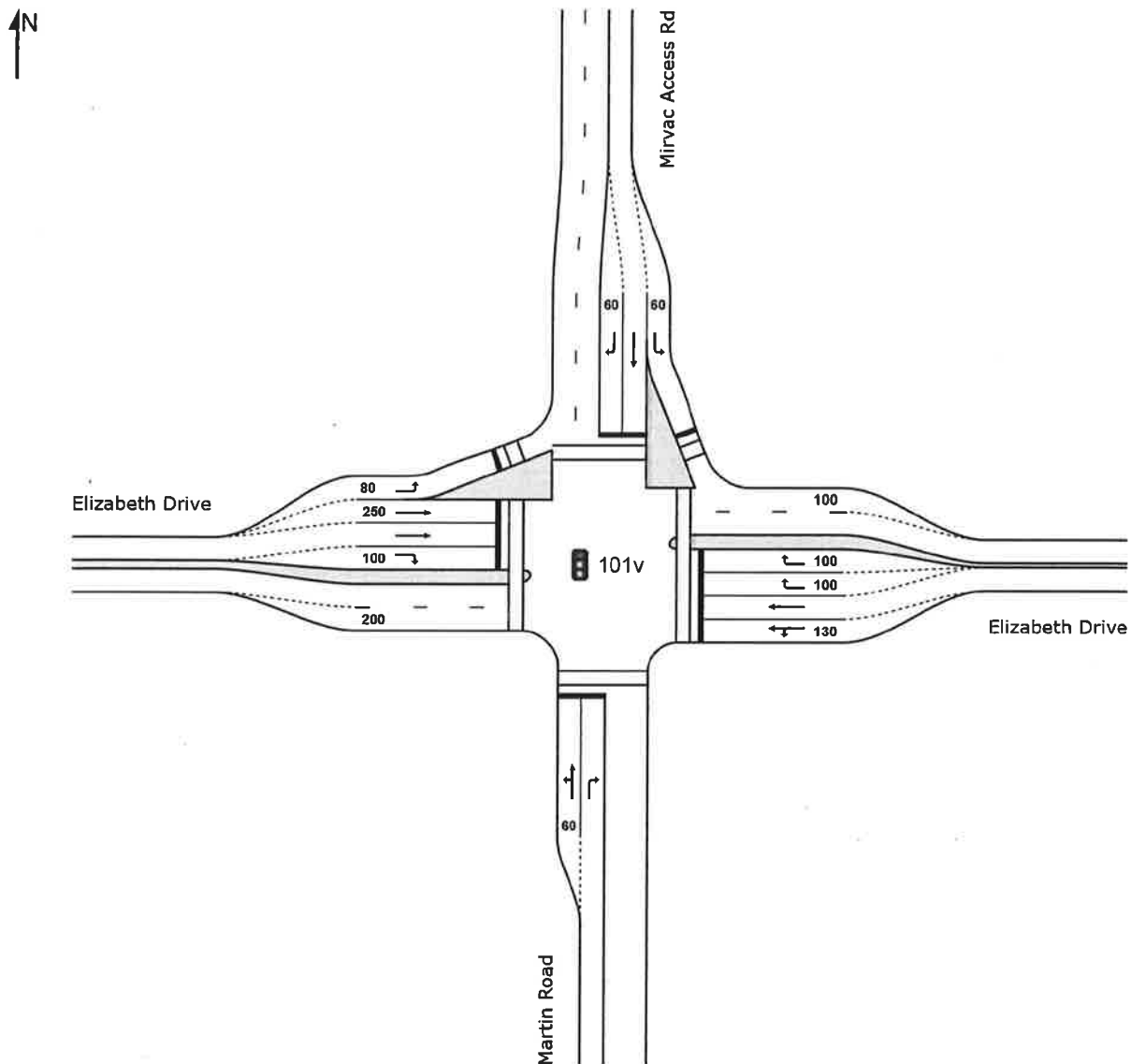
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.059	46.9	LOS D	1.0	16.9	0.77	0.69	0.77	32.8
2	T1	1	0.0	0.059	40.5	LOS C	1.0	16.9	0.77	0.69	0.77	34.4
3	R2	65	64.6	0.358	65.8	LOS E	4.1	68.8	0.94	0.77	0.94	28.2
Approach		85	64.7	0.358	61.2	LOS E	4.1	68.8	0.90	0.75	0.90	29.2
East: Elizabeth Drive												
4	L2	98	53.1	0.315	21.5	LOS B	10.6	99.4	0.51	0.54	0.51	50.5
5	T1	550	17.3	0.315	13.6	LOS A	10.6	99.4	0.51	0.49	0.51	61.2
6	R2	566	10.1	0.915	68.7	LOS E	17.0	125.8	1.00	1.01	1.52	29.6
Approach		1214	16.8	0.915	39.9	LOS C	17.0	125.8	0.74	0.74	0.98	40.4
North: Mirvac Access Rd												
7	L2	141	9.9	0.455	39.2	LOS C	6.3	53.4	0.94	0.79	0.94	36.2
8	T1	1	0.0	0.003	53.4	LOS D	0.1	0.4	0.87	0.52	0.87	32.1
9	R2	40	10.0	0.195	63.9	LOS E	2.5	20.9	0.92	0.74	0.92	29.0
Approach		182	9.9	0.455	44.7	LOS D	6.3	53.4	0.93	0.77	0.93	34.3
West: Elizabeth Drive												
10	L2	161	9.9	0.194	29.6	LOS C	6.2	52.6	0.61	0.75	0.61	43.7
11	T1	1222	8.0	0.914	42.2	LOS C	58.0	476.0	0.89	0.89	0.99	41.7
12	R2	28	42.9	0.212	73.6	LOS F	1.8	24.7	0.96	0.73	0.96	28.2
Approach		1411	8.9	0.914	41.4	LOS C	58.0	476.0	0.86	0.87	0.95	41.5
All Vehicles		2892	13.9	0.915	41.6	LOS C	58.0	476.0	0.82	0.80	0.96	40.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	14.7	LOS B	0.1	0.1	0.46	0.46	
P2	East Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59	
All Pedestrians		300	48.9	LOS E			0.81	0.81	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

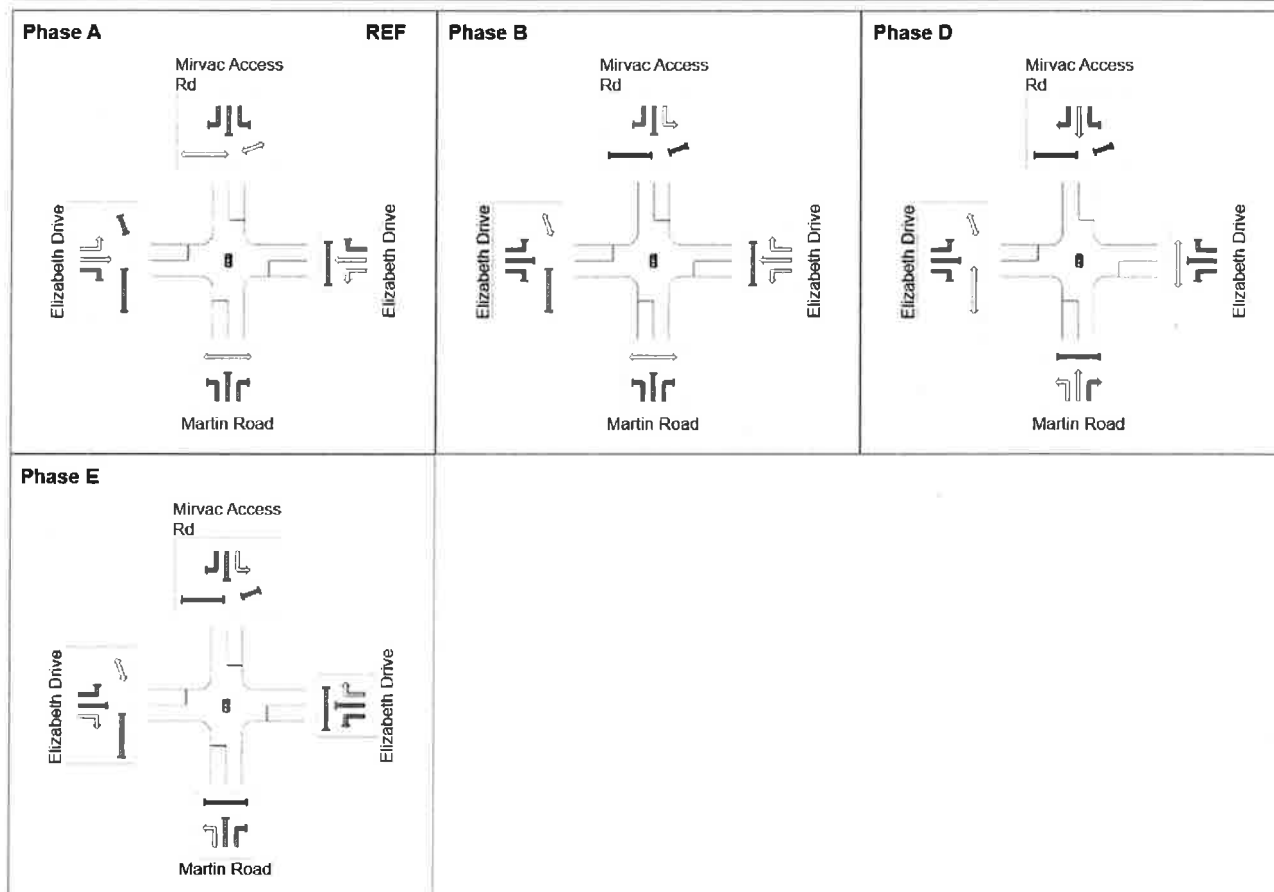
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	73	92	120
Green Time (sec)	67	12	21	13
Phase Time (sec)	74	19	28	19
Phase Split	53%	14%	20%	14%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 PM Mirvac & Mod 4 TCS]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.140	43.5	LOS D	2.8	26.5	0.80	0.74	0.80	34.2
2	T1	1	0.0	0.140	37.8	LOS C	2.8	26.5	0.80	0.74	0.80	35.1
3	R2	169	24.3	0.748	64.5	LOS E	10.6	112.6	1.00	0.88	1.13	28.8
Approach		229	22.3	0.748	59.0	LOS E	10.6	112.6	0.95	0.85	1.04	30.1
East: Elizabeth Drive												
4	L2	68	54.4	0.557	21.7	LOS B	22.3	174.7	0.61	0.59	0.61	50.8
5	T1	1190	5.9	0.557	13.6	LOS A	22.3	174.7	0.61	0.56	0.61	61.5
6	R2	141	9.9	0.108	21.2	LOS B	1.6	13.4	0.68	0.73	0.68	48.0
Approach		1399	8.6	0.557	14.8	LOS B	22.3	174.7	0.61	0.58	0.61	59.3
North: Mirvac Access Rd												
7	L2	566	10.1	0.869	35.3	LOS C	22.7	193.4	0.99	0.95	1.13	37.6
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	161	9.9	0.826	71.3	LOS F	10.7	91.2	1.00	0.94	1.28	27.4
Approach		728	10.0	0.869	43.3	LOS D	22.7	193.4	0.99	0.95	1.16	34.8
West: Elizabeth Drive												
10	L2	40	10.0	0.093	46.2	LOS D	1.9	15.9	0.80	0.73	0.80	36.5
11	T1	595	14.8	0.870	53.2	LOS D	25.0	230.2	0.97	0.92	1.10	37.0
12	R2	22	59.1	0.351	76.1	LOS F	1.4	22.6	1.00	0.72	1.00	27.6
Approach		657	16.0	0.870	53.6	LOS D	25.0	230.2	0.96	0.90	1.08	36.6
All Vehicles		3013	11.6	0.870	33.5	LOS C	25.0	230.2	0.81	0.76	0.88	42.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	12.6	LOS B	0.1	0.1	0.45	0.45	
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	56.8	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	8.9	LOS A	0.1	0.1	0.38	0.38	
All Pedestrians		300	40.9	LOS E			0.77	0.77	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 PM Mirvac & Mod 4 TCS]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

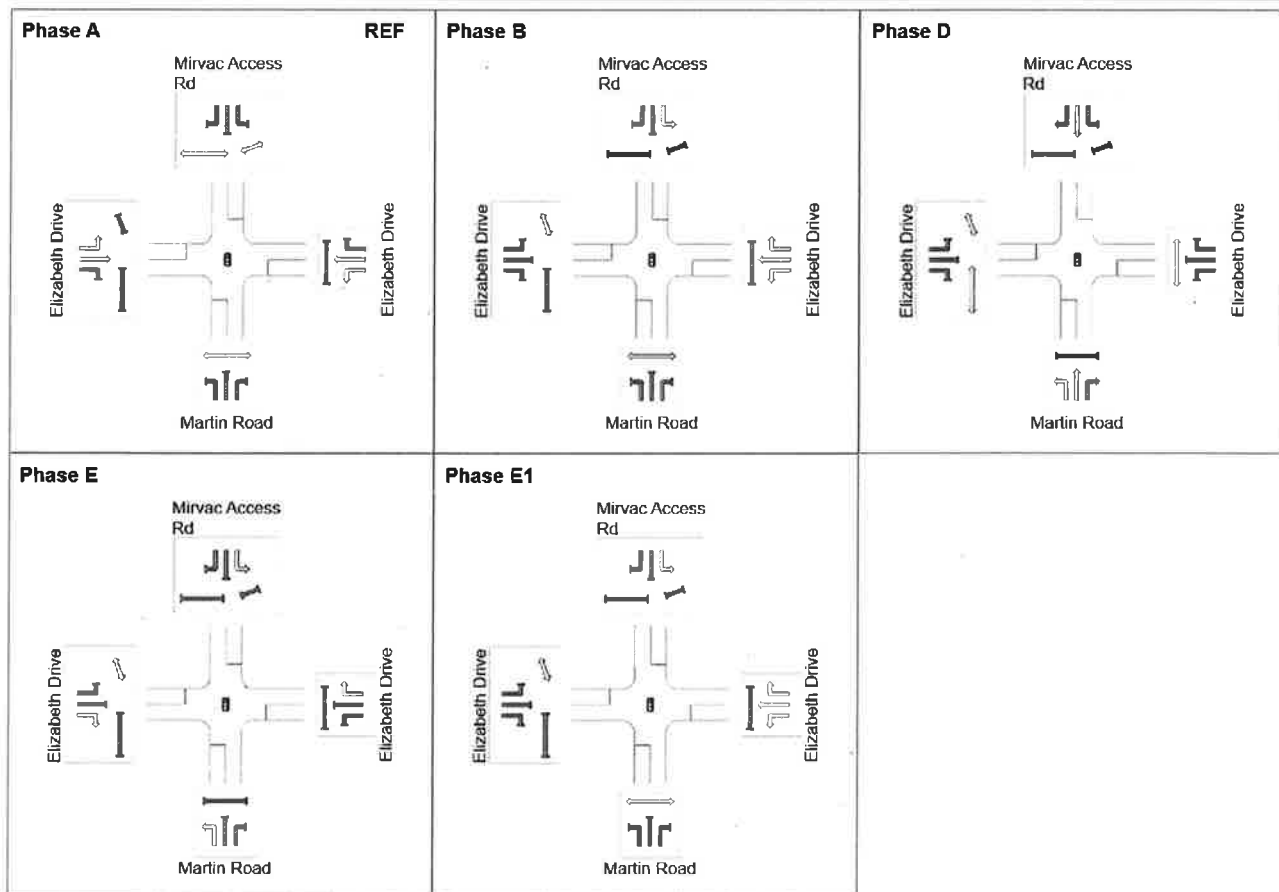
Output Phase Sequence: A, B, D, E, E1

Phase Timing Summary

Phase	A	B	D	E	E1
Phase Change Time (sec)	0	37	71	98	111
Green Time (sec)	31	27	20	6	8
Phase Time (sec)	38	34	27	12	14
Phase Split	30%	27%	22%	10%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



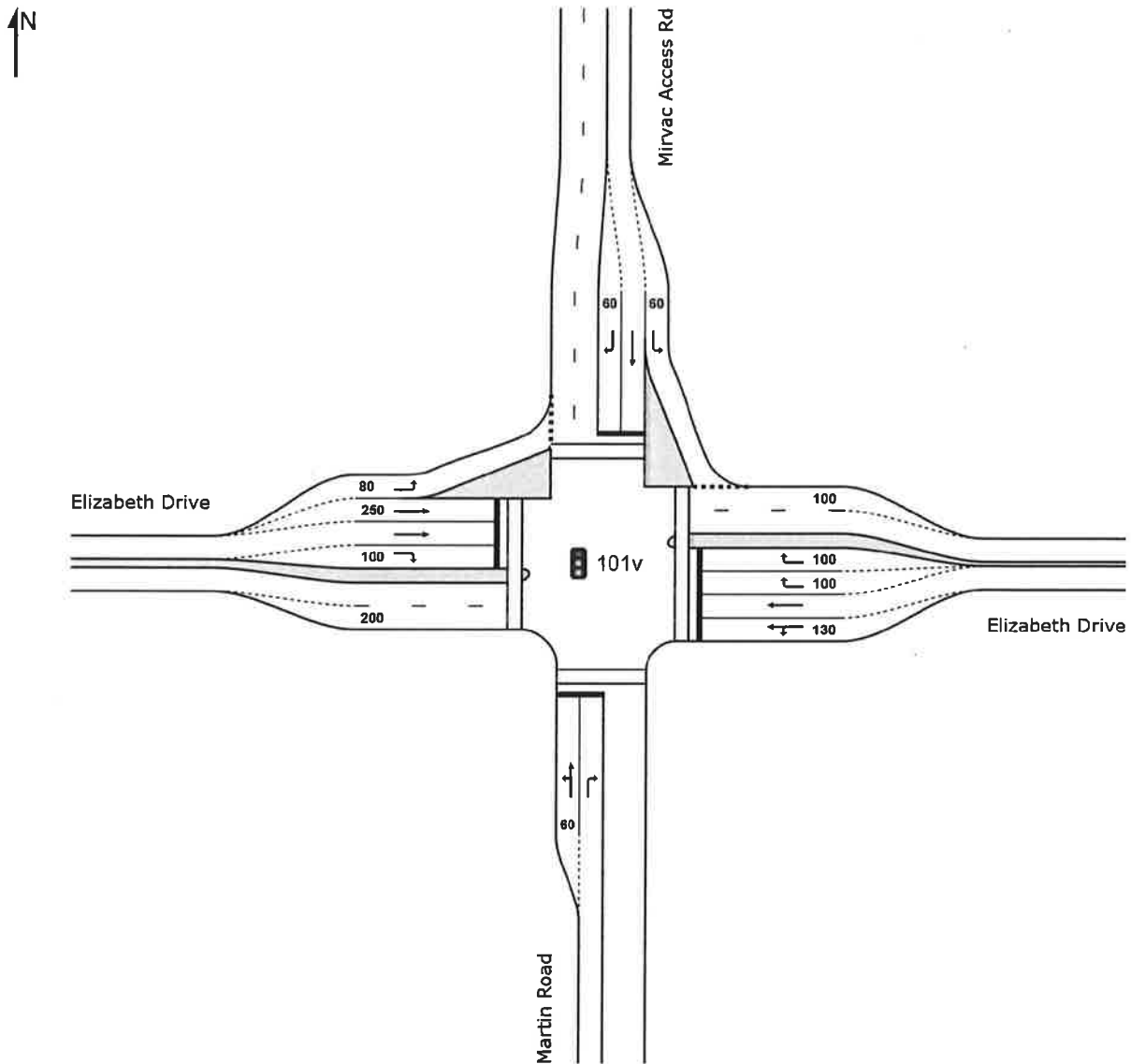
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.060	43.4	LOS D	0.9	15.3	0.78	0.69	0.78	33.8
2	T1	1	0.0	0.060	37.1	LOS C	0.9	15.3	0.78	0.69	0.78	35.6
3	R2	65	64.6	0.334	58.2	LOS E	3.6	60.8	0.93	0.77	0.93	29.9
Approach		85	64.7	0.334	54.7	LOS D	3.6	60.8	0.89	0.75	0.89	30.8
East: Elizabeth Drive												
4	L2	98	53.1	0.388	20.7	LOS B	12.8	112.9	0.54	0.55	0.54	51.2
5	T1	721	14.8	0.388	12.8	LOS A	12.8	112.9	0.54	0.51	0.54	62.1
6	R2	566	10.1	0.851	45.6	LOS D	13.2	97.7	1.00	0.91	1.22	36.4
Approach		1385	15.6	0.851	26.8	LOS B	13.2	132.6	0.73	0.68	0.82	47.7
North: Mirvac Access Rd												
7	L2	141	9.9	0.189	15.9	LOS B	3.4	29.3	0.53	0.70	0.53	46.9
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	40	10.0	0.181	56.6	LOS E	2.2	18.5	0.91	0.74	0.91	30.8
Approach		182	9.9	0.189	25.0	LOS B	3.4	29.3	0.62	0.70	0.62	42.0
West: Elizabeth Drive												
10	L2	161	9.9	0.175	21.6	LOS B	4.8	40.9	0.55	0.72	0.55	48.2
11	T1	1021	10.5	0.841	34.0	LOS C	36.8	315.7	0.88	0.82	0.92	46.0
12	R2	28	42.9	0.308	72.2	LOS F	1.7	23.4	0.99	0.73	0.99	28.5
Approach		1210	11.2	0.841	33.2	LOS C	36.8	315.7	0.84	0.80	0.87	45.6
All Vehicles		2862	14.8	0.851	30.2	LOS C	36.8	315.7	0.77	0.74	0.83	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	13.5	LOS B	0.1	0.1	0.46	0.46	
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		200	45.2	LOS E			0.83	0.83	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

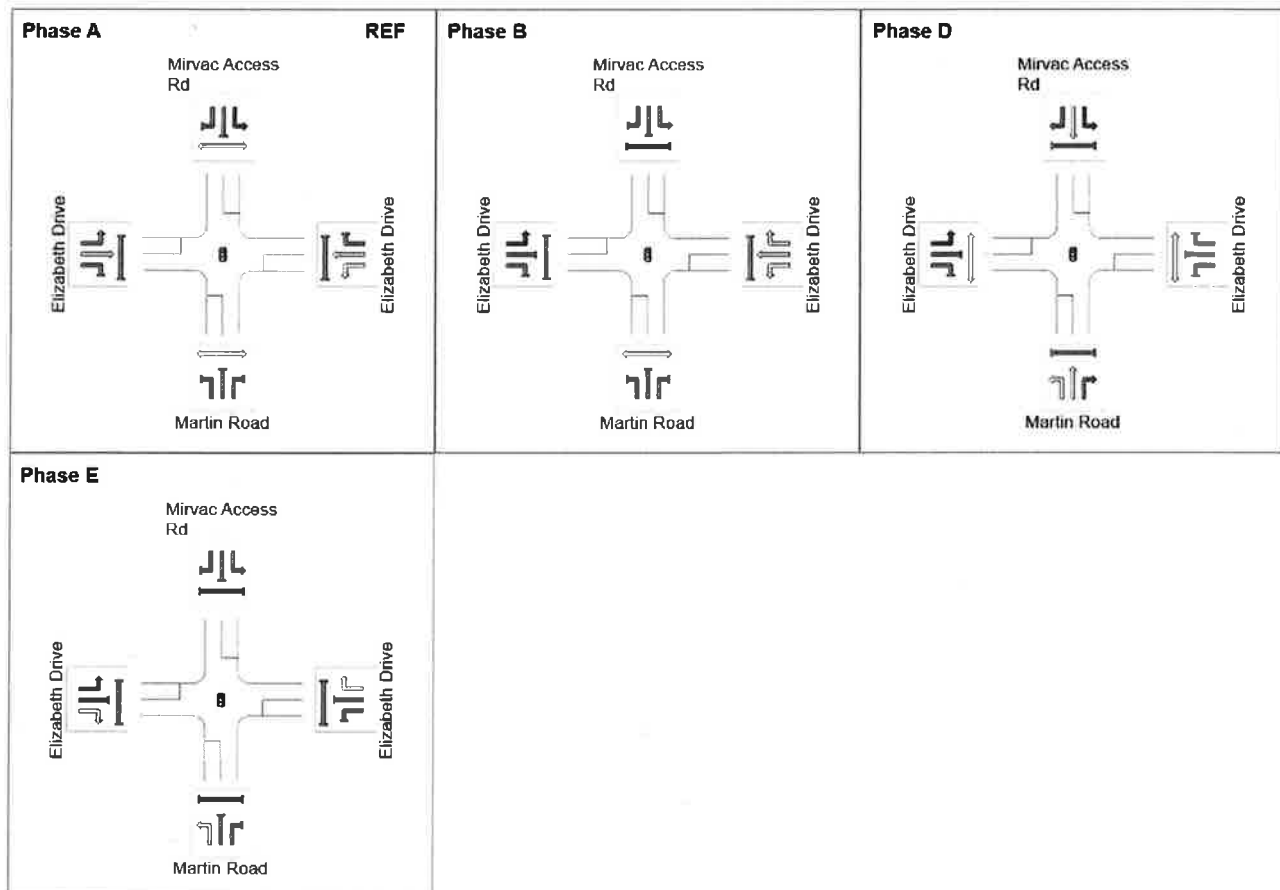
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	60	83	110
Green Time (sec)	54	16	20	8
Phase Time (sec)	61	23	27	14
Phase Split	49%	18%	22%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



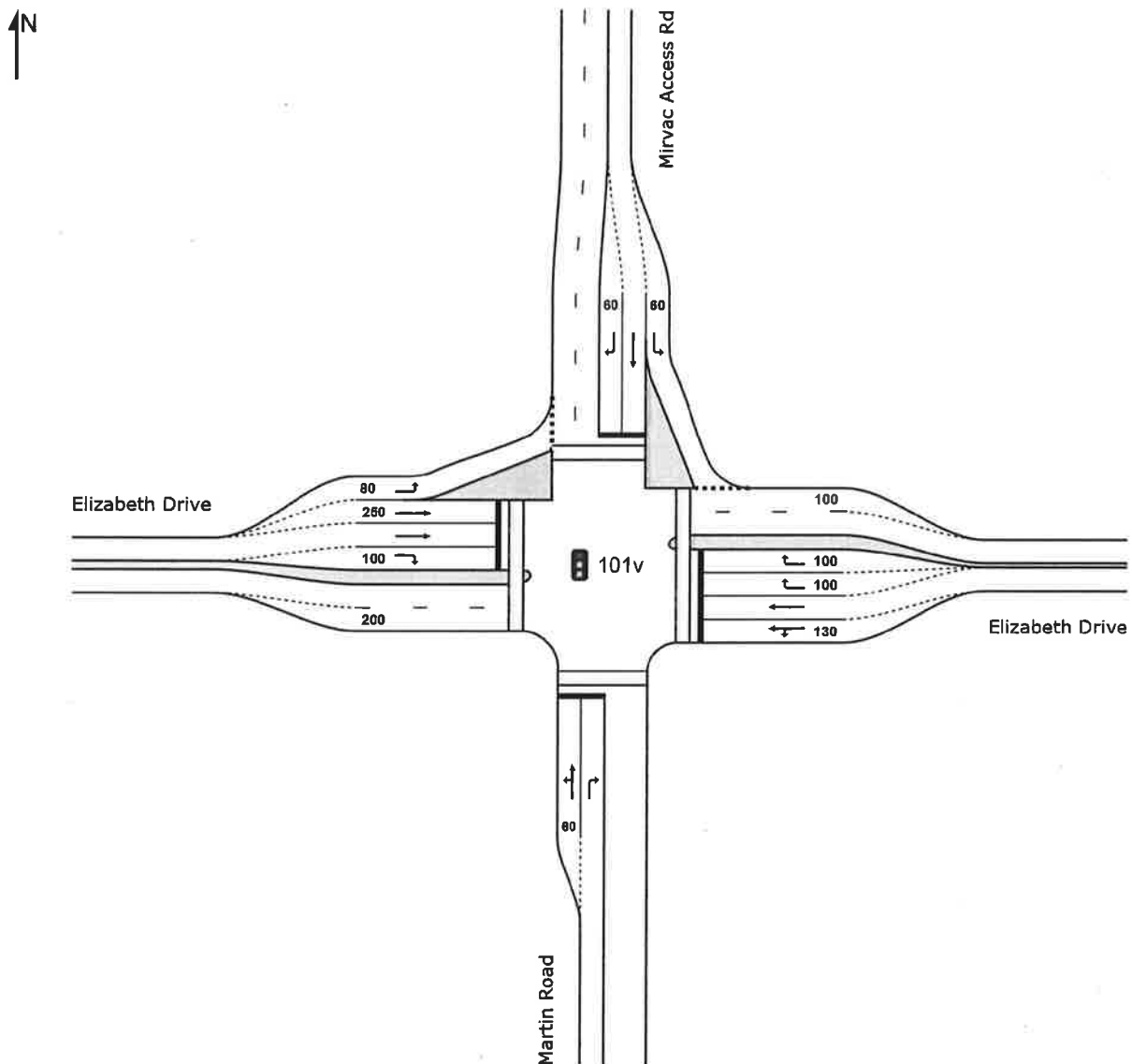
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.115	26.3	LOS B	1.7	15.7	0.73	0.72	0.73	40.8
2	T1	1	0.0	0.115	20.5	LOS B	1.7	15.7	0.73	0.72	0.73	42.1
3	R2	169	24.3	0.689	43.1	LOS D	6.8	72.0	0.99	0.87	1.11	34.6
Approach		229	22.3	0.689	38.7	LOS C	6.8	72.0	0.93	0.83	1.01	36.0
East: Elizabeth Drive												
4	L2	68	54.4	0.578	22.5	LOS B	14.8	118.5	0.74	0.68	0.74	50.3
5	T1	997	9.1	0.578	14.6	LOS B	14.8	118.5	0.74	0.67	0.74	60.5
6	R2	141	9.9	0.271	25.6	LOS B	1.6	13.6	0.92	0.75	0.92	45.4
Approach		1206	11.8	0.578	16.3	LOS B	14.8	135.4	0.76	0.68	0.76	57.6
North: Mirvac Access Rd												
7	L2	566	10.1	0.749	16.5	LOS B	12.5	106.3	0.86	0.86	0.89	46.5
8	T1	1	0.0	0.003	30.1	LOS C	0.0	0.2	0.85	0.51	0.85	40.3
9	R2	161	9.9	0.737	45.8	LOS D	6.7	56.7	1.00	0.90	1.19	33.9
Approach		728	10.0	0.749	23.0	LOS B	12.5	106.3	0.89	0.86	0.96	43.0
West: Elizabeth Drive												
10	L2	40	10.0	0.042	13.6	LOS A	0.6	5.0	0.47	0.68	0.47	53.8
11	T1	733	14.6	0.748	24.9	LOS B	17.0	156.2	0.89	0.80	0.93	51.9
12	R2	22	59.1	0.224	49.2	LOS D	0.9	14.1	0.97	0.71	0.97	34.5
Approach		795	15.6	0.748	25.0	LOS B	17.0	156.2	0.88	0.79	0.91	51.3
All Vehicles		2958	13.2	0.749	22.0	LOS B	17.0	156.2	0.84	0.77	0.87	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91
P2	East Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91
P3	North Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91
All Pedestrians		200	33.4	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd (phase reduction applied)

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

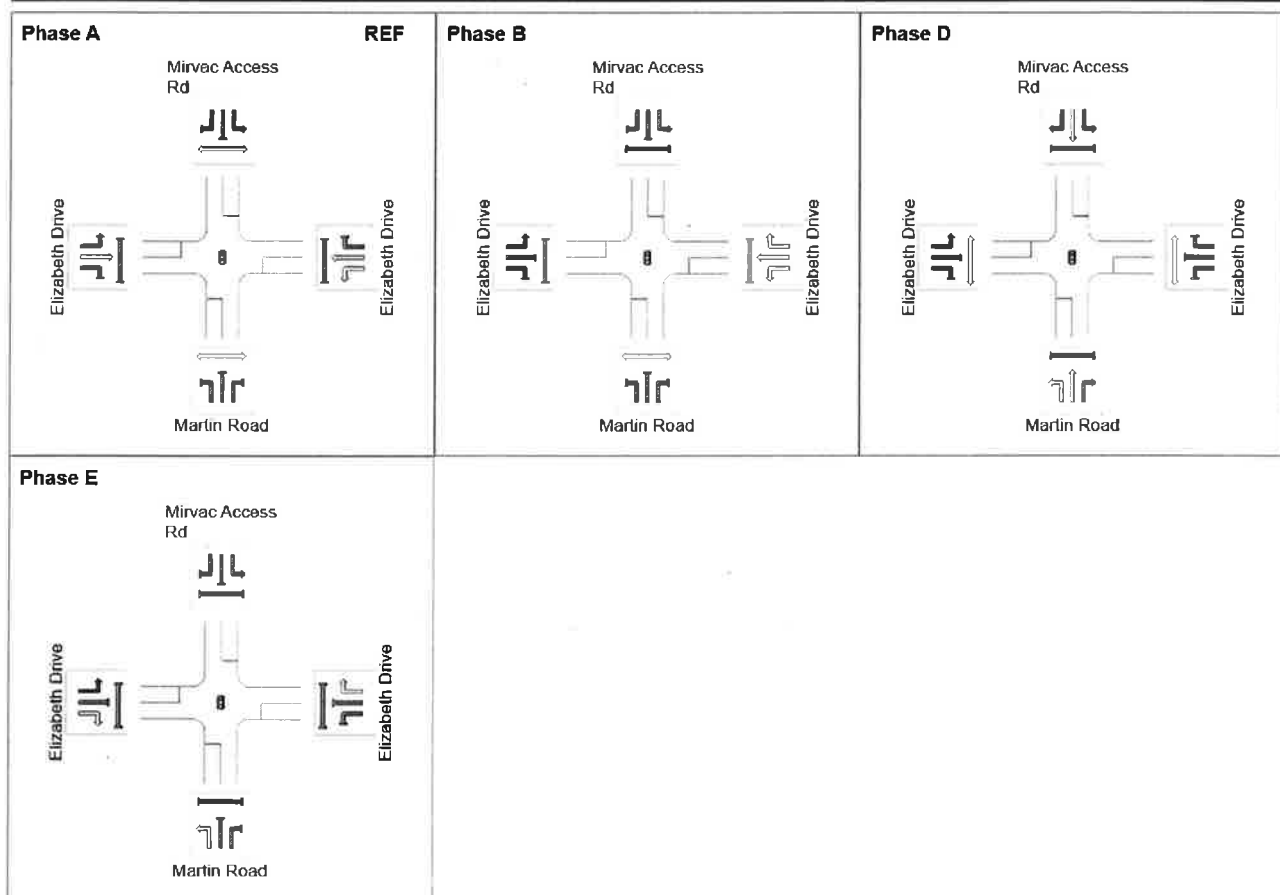
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	34	47	67
Green Time (sec)	28	6	13	6
Phase Time (sec)	35	13	20	12
Phase Split	44%	16%	25%	15%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



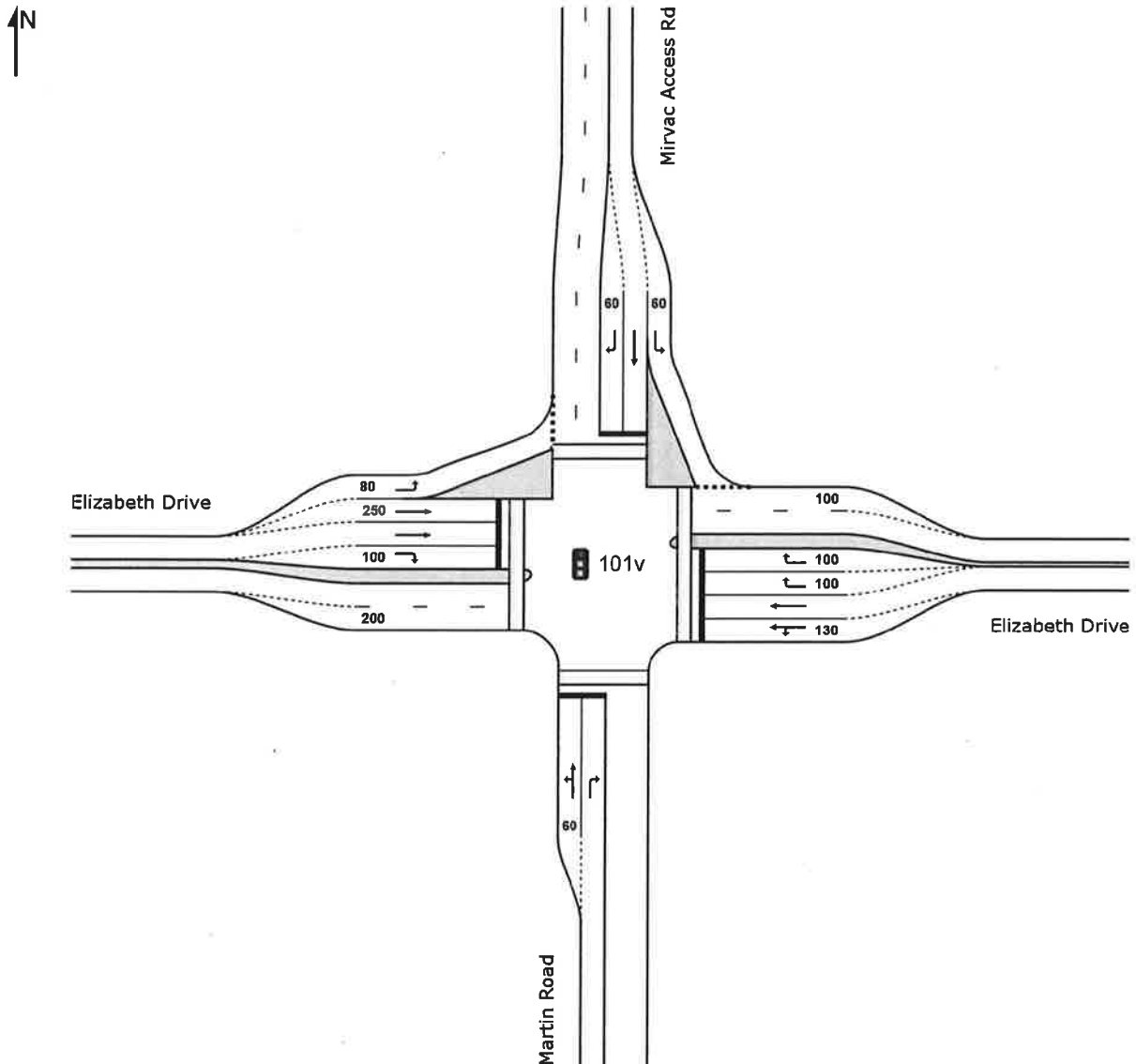
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.060	47.7	LOS D	1.0	17.1	0.78	0.69	0.78	32.5
2	T1	1	0.0	0.060	41.3	LOS C	1.0	17.1	0.78	0.69	0.78	34.2
3	R2	65	64.6	0.358	65.8	LOS E	4.1	68.8	0.94	0.77	0.94	28.2
Approach		85	64.7	0.358	61.4	LOS E	4.1	68.8	0.90	0.75	0.90	29.1
East: Elizabeth Drive												
4	L2	98	53.1	0.311	21.0	LOS B	10.4	97.5	0.50	0.54	0.50	50.8
5	T1	550	17.3	0.311	13.1	LOS A	10.4	97.5	0.50	0.48	0.50	61.7
6	R2	566	10.1	0.915	66.9	LOS E	17.1	126.4	1.00	1.00	1.48	30.1
Approach		1214	16.8	0.915	38.8	LOS C	17.1	126.4	0.73	0.73	0.96	40.9
North: Mirvac Access Rd												
7	L2	141	9.9	0.215	21.8	LOS B	4.7	39.7	0.61	0.72	0.61	43.6
8	T1	1	0.0	0.003	53.4	LOS D	0.1	0.4	0.87	0.52	0.87	32.1
9	R2	40	10.0	0.195	63.9	LOS E	2.5	20.9	0.92	0.74	0.92	29.0
Approach		182	9.9	0.215	31.2	LOS C	4.7	39.7	0.68	0.72	0.68	39.2
West: Elizabeth Drive												
10	L2	161	9.9	0.167	22.1	LOS B	5.2	44.0	0.52	0.71	0.52	47.9
11	T1	1222	8.0	0.914	42.2	LOS C	58.0	476.0	0.89	0.89	0.99	41.7
12	R2	28	42.9	0.230	74.9	LOS F	1.9	25.0	0.97	0.73	0.97	27.9
Approach		1411	8.9	0.914	40.5	LOS C	58.0	476.0	0.85	0.87	0.94	41.9
All Vehicles		2892	13.9	0.915	39.8	LOS C	58.0	476.0	0.79	0.80	0.93	40.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	14.2	LOS B	0.1	0.1	0.45	0.45	
P2	East Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
All Pedestrians		200	51.0	LOS E			0.83	0.83	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

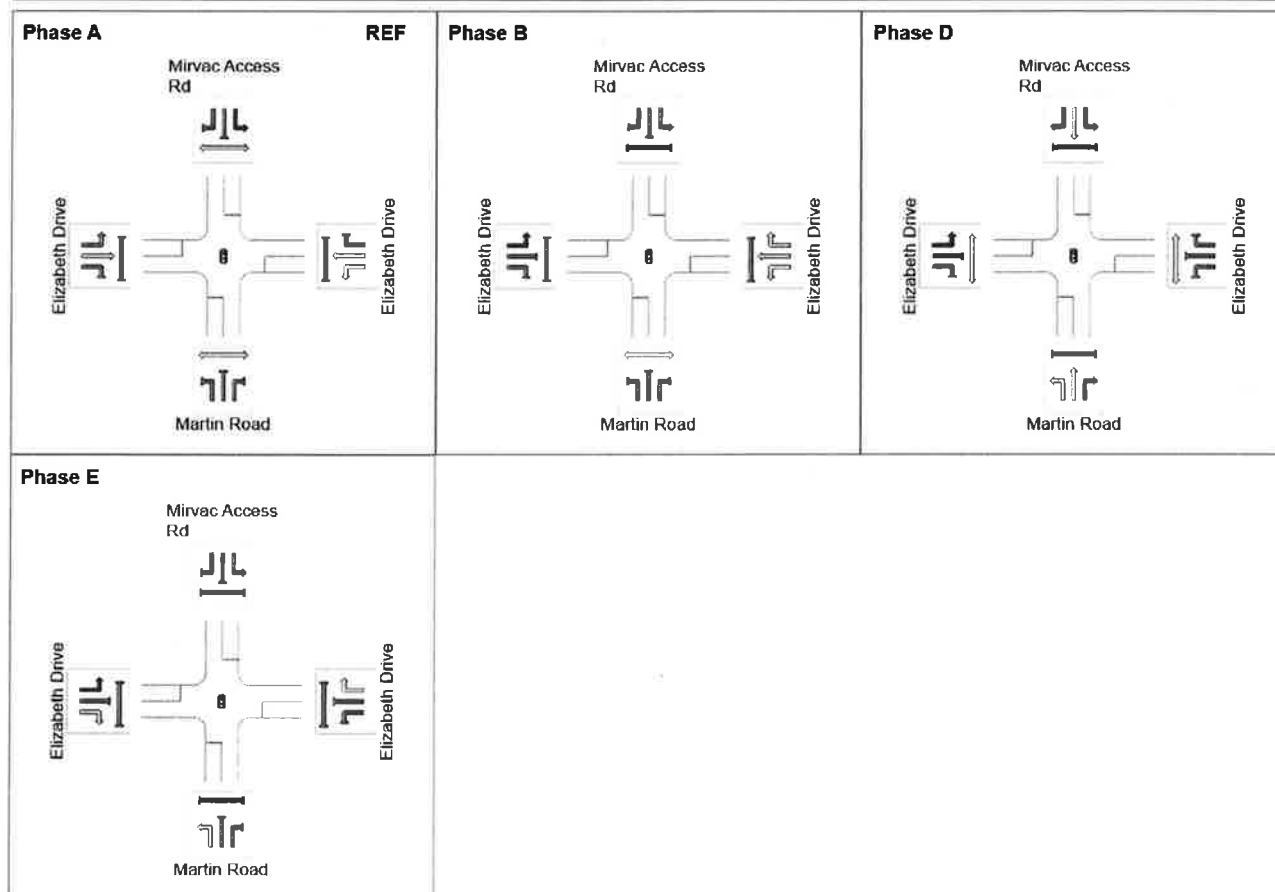
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	73	93	121
Green Time (sec)	67	13	21	12
Phase Time (sec)	74	20	28	18
Phase Split	53%	14%	20%	13%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



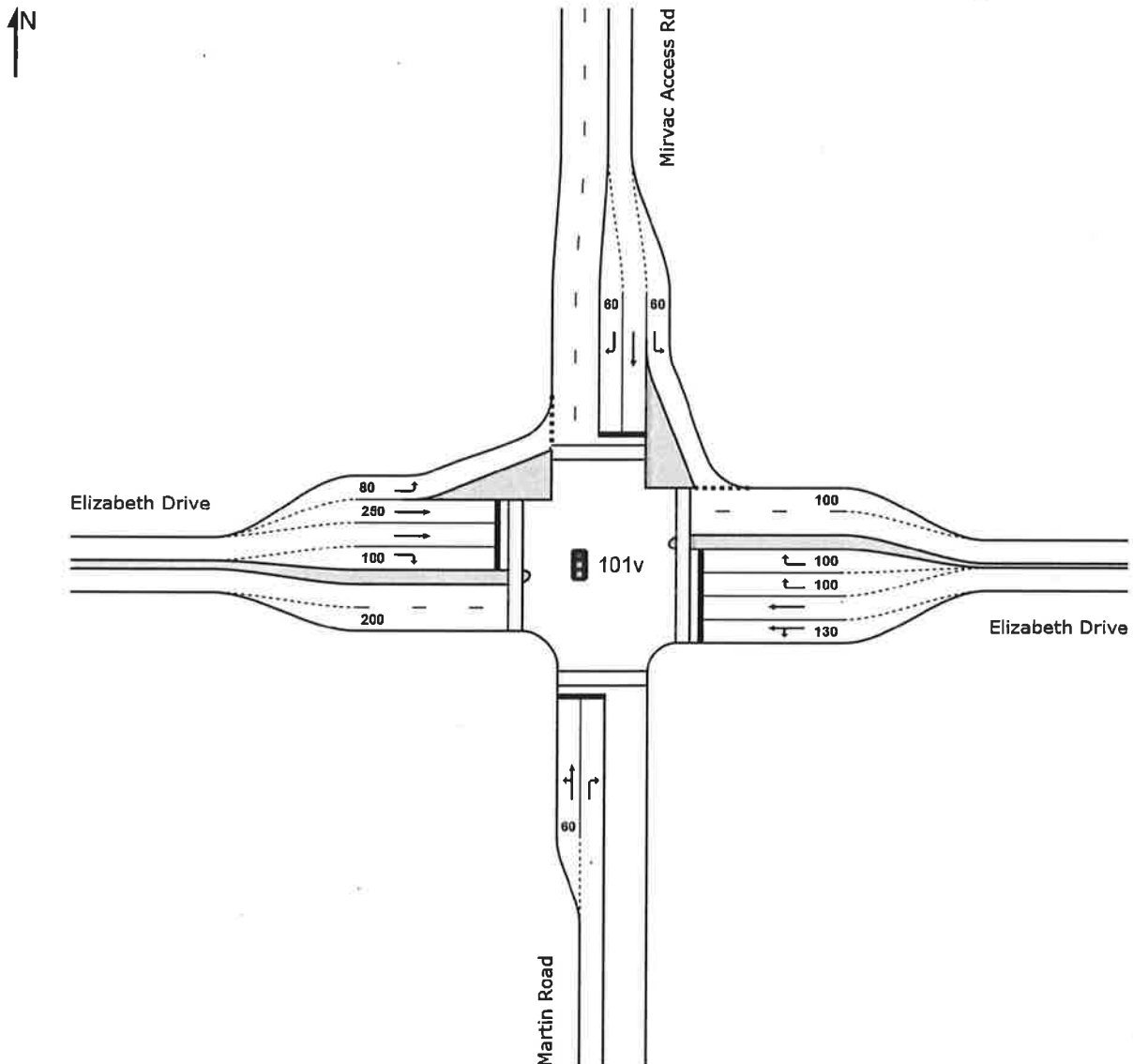
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 75 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.107	23.8	LOS B	1.5	14.3	0.71	0.71	0.71	42.0
2	T1	1	0.0	0.107	18.0	LOS B	1.5	14.3	0.71	0.71	0.71	43.3
3	R2	169	24.3	0.646	39.4	LOS C	6.2	65.9	0.98	0.84	1.05	35.9
Approach		229	22.3	0.646	35.3	LOS C	6.2	65.9	0.91	0.81	0.96	37.3
East: Elizabeth Drive												
4	L2	68	54.4	0.713	24.6	LOS B	18.5	145.8	0.85	0.77	0.85	48.9
5	T1	1190	5.9	0.713	16.7	LOS B	18.5	145.8	0.85	0.77	0.85	58.5
6	R2	141	9.9	0.254	23.7	LOS B	1.4	11.9	0.91	0.75	0.91	46.5
Approach		1399	8.6	0.713	17.8	LOS B	18.5	157.4	0.86	0.76	0.86	56.5
North: Mirvac Access Rd												
7	L2	566	10.1	0.691	12.9	LOS A	9.4	80.1	0.78	0.81	0.78	48.8
8	T1	1	0.0	0.003	27.5	LOS B	0.0	0.2	0.84	0.50	0.84	41.5
9	R2	161	9.9	0.682	40.9	LOS C	6.1	51.6	0.99	0.87	1.12	35.5
Approach		728	10.0	0.691	19.1	LOS B	9.4	80.1	0.83	0.82	0.86	45.0
West: Elizabeth Drive												
10	L2	40	10.0	0.044	14.0	LOS A	0.6	5.0	0.50	0.68	0.50	53.5
11	T1	595	14.8	0.694	24.7	LOS B	12.7	117.3	0.90	0.78	0.92	52.0
12	R2	22	59.1	0.210	46.2	LOS D	0.8	13.1	0.97	0.71	0.97	35.5
Approach		657	16.0	0.694	24.7	LOS B	12.7	117.3	0.88	0.77	0.90	51.3
All Vehicles		3013	11.6	0.713	21.0	LOS B	18.5	157.4	0.86	0.78	0.87	50.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P2	East Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P3	North Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P4	West Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
All Pedestrians		200	30.9	LOS D			0.91	0.91	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 75 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd (phase reduction applied)

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

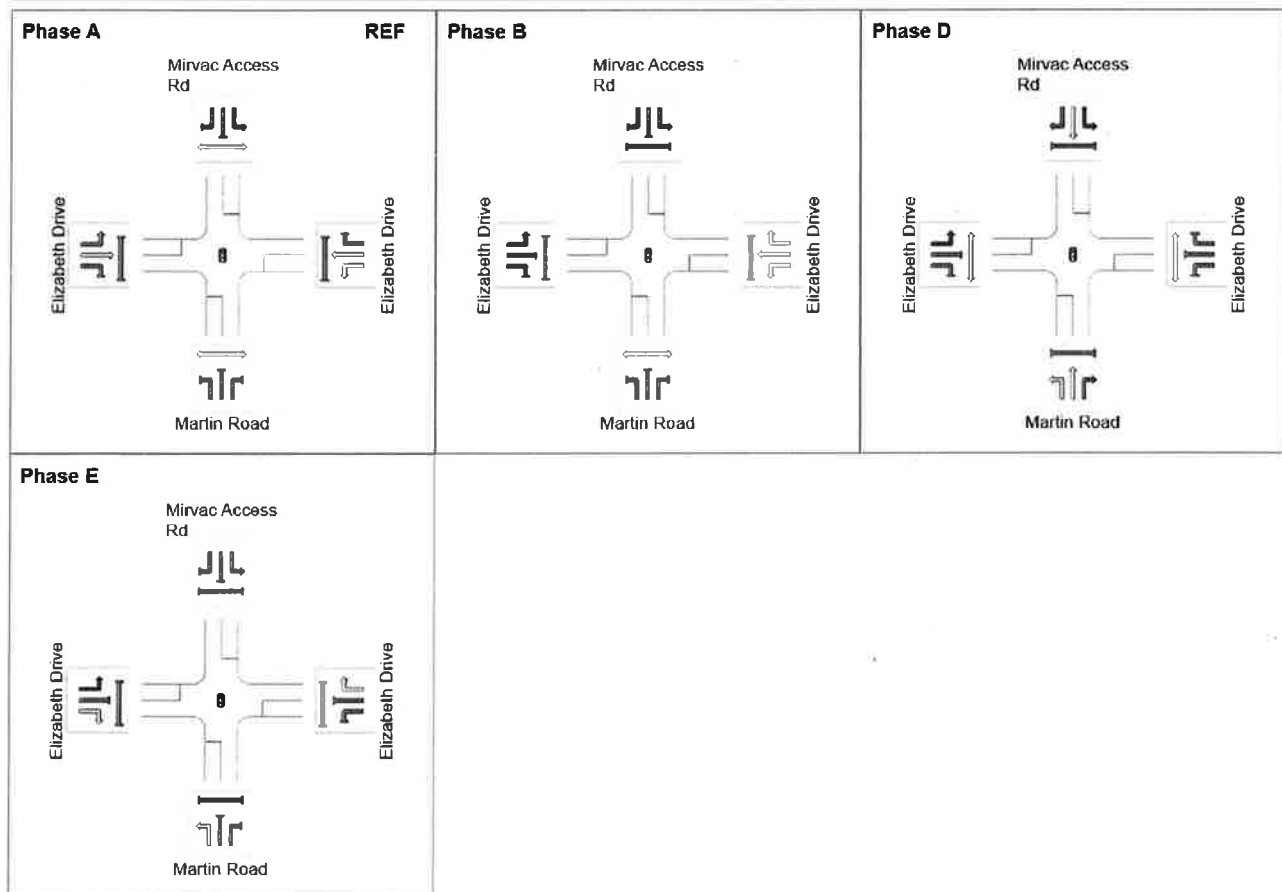
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	29	42	62
Green Time (sec)	23	6	13	6
Phase Time (sec)	30	13	20	12
Phase Split	40%	17%	27%	16%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



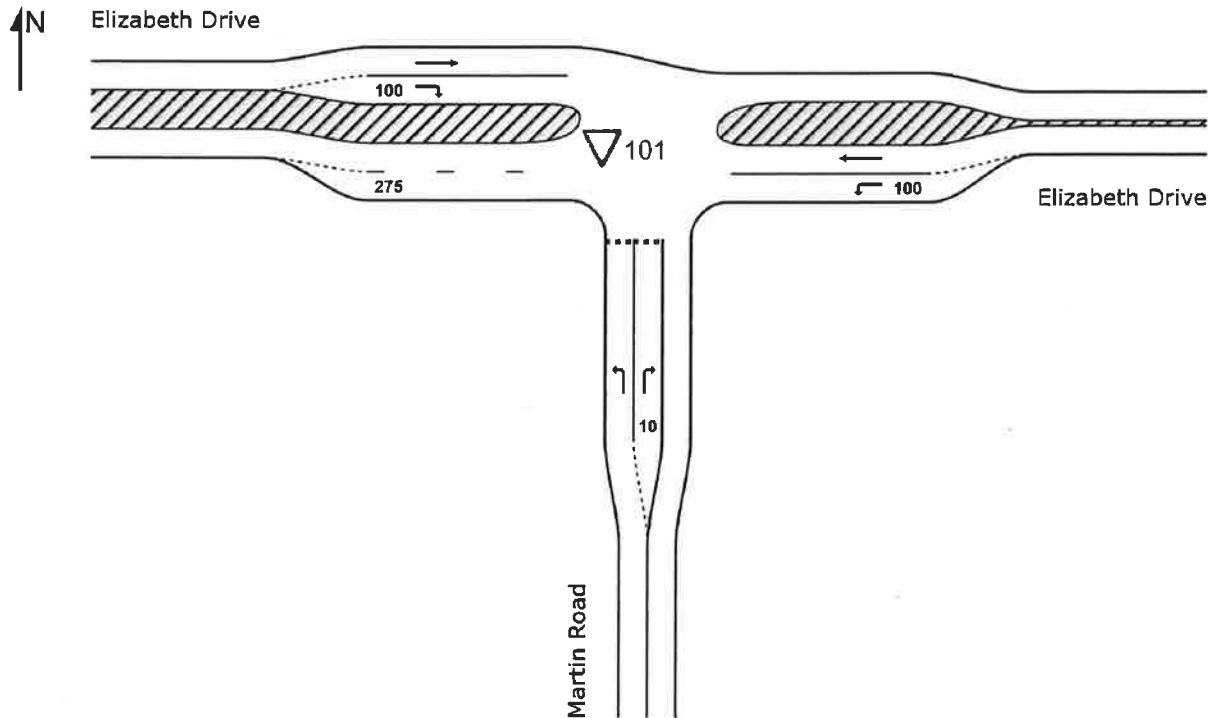
SITE LAYOUT

▽ Site: 101 [Elizabeth Drive & Martin Rd - 2020 AM Base]

2020 AM Base

Site Category: (None)

Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Elizabeth Drive & Martin Rd - 2020 AM Base]

2020 AM Base
Site Category: (None)
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	5	20.0	0.009	11.9	LOS A	0.0	0.5	0.66	0.62	0.66	48.5
3	R2	21	52.4	0.172	41.2	LOS C	0.7	9.8	0.88	0.95	0.88	34.3
Approach		26	46.2	0.172	35.6	LOS C	0.7	9.8	0.84	0.89	0.84	36.3
East: Elizabeth Drive												
4	L2	34	38.2	0.023	7.6	LOS A	0.0	0.0	0.00	0.63	0.00	54.4
5	T1	655	14.4	0.367	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		689	15.5	0.367	0.4	NA	0.0	0.0	0.00	0.03	0.00	78.0
West: Elizabeth Drive												
11	T1	851	11.0	0.468	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
12	R2	7	0.0	0.013	12.7	LOS A	0.1	0.4	0.54	0.65	0.54	54.1
Approach		858	11.0	0.468	0.2	NA	0.1	0.4	0.00	0.01	0.00	79.4
All Vehicles		1573	13.5	0.468	0.9	NA	0.7	9.8	0.02	0.03	0.02	77.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Elizabeth Drive & Martin Rd - 2020 PM Base]

2020 PM Base
Site Category: (None)
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	25	8.0	0.054	14.6	LOS B	0.3	2.3	0.73	0.76	0.73	47.1
3	R2	63	15.9	0.339	34.9	LOS C	1.6	15.3	0.87	1.01	1.07	37.1
Approach		88	13.6	0.339	29.1	LOS C	1.6	15.3	0.83	0.94	0.97	39.5
East: Elizabeth Drive												
4	L2	21	28.6	0.014	7.5	LOS A	0.0	0.0	0.00	0.63	0.00	56.8
5	T1	849	9.5	0.462	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		870	10.0	0.462	0.3	NA	0.0	0.0	0.00	0.02	0.00	79.0
West: Elizabeth Drive												
11	T1	652	14.6	0.366	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	5	20.0	0.014	17.6	LOS B	0.1	0.5	0.67	0.72	0.67	49.9
Approach		657	14.6	0.366	0.2	NA	0.1	0.5	0.01	0.01	0.01	79.5
All Vehicles		1615	12.1	0.462	1.8	NA	1.6	15.3	0.05	0.06	0.06	75.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Elizabeth Drive & Martin Rd - 2020 AM Construction Traffic]

2020 AM with Construction Traffic

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	Queue Distance m	Prop Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	6	33.3	0.012	12.8	LOS A	0.1	0.7	0.66	0.64	0.66	47.6
3	R2	26	61.5	0.245	50.7	LOS D	1.0	15.8	0.90	0.99	0.98	31.4
Approach		32	56.3	0.245	43.6	LOS D	1.0	15.8	0.86	0.92	0.92	33.5
East: Elizabeth Drive												
4	L2	75	24.0	0.047	7.4	LOS A	0.0	0.0	0.00	0.63	0.00	58.0
5	T1	655	14.4	0.367	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		730	15.3	0.367	0.8	NA	0.0	0.0	0.00	0.06	0.00	76.8
West: Elizabeth Drive												
11	T1	851	11.0	0.468	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
12	R2	20	5.0	0.038	13.5	LOS A	0.2	1.2	0.56	0.71	0.56	53.3
Approach		871	10.9	0.468	0.4	NA	0.2	1.2	0.01	0.02	0.01	78.8
All Vehicles		1633	13.8	0.468	1.4	NA	1.0	15.8	0.02	0.06	0.03	75.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: 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 movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Elizabeth Drive & Martin Rd - 2020 PM Construction]

2020 PM with Construction Traffic

Site Category: (None)

Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver No Cycles	Average Speed km/h
South: Martin Road												
1	L2	38	7.9	0.082	14.8	LOS B	0.4	3.5	0.73	0.78	0.73	47.0
3	R2	104	14.4	0.552	44.5	LOS D	3.3	30.1	0.91	1.13	1.45	33.8
Approach		142	12.7	0.552	36.6	LOS C	3.3	30.1	0.86	1.04	1.26	36.5
East: Elizabeth Drive												
4	L2	26	42.3	0.018	7.7	LOS A	0.0	0.0	0.00	0.63	0.00	53.5
5	T1	849	9.5	0.462	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		875	10.5	0.462	0.3	NA	0.0	0.0	0.00	0.02	0.00	78.6
West: Elizabeth Drive												
11	T1	652	14.6	0.366	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	6	33.3	0.018	19.2	LOS B	0.1	0.8	0.69	0.75	0.69	48.5
Approach		658	14.7	0.366	0.2	NA	0.1	0.8	0.01	0.01	0.01	79.4
All Vehicles		1675	12.4	0.552	3.3	NA	3.3	30.1	0.08	0.10	0.11	71.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

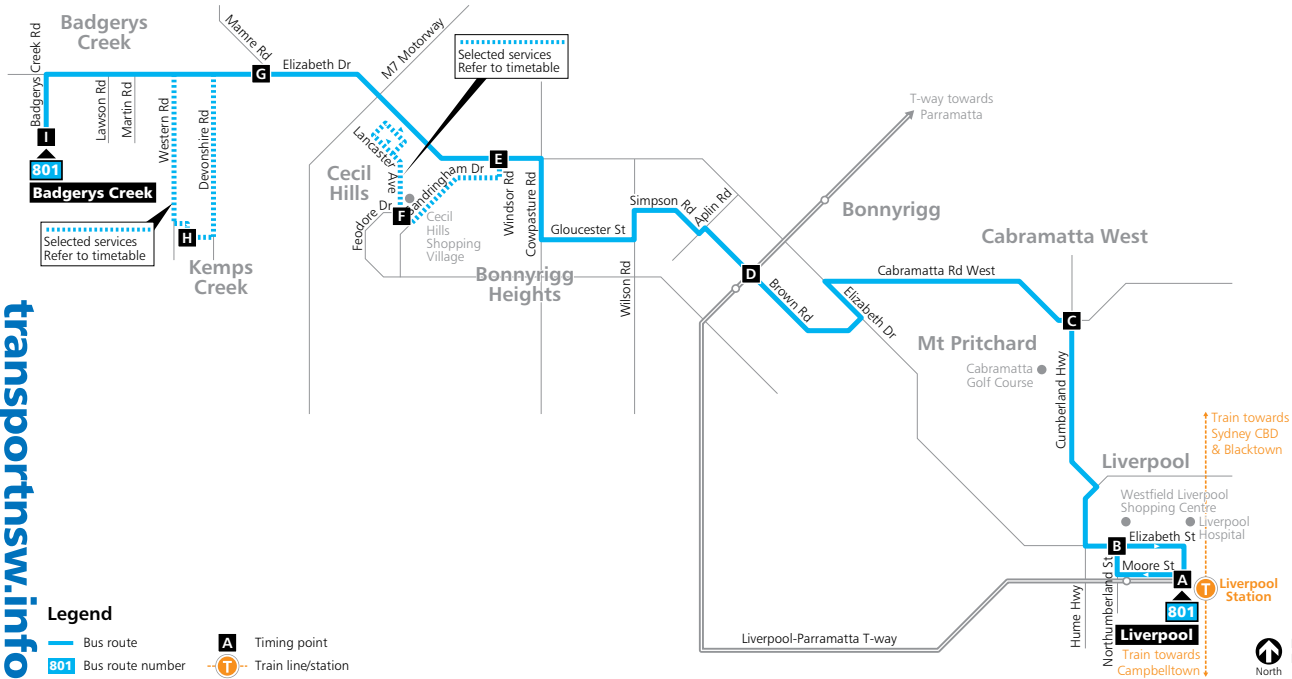
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX 2



Diagrammatic Map
Not to Scale



Local Attractions

The Rooty Hill

Get to the top of this historic landmark and enjoy great views across Sydney.

Sydney International Equestrian Centre

The Sydney International Equestrian Centre is Australia's premier location for equestrian activities including show jumping, dressage, children's horse riding camps, spring horse shows, rodeos, exhibitions, trade shows and farm field days. For a full list of events contact the Centre www.equestrian-centre.com.au

Prospect Reservoir

Prospect Reservoir was completed in 1888 and was the first earthen embankment dam in Australia. The original purpose was to store water from the dams of the Upper Nepean system. Prospect Reservoir remains an integral part of Sydney's drinking water supply.

There are picnic grounds and lookouts to explore and the heritage listed Royal Cricketers Arms Hotel is nearby.

Blacktown Olympic Park

Blacktown Olympic Park was developed for the Sydney Olympics and is now one of the finest regional sporting centres in Australia. For more information: www.blacktownolympicpark.com.au

Fairfield City Farm

Fairfield City Farm is a place where everyone can enjoy a variety of exciting shows and exhibits and get up close to a range of native and farmland animals. For information about opening hours and prices call 9823 3222 or www.cityfarm.com.au

Western Sydney Regional Park

Western Sydney Regional Park is a large area of open space. The main vegetation in the park is Cumberland Plain Woodland and includes the endangered *Pimelia spicata*.

The park is home to 18 native animal species including the Gould's Wattled Bat, the Pale-flecked Garden Sunshin and the endangered Cumberland Plain Land Snail. A full list of the animals that live in the park is provided by the National Parks and Wildlife Service www.nationalparks.nsw.gov.au

Plough and Harrow Park

The Plough and Harrow Park is a family recreation area. It features a playground, walking tracks, picnic shelters, electric barbecues, cafe and kiosks, and dams to create a series of wetland areas.

Distances

The cycleway is about 40 kilometres long.

So, if you ride the entire length and back, you'll have travelled close to 80 kilometres.

This table gives an indication of the approximate distances involved in some typical trips.

And don't forget, it can get very hot! So make sure you take plenty of water and allow yourself rest stops.

From	To	Approx. Distance
M4 Motorway	M5 Motorway	20 km
Richmond Road	Power Street	2 km
Norwest Boulevard	M5 Motorway	37 km
Sunnyholt Road	Quakers Hill Parkway	4 km
Cowpasture Road	M5 Motorway	5.5 km
Old Windsor Road	The Horsley Drive	23 km
The Horsley Drive	M5 Motorway	15 km
Richmond Road	Sunnyholt Road	7 km
Great Western Highway	Richmond Road	7 km
M4 Motorway	Elizabeth Drive	9 km
Woodstock Avenue	M5 Motorway	25 km

More information

For more information about cycling in Sydney's west, contact:

RTA Bicycles & Pedestrians Branch
Bicycles@rta.nsw.gov.au
13 17 82

Blacktown City Council
Council@blacktown.nsw.gov.au
9839 6000

Fairfield City Council
Mail@fairfieldcity.nsw.gov.au
9752 0222

Liverpool City Council
lcc@liverpoolnsw.gov.au
1300 36 2170

Bicycle NSW
Info@bicyclensw.org.au
9281 4099

People using this map do so at their own risk. Every care has been taken in the preparation of this map, however Westlink M7 will not accept responsibility for any personal injury and/or damage to property arising from the use of this map.

Be smart... wear a helmet!

Keep to the left so that others can pass safely.

The cycleway is for everyone – walkers and cyclists.

The RTA website has information on rules for cyclists www.rta.nsw.gov.au

All cyclists must wear a helmet – on both roads and cycleways. This is the law.

Make sure your bike is well maintained and has a bell or a horn and is visible with a reflector or lights.

westlink M7
www.westlinkm7.com.au

Welcome to the Westlink Cycleway & Walking Path. It is for everyone to share and enjoy.

The cycleway is part of the Westlink M7 project. It is an off-road cycleway – separated from the Westlink M7's traffic.

- Stretches across Sydney's west between Prestons in the south and Baukhurst Hills in the north
- Specially designed bridges over roads and creeks
- 4 metres wide to provide plenty of space for both pedestrians and cyclists
- Asphalt surface for a smooth ride
- On bridges it is 3 metres wide with concrete surfaces
- Well lit along the entire length
- More than 60 entry/exit points

The Westlink Cycleway is unique. It has its own bridges for an uninterrupted 40 kilometre trip across Sydney. It is a great facility for cyclists, walkers and joggers. Use it to get some exercise, for fun or to get to work. It is great for locals and for tourists. Enjoy it!

A Shared Path

The Westlink Cycleway has been built to be shared by cyclists and pedestrians. The law requires cyclists to ride to the left and to give pedestrians priority. Please take care.

Heritage Panels

Along the cycleway there are heritage panels which outline the natural, Aboriginal and European heritage of the local area. These panels provide a good introduction to the fascinating history of Western Sydney.

Westlink Cycleway & Walking Path

www.westlinkm7.com.au

An uninterrupted 40 kilometre trip across Sydney

- No traffic
- No intersections
- More than 60 entry points

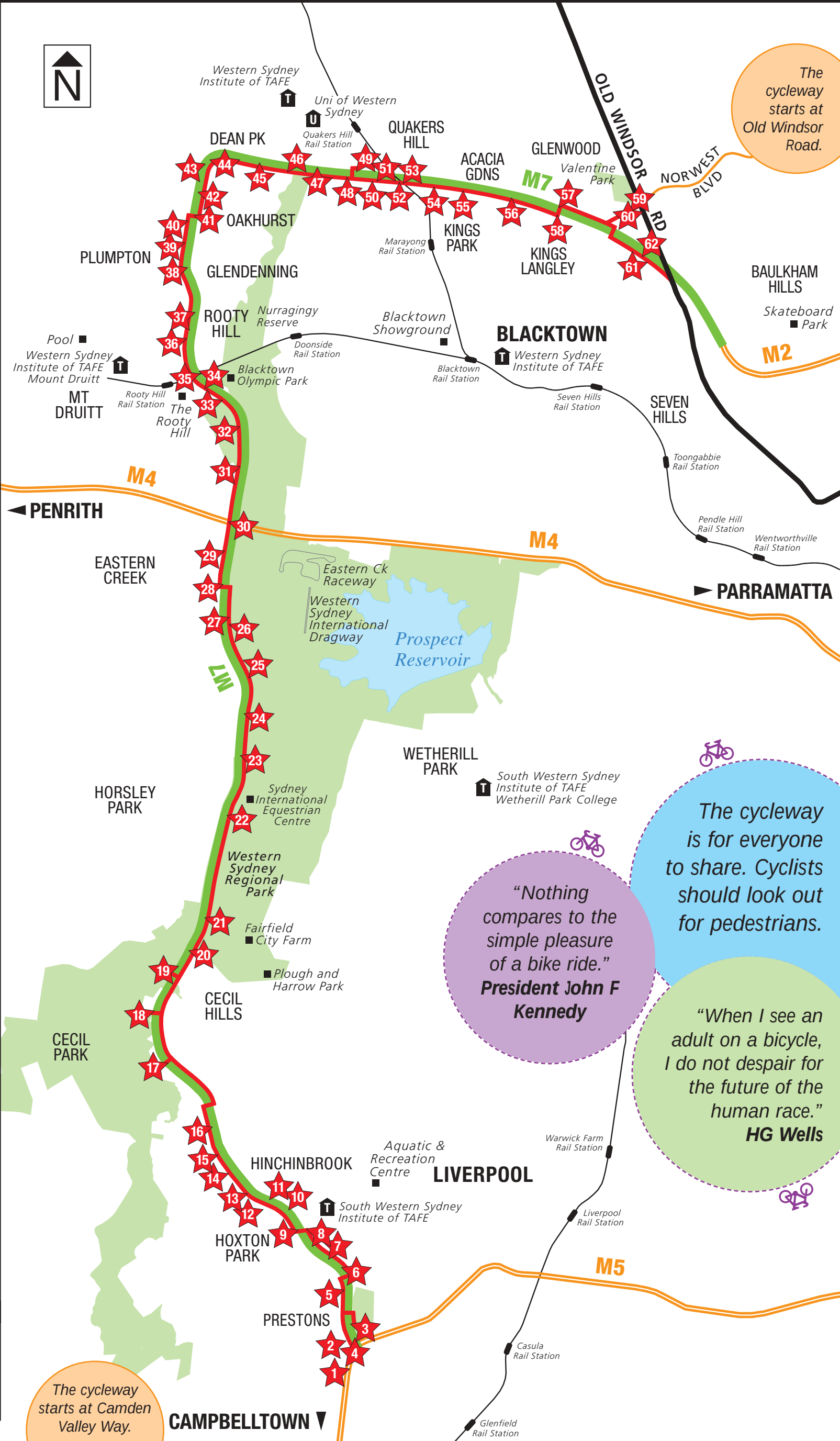
Check website for opening date

westlink M7

CYCLEWAY CONNECTIONS

1	Camden Valley Way	Prestons
2	Hume Highway	Prestons
3	Melaleuca Place	Prestons
4	M5 Motorway	Prestons
5	Kurrajong Road	Prestons
6	Ash Road	Prestons
7	Bernera Road	Prestons
8	Jedda Road	Prestons
9	Illaroo Road	Hinchinbrook
10	Wilson Road	Hinchinbrook
11	Near Hinchinbrook Creek	Hinchinbrook
12	Government Road	Hoxton Park
13	Lightning Ridge Road	Hoxton Park
14	Cowpasture Road	West Hoxton
15	Seventeenth Avenue	West Hoxton
16	Mclver Avenue	West Hoxton
17	Western side of M7 near Stirling Street	Cecil Park
18	East & west side of M7 near Anjou Circuit	Cecil Park
19	East & west side of M7 near Isabel Street	Cecil Park
20	Elizabeth Drive	Cecil Park
21	Villiers Road	Cecil Park
22	Saxony Road	Horsley Park
23	The Horsley Drive	Horsley Park
24	Redmayne Road	Horsley Park
25	Chandos Road	Horsley Park
26	The Austral Bricks access road	Horsley Park
27	Wallgrove Road at Reedy Creek	Eastern Creek
28	Old Wallgrove Road	Eastern Creek
29	Wallgrove Road	Eastern Creek
30	Eastbound on ramp to M4	Eastern Creek
31	The Great Western Highway	Eastern Creek
32	Church Street	Eastern Creek
33	Eastern Road	Rooty Hill
34	Mavis Street	Rooty Hill
35	The pedestrian & cycle underpass north of the main western railway line	Rooty Hill
36	Station Street	Rooty Hill
37	Woodstock Avenue & Polonia Avenue	Rooty Hill
38	Power Street	Glendenning
39	Plumpton Road	Plumpton
40	Lamb Street	Glendenning
41	The pedestrian & cycle underpass at Florence Street	Oakhurst and Glendenning
42	The pedestrian & cycle underpass at Simms Road & Ainsley Avenue	Oakhurst and Glendenning
43	Richmond Road	Oakhurst
44	Cedarwood Grove	Dean Park
45	Symonds Road	Dean Park
46	The pedestrian & cycle underpass at Eastern Creek	Quakers Hill
47	Quakers Hill Parkway	Quakers Hill
48	Quakers Road	Quakers Hill
49	The pedestrian & cycle overbridge at Eastern Road	Quakers Hill
50	Warrimoo Drive	Quakers Hill
51	Rickard Road	Quakers Hill
52	Railway Road	Quakers Hill
53	Pedestrian & cycle underpass east of Richmond Railway line	Kings Park
54	Donohue Street	Kings Park
55	Parer Street	Kings Park
56	Sunnyholt Road	Kings Langley
57	Marie Avenue	Glenwood
58	Lady Penrhyn Park	Kings Langley
59	Norwest Boulevard	Glenwood
60	Fairmont Circuit	Glenwood
61	Gavin Place	Kings Langley
62	Old Windsor Road	Glenwood

LEGEND	
★	Cycleway Connections
■	Attractions
T	TAFES & Universities
—	Westlink Cycleway
—	Westlink M7





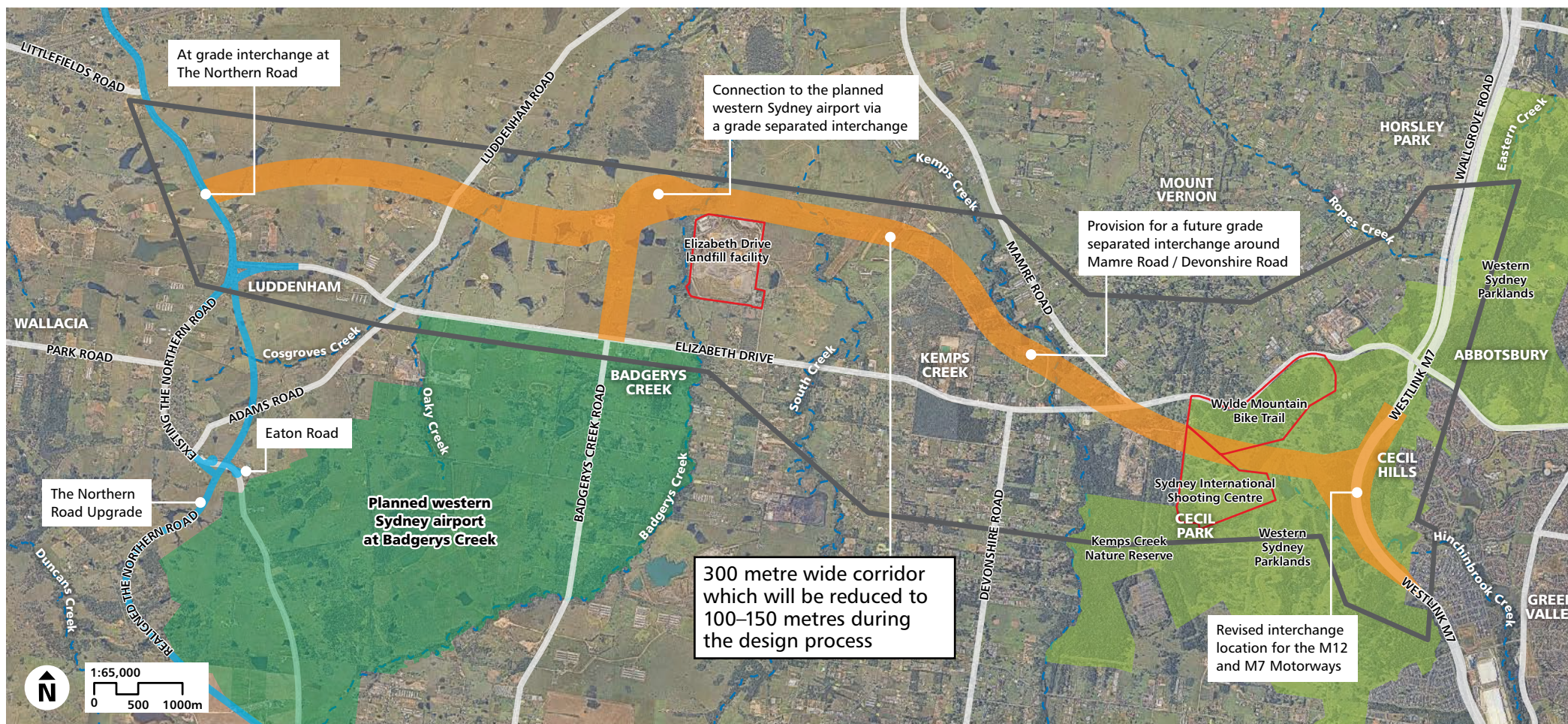
Australian Government

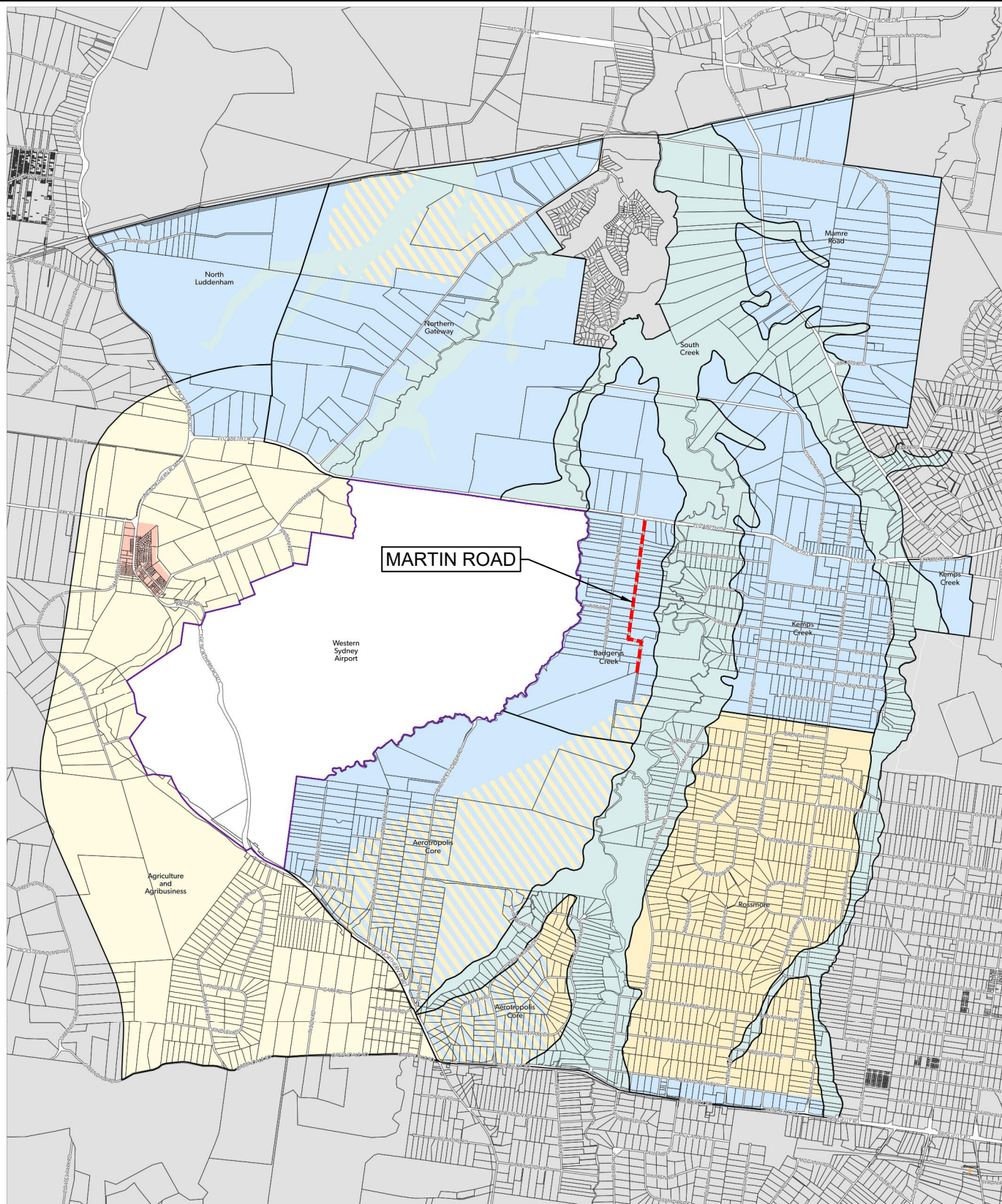
BUILDING OUR FUTURE



M12 Motorway preferred corridor route

November 2016





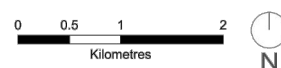
Please note that the precinct boundaries are for strategic planning purposes. The boundaries do not indicate future zone boundaries or commitments to the provision of infrastructure.



- Western Sydney Airport
- Precinct Boundary
- Cadastre Lot

- Agricultural
- Luddenham Village
- Flexible Employment
- Urban Land

- Non Urban Land
- Mixed Flexible Employment & Urban Land



TRANSPORT AND URBAN PLANNING

TRAFFIC, TRANSPORT & PROJECT MANAGEMENT CONSULTANTS

5/90 Toronto Parade, Sutherland NSW 2232
Phone 02 9545 1411 Fax 02 9545 1556

admin@transurbanplan.com.au

APPENDIX 2

BADGERYS CREEK BRICK MAKING FACILITY, MODIFICATION 3

WESTERN SYDNEY AEROTROPOLIS STAGE 1 STRUCTURE PLAN

JOB NO.17179

25/02/19

**CSR ADVANCED MANUFACTURING
HUB**

MODIFICATIONS 3 AND 4

**235 MARTIN ROAD
BADGERYS CREEK**

**TRAFFIC ASSESSMENT REPORT
VOLUME 2**

ADDITIONAL INVESTIGATIONS

Ref. 19010Vol2

25 February 2019

Prepared By

TRANSPORT & URBAN PLANNING PTY LTD
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Road Safety & Project Management Consultants
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Executive Summary

Elizabeth Drive and Martin Road Intersection at Badgerys Creek – Road Safety Audit and Safety Review Report

Elizabeth Drive and Martin Road Intersection at Badgerys Creek – Options Report for Upgrade of Intersection Controls

Traffic Signal Warrant Report for Elizabeth Drive and Martin Road Intersection at Badgerys Creek

EXECUTIVE SUMMARY

1. *This report documents the additional investigations undertaken into the proposed upgrade of the traffic controls at the intersection of Elizabeth Drive and Martin Road at Badgerys Creek for the proposed CSR Modifications 3 and 4. This report is Volume 2 of the Traffic Assessment Report.*
2. *Following the initial discussions with the RMS concerning the Elizabeth Drive/Martin Road intersection, a follow up meeting was held with the RMS on the 12 December 2018 to discuss the future intersection controls. As a result of this meeting, additional investigations were undertaken to determine the most appropriate type of traffic control for the intersection, given the increase in traffic volumes forecasted to use the intersection. The intersection upgrade would be an interim measure, until the ultimate widening of Elizabeth Drive was undertaken by the RMS.*
3. *These investigations included;*
 - *An independent road safety audit and safety review of the intersection, with regard to the future traffic volume increases;*
 - *An options report reviewing the available options to upgrade the intersection's traffic controls; and*
 - *A traffic signal warrant report.*
4. *These investigations included the future traffic volumes forecasted to use the Elizabeth Drive/Martin Road intersection including the CSR Modification proposals, as well as the Mirvac future proposal, background traffic growth and Western Sydney Airport Construction traffic in 2021 and 2026 (prior to the opening of the M12 and the Airport).*
5. *The independent road safety audit and safety review concluded that the existing give way controls at the intersection would be unsafe and should be upgraded having regard to the increased volumes including the large number of heavy vehicles using the intersection, as well as the increased vehicle delays.*
6. *The auditors noted that a future roundabout or traffic signal control may be suitable options.*
7. *The options report found that due to increased volumes associated with the future growth, including the Mirvac proposal, that a new roundabout would need to be two lanes and would require a large road reserve footprint of 67.6 metres to accommodate the roundabout. However even a two lane roundabout would have limited capacity and traffic modelling showed that during the 2026 AM peak the very large right turn movement into the Mirvac Access Road would cause extensive delays and queueing in the western approach of Elizabeth Drive, consistent with a Level of Service F operation for this approach. Other disadvantages included the non provision of safe pedestrian crossing facilities and conflict for cyclists using the roundabout due to high levels of heavy vehicles and circulating traffic.*

8. *The options report ruled out a roundabout and concluded that traffic signals would be the better option. Traffic signals will/can provide safe pedestrian crossing facilities, result in less conflict with cyclists, can provide sufficient capacity at the intersection based on a smaller land footprint and are relatively simple to keep operating, when future road upgrading occurs in Elizabeth Drive.*
9. *The traffic signal warrant report concluded on the range of relevant factors and criteria that are taken into consideration in a decision on traffic signals, including traffic volumes, vehicle delays, road safety and future planning that a warrant is met for the provision of traffic signals for the CSR Modifications, as well as for the future Mirvac development.*
10. *The three reports are included in the following sections of the Volume 2 Report.*

Elizabeth Drive and Martin Road Intersection at Badgerys Creek

Road Safety Audit and Safety Review Report

TRANPACK PTY LTD

ABN: 50 077 328 708

TRAFFIC IMPACT AND ROAD SAFETY CONSULTANTS

30 January 2019

Mr Terry Lawrence
Director
Transport and Urban Planning Pty Ltd
PO Box 533
Sutherland NSW 1499

Dear Terry,

Re: Road Safety at Intersection of Elizabeth Drive and Martin Road, Badgerys Creek

Thank you for engaging Tranpack to carry out an independent Road Safety Audit and road safety review of the subject intersection, in relation to the traffic impacts of a proposed industrial development at 235 Martin Road, Badgerys Creek

The Site

Elizabeth Drive is a major east/west State Road travelling between the Hume Highway, Liverpool and The Northern Road, Luddenham. Martin Road is a local road forming a T-intersection on the south side of Elizabeth Drive, approximately 8km west of the M7 and 4km west of Mamre Road.

In the vicinity of the subject intersection, Elizabeth Drive is a two lane rural road with additional turning lanes at most intersections. It carries in the order of 12,000vpd including a high proportion of large trucks. It has an 80km/h speed limit at the subject site, and is straight with undulating vertical curves. A crest is located 140 metres west of Martin Road.

Martin Road is a two lane local access road, which terminates 2.1km south of Elizabeth Drive. Several resource recovery/landscaping businesses currently use Martin Road for access and it carries approximately 880vpd including a very high proportion of trucks.

Current Intersection Traffic Conditions

Current traffic conditions are assessed as good and the intersection operates at a Level of Service C (acceptable delays but nearing capacity) during AM and PM peak hours, under Give Way sign control.

Sight distances for turning movements are generally satisfactory, although it is noted that the crest on Elizabeth Drive west of Martin Road does limit sight distance for vehicles turning right out of Martin Road. Also, the Austroads Safe Intersection Sight Distance (SISD) requirement for an eastbound motorist to observe a vehicle entering Elizabeth Drive from Martin Road of 181 metres is not met, when trucks and cars are queued in the right turn bay in Elizabeth Drive at the adjacent Suez Access Road. (Austroads Guide to Road Design Part 4A, Table 3.2). This also affects and restricts the sight distance for vehicles turning right out of Martin Road. This deficiency may have road safety implications as identified in the Audit.

Proposed Developments and Traffic Growth

We understand that several developments are planned along Martin Road that will increase traffic volumes at the subject intersection. These include:

- Recommencing brick manufacturing on the CSR site at 235 Martin Road;
- A new roof tile manufacturing operation on the same site;
- Remediation of certain areas within that site involving transportation of significant volumes of VENM to the site; and
- New resource recovery operations at Nos. 25 and 55 Martin Road.

The traffic impacts of these developments are expected to be in effect by 2021. The Western Sydney Airport construction traffic is also expected to be at peak in 2021, and the subject intersection will be used by significant volumes of light and heavy vehicles to and from the airport site.

In addition, it is understood that Mirvac are planning a large industrial development on the north side of Elizabeth Drive, with access via a new road which will create a four way cross intersection at the current T-junction at Martin Road. Stage 1 is expected to be operational by 2021, and Stage 2 by 2026.

Elizabeth Drive Route Capacity

Table 4.5 of the RMS Guide to Traffic Generating Developments Ver. 2.0 2002 indicates the following traffic service levels for two way hourly traffic flows on two lane rural roads in rolling terrain with 10% heavy vehicles, adjusted for the 80km/h design speed of Elizabeth Drive.

- Level of Service (LoS) C 617 veh per hour
- Level of Service (LoS) D 921 veh per hour
- Level of Service (LoS) E 1634 veh per hour

The existing and projected (Year 2021) peak hour two way traffic flows on Elizabeth Drive at Martin Road have been sourced from various reports by Transport and Urban Planning Pty Ltd, the Western Sydney Airport EIS and Mirvac. They include current (2018) traffic volumes plus background growth, airport construction traffic, CSR and Mirvac development traffic forecasts for 2021.

TWO WAY PEAK HOUR FLOWS ON ELIZABETH DRIVE

Two Way Flow on Elizabeth Drive	AM Peak		PM Peak	
	Existing	2021	Existing	2021
West of Martin Road	1,211	1,699	1,217	1,631
East of Martin Road	1,245	2,039	1,261	2,083

The increases range from 35% (AM) to 65% (PM). These flows indicate Elizabeth Drive currently operates within LoS E capacity both east and west of Martin Road. The 2021 flows significantly exceed the LoS E capacity east of Martin Road, and will be at LoS E capacity, west of Martin Road.

Road Safety Audit

A Road Safety Audit has been carried out and the report is attached. In summary, the Audit found that the existing intersection, under current traffic volumes, has no significant traffic safety deficiencies. However, the Audit also identified that under expected traffic growth along Elizabeth Drive from the Western Sydney Airport, and traffic generated by the CSR brick and roof tile manufacturing operations and the site remediation works there is a significant future road safety risk as heavy vehicle turning movements increase.

The Audit identified that the existing Give Way sign control should be upgraded due to a forecast increase in vehicle delays and queueing. In particular, right turning vehicles out of Martin Road would experience significant delays (Level of Service F).

Given the limited SISD for eastbound traffic on Elizabeth Drive (when trucks and cars are stored in the adjacent right turn bay) and the likelihood that delayed trucks turning right from Martin Road will utilise inadequate gaps in traffic, the Audit ranked this road safety risk as “intolerable”, meaning the situation “must be corrected” as a priority.

Potential Improvements

Potential options for correcting the identified safety risk of retaining Give Way control under future traffic volumes include;

- Eliminating the right turn out of Martin Road (i.e. a median);
- Seagull channelization;
- A roundabout;
- Signalisation.

The possibility of eliminating the right turn out of Martin Road is not recommended because there is no alternate exit road from Martin Road. All existing traffic would be required to turn left to travel west along Elizabeth Drive. It is very likely that many vehicles, including large trucks would then do U-turns at nearby intersections such as the SUEZ access road, which would create significant road safety risks. A median on Elizabeth Drive would also impact on the existing ANL generated traffic and the proposed Mirvac development to the north.

The potential seagull channelization is not recommended because current RMS practice is to not install them. Also it would impact on the potential for a future cross intersection with the Mirvac site access.

The options of a roundabout or signalisation may be suitable to treat the road safety risk and manage road access requirements, and are recommended for further investigation.

Conclusion

The Audit finding that the existing mode of control of the intersection of Elizabeth Drive and Martin Road should be upgraded by 2021 is strongly supported and planning for the appropriate upgrade road and intersection works is **recommended**.

Yours faithfully,



Michael Bridgman
Traffic, Transport and Road Safety Consultant
Director
Tranpact Pty Ltd



Geoff Morris
Traffic, Transport and Road Safety Consultant
Tranpact Pty Ltd

COMMERCIAL IN CONFIDENCE

EXISTING

ROAD SAFETY AUDIT REPORT

OF

ELIZABETH DRIVE AND MARTIN ROAD

“INTERSECTION”

AT

BADGERYS CREEK

TRANPACT PTY LTD
Traffic, Transport, Road Safety & Project Management Consultants
7 Belarada Close, Bangor NSW 2234
Tel: (02) 9541 2179

Ref: T-1901 RSA/19009rsa

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Figure 1 Site

APPENDICES

Appendix 1	Documents Used during the Audit
Appendix 2	Checklist Stage 6 Audit – Existing Roads
Appendix 3	Austroads Risk Rating
Appendix 4	Photographs

1.0 INTRODUCTION

1.1 Auditors and Audit Process

This report details the results of a Road Safety Audit and Review of the intersection of Martin Road with Elizabeth Drive at Badgerys Creek.

The Road Safety Audit was requested by Transport and Urban Planning Pty Ltd.

The audit was carried out by:

- Geoff Morris - Level 3 Road Safety Auditor (Audit Team Leader) - RSA-02-0876
- Mick Bridgman - Level 3 Road Safety Auditor - RSA-02-0014

The audit included a commencement briefing meeting with Mr T Lawrence of Transport and Urban Planning Pty Ltd on Thursday 17 January 2019 two Transport and Urban Planning Pty Ltd traffic assessment reports were provided as background information for the audit as identified as **Appendix 1**. A day/night inspection was undertaken on 18 January, 2019 and a follow up inspection was carried out on 21 January 2019. The audit report was prepared following the audit inspections.

The audit has been carried out following the procedures set out in the Roads and Maritime Services Guidelines for Road Safety Audit Practice. The audit examines the existing features of the intersection and future traffic conditions at the intersection which may affect road user safety and it has sought to identify potential safety hazards. However, the auditors point out that no guarantee is made that every deficiency has been identified. Further, if all the findings in this report were to be addressed, this would not confirm that the intersection layout is 'safe'; rather, adoption of any actions should improve the level of safety of the audited site.

1.2 Description of the Intersection

Martin Road forms an uncontrolled southern "Tee" Intersection leg with Elizabeth Drive. See **Figure 1** overleaf.

- Elizabeth Drive, a State Road, is primarily a two lane undivided road, east and west of Martin Road. Sight distance to the west is restricted by a crest at the Suez Recycling Access Driveway.
- Austroad/RMS rural AUL and AUR left and right turning treatments have been provided into Martin Road from Elizabeth Drive.
- Kerb and guttering is provided on the south east and south west corners to Martin Road.
- The posted speed zone is 80km/h and intersection street lighting is provided.
- Sealed and unsealed gravel, variable width, shoulders are provided on Elizabeth Drive.

- Unsealed shoulders 1-2 metres wide are provided in Martin Road.
- Sight stopping distances along Elizabeth Drive from Martin Road are satisfactory for the existing 80km/h speed zone and are 250+ metres east and 185 metres west. There is a crest in Elizabeth Drive, west of the adjacent Suez Access Road intersection.
- The Austroads Safe Intersection Sight Distance (SISD) requirement of 181 metres for eastbound traffic on Elizabeth Drive is not available when trucks and cars are using the adjacent right turn bay in Elizabeth Drive at the Suez Access Road. Vehicles using this right turn bay restrict the sight distance for both eastbound vehicles approaching Martin Road in Elizabeth Drive and for drivers turning right out of Martin Road.

1.3 Existing Road Conditions

- Elizabeth Drive is an east west state arterial road that runs between the Hume Highway at Liverpool and the Northern Road at Bringelly. Major roads that intersect/connect with Elizabeth Drive include Cowpasture Road, the M7 and Mamre Road.

At Badgerys Creek, Elizabeth Drive is generally an undivided two lane rural road with sealed shoulders, centerline and edgeline markings and an 80km/h speed limit.

Intersection treatments in the two lane section of Elizabeth Drive, vary between basic treatments and channelized treatments that include turning lanes.

A number of nearby intersections have channelized intersection treatments including Martin Road, Lawson Road and the Access Road to Kemps Creek Waste Facility, which is 140m west of Martin Road.

Daily average two way traffic volumes on Elizabeth Drive are in the order of 12,000 veh/day (2018) including 13% heavy vehicles. Onsite observations showed a significant proportion of heavy vehicles were very large trucks, commonly semis, truck and dog and B-doubles.

- Martin Road is a two lane north south local road under the control of Liverpool City Council that intersects with Elizabeth Drive at its northern end and is a dead end at its southern end at the CSR brickworks site entrance.

Martin Road is approximately 2.1km in length and has an S shaped bend in the road alignment approximately 400 metres, north of the CSR site.

It has a sealed road pavement of variable road width between 8-10 metres with additional pavement width at its intersection with Elizabeth Drive.

No kerb and guttering is provided and it generally has a 20 metre road reserve.

Martin Road provides vehicle access to the rural and other uses that have frontages to Martin Road.

Average daily traffic volumes on Martin Road are in the order of 880 veh/day including 41% heavy vehicles.

1.4 Proposed Road Upgrades

Whilst there are no details currently available as to any proposed Elizabeth Drive upgrades, Elizabeth Drive will be a major route for increasing construction traffic to the new Western Sydney Airport due to be operational by 2026. In addition, significant land use changes are planned in the area.

The RMS has indicated that they will build the new M12 as the main east/west airport access road by 2026 and upgrade Elizabeth Drive. However, there is no date or works details of the upgrade to Elizabeth Drive at this time. In the interim;

- CSR own the Brickmakers Site next to Badgerys Creek Airport, at end of Martin Road and have proposed two D/A Modifications (concurrent) to restart Brickmaking and a new roof tile manufacturing facility. The site is currently not operating;
- Large trucks from ANL currently use Martin Road and Elizabeth Drive. Current other uses include semi rural type uses and resource recovery operations;
- CSR will add to light and heavy vehicles (i.e. large trucks) using Martin Road and the Elizabeth Drive intersection;
- Transport and Urban Planning Pty Ltd have recommended traffic signals as an interim option prior to RMS upgrades in Elizabeth Drive. It is expected that the traffic signals will be retained in longer term;
- Mirvac are proposing an industrial development opposite Martin Road. RMS have advised Mirvac to provide that site's Access Road opposite Martin Road to create a cross junction at Elizabeth Drive;

Preliminary traffic volumes provided for the Mirvac development indicates an upgraded signalised 4 way intersection will be required at Martin Road including 2 traffic lanes in each direction along Elizabeth Drive.

1.5 Future Traffic Volumes 2021

The projected future design hour traffic movements from the CSR Modification 3 and 4 proposal are:

- A total of 85 inbound trips including 51 heavy vehicle trips and 58 outbound trips including 51 heavy vehicles in the AM peak hour; and

- A total of 63 inbound trips, including 41 heavy vehicles and a total of 140 outbound trips including 41 heavy vehicle trips in the PM peak hour.

Another proposed development at 55 Martin Road will generate a total of 5 light vehicle inbound trips in the AM peak hour and 5 outbound trips in the PM peak hour.

These have been assigned at the intersection of Elizabeth Drive/Martin Road with 75% of arrivals/departures to and from the east and 25% of arrivals/departures to and from the west.

The additional design hour traffic projections from the Mirvac proposal are +404 veh/hr for Stage 1 and +909 veh/hr for Stages 1 and 2.

Construction Traffic of Western Sydney Airport 2021

Volume 2 of the EIS for Western Sydney Airport identified that 80% of the construction traffic will arrive and depart from the east along Elizabeth Drive.

For the peak year identified in the EIS which will be 2021, this will result in the following peak hour volumes using Elizabeth Drive at Martin Road;

- AM peak hour;
 - 20 heavy vehicles travelling eastbound and a total of 231 vehicles travelling westbound which includes 20 heavy vehicles;
- PM peak hour;
 - A total of 205 vehicles travelling eastbound which includes 29 heavy vehicles and 29 heavy vehicles travelling westbound.

Future Background Traffic Growth in Elizabeth Drive

Future background traffic growth in Elizabeth Drive between 2018 and 2021 is estimated to be;

- AM Peak Hour
 - 73 vehicles travelling eastbound including 6 heavy vehicles; and
 - 36 vehicles westbound, including 6 heavy vehicles
- PM Peak Hour
 - 38 vehicles eastbound including 6 heavy vehicles; and
 - 70 vehicles westbound including 4 heavy vehicles.

1.6 Future Intersection Operation

During the audit commencement briefing, Transport and Urban Planning Pty Ltd provided their traffic modelling assessment of the subject intersection, including the future operation in 2021 with the CSR Advanced Manufacturing Hub in operation and

the construction traffic from Western Sydney Airport. (NB: Mirvac proposal not included).

Under the existing Give Way sign control, the subject intersection is shown to operate at Level of Services E and F in the AM and PM peak hours respectively. (At capacity/over saturated and requires alternate control).

The highest movement delay is forecast to be the right turn out of Martin Road in the PM peak hour, with an average delay of 167 seconds per vehicle.

Transport and Urban Planning Pty Ltd advised that traffic signalization was proposed to resolve these delays, and to accommodate additional planned truck traffic and light vehicles generated by the CSR proposals. SIDRA modelling of the proposed signal operation in 2021, showed the signals would operate at Level of Service A/B (good operation with acceptable delays).

Transport and Urban Planning Pty Ltd requested that this Audit consider the safety of the intersection if it remained under Give Way sign control in 2021, with the expected growth in traffic.

2.0 PREVIOUS STAGE AUDITS

There are no known previous road safety audits undertaken for this section of Elizabeth Drive.

3.0 AUDIT FINDINGS AND RECOMMENDATIONS

3.1 Audit Findings and Risk Ranking

Existing Conditions

The finding of the audit relative to the following existing conditions are:

- Alignment: Horizontal and vertical alignments were found to be commensurate and safe for a rural 80km/h speed zone.
- Sight distances: safe stopping sight distance (80 metres) is met in both directions of travel on Elizabeth Drive, however, safe intersection sight distance (SISD) is not always met in the eastbound direction.
- Grades: Were found to be undulating i.e. +/- 10% and safe for existing conditions.
- Clearzones: Shoulder and clearzone did not fully comply with RMS Austroad Guidelines but are considered adequate for existing conditions and unlikely to be a safety hazard for the existing alignments, traffic speed and/or volumes.

- Drainage: Structures did not represent any noticeable safety hazards.
- Intersection Lighting: Was adequate for existing conditions and was not a noticeable safety hazard.
- Speed Zoning: 80km/h was considered appropriate for existing rural conditions, alignments, traffic volumes and mix.
- Traffic Volumes: Peak hourly volumes and turning movements including delay times are adequate for existing traffic service levels and traffic conditions.
- Turning Traffic: Volume and delay times are acceptable for current traffic conditions and service levels.
- Traffic Mix (including heavy vehicles): 13% HV on Elizabeth Drive and 41% HV on Martin Road are acceptable for existing conditions and volumes.
- Pedestrian and Cyclists: No provisions are made for pedestrians or cyclists however volumes are understood to be very low.

Future Conditions

The audit findings relative to projected Year 2021 traffic volumes and conditions are:

- Alignment: no change
- Site Distance: No change, however increase in truck volumes turning right out of Martin Road during inadequate gaps will present further risk to road safety, due to the inadequate safe intersection sight distance (SISD) in the eastbound approach of Elizabeth Drive.
- Gradients: no change
- Clearzones: no change, however increased traffic volumes and turning traffic movements under existing traffic controls may exacerbate existing clearzone non compliance items.
- Drainage: no change
- Lighting: no change
- Speedzoning: no change

- Traffic Volumes: Increased traffic volumes and turning movements are likely to reduce existing traffic level of service levels under existing controls.
- Turning traffic: Increased volumes and delay times under existing traffic controls are likely to reduce road safety and increase conflict and accident potential. In particular, right turning trucks out of Martin Road are expected to experience delays in the order of 2-3 minutes, which may generate unsafe gap selection into high speed traffic along Elizabeth Drive.
- Traffic mix: as above
- Pedestrians and Cyclists: pedestrian volumes are low, but may increase cyclist volumes may also increase with additional developments and land use densities in place.

Table 3.1 below presents the auditor's comments on the various matters identified during the audit.

If applicable, where risks and potential safety issues have been identified, these have been ranked using Austroads Risk Ranking method, based on frequency, severity, overall level of risk and treatment approach presented in Tables 4.1 to 4.4 in Guide to Road Safety Part 6: Road Safety Audit (See Appendix 3).

The risk rankings and Austroads Suggested treatment approach are defined as follows;

- Intolerable - Must be corrected
- High - Should be corrected or the risk significantly reduced, even if the treatment cost is high
- Medium - Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high
- Low - Should be corrected or the risk reduced, if the treatment cost is low

The audit findings are shown in Table 3.1.

There are a number of items identified, relative to road safety and traffic operation that will require consideration by the road authority (RMS) either now or in the future as developments in the region are approved and subsequent follow up actions as applicable are suggested by the relevant authority.

Conclusions

Based on the projected increased traffic volumes at Elizabeth Drive and increased daily trips in Martin Road, traffic control improvements are likely to be required to facilitate

the safe turning movements of additional traffic including heavy vehicles into and out of Martin Road and to keep average delay times including heavy vehicles, at an acceptable and manageable level.

Such future traffic improvements by year 2021, may include;

- Sufficient capacity in Elizabeth Drive and at the intersection;
- Closing the central median in Elizabeth Drive thereby banning all right turn movements in/out of Martin Road.
- Seagull intersection channelization (as a T junction only).
- Safe intersection controls which may include;
 - o A one lane and future two lane roundabout; or
 - o Traffic control signals.

In addition, **Appendix 3** (Audit checklists) shows the auditors comments on all matters considered as part of the Stage 5 audit.

Photographs of relevant items are provided in **Appendix 4**.

TABLE 3.1**AUDIT FINDINGS**

Item	Issue	Preliminary Risk Ranking	Response by Audit Manager
1	With expected traffic volume increases by 2021 both on Elizabeth Drive and Martin Road, Give Way sign control will cause significant delays to vehicles exiting Martin Road. Delayed right turning trucks are likely to select inadequate gaps in traffic. When combined with the inadequate SIRD for eastbound vehicles on Elizabeth Drive, a significant increase in the likelihood of crashes involving trucks will occur.	Intolerable	
2	Projected delays and queues at the intersection by 2021 suggest an upgraded mode of traffic control will be required at the intersection as an interim measure if the Elizabeth Drive road upgrade works are not complete.	High	
3	Future intersection traffic volumes and traffic conditions will require further ongoing assessment and analysis by RMS as development in the region progresses, to ensure adequate traffic service levels continue.	Medium to High	

4.0 FORMAL STATEMENT

We have examined the road network as described in Section 1.2 of this report and have audited this road junction in accordance with the procedures set out in the RMS Guidelines for Road Safety Audit Practice. The audit has been carried out for the sole purpose of identifying any features of the road network that could be changed to improve safety either now or in the future. The audit findings are presented in Section 3 and Table 3.1. There are a number of items that require consideration and/or follow up for future traffic volumes and road safety conditions.

30 January 2019

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Geoff Morris

Lead Road Safety Auditor (Level 3)



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Michael Bridgman

Road Safety Auditor (Level 3)

APPENDIX 1

1. Transport and Urban Planning Pty Ltd Reports re proposed CSR Manufacturing at 235 Martin Road, Badgerys Creek
2. Mirvac Traffic Volumes (Ason Group)
3. RMS Guidelines for Road Safety Audit Practice (2011)
4. Austroads Guide to Road Safety Part 6 (2009)

APPENDIX 2

Checklist 6 – Road Safety Audit for Existing Roads

CHECKLIST 6: EXISTING ROADS: ROAD SAFETY AUDIT

APPENDIX 2 - ELIZABETH DRIVE AND MARTIN ROAD, BADGERYS CREEK

Issue	Yes	No	Comment
6.1 Road alignment and cross-section			
6.1.1 Visibility; sight distance			
Is sight distance adequate for the speed of traffic using the route?	✓		
Is adequate sight distance provided for intersections and crossings? (for example, pedestrian, cyclist, cattle, railway)	✓		
Is adequate sight distance provided at all private driveways and property entrances?	✓		
6.1.2 Design speed			
Is the horizontal and vertical alignment suitable for the (85th percentile) traffic speed?	✓		
If not: - are warning signs installed? - are advisory speed signs installed?			N/A
Are the posted advisory speeds for curves appropriate?			N/A
6.1.3 Speed limit/speed zoning			
Is the speed limit compatible with the function, road geometry, land use and sight distance?	✓		
6.1.4 Overtaking			
Are safe overtaking opportunities provided?			N/A at intersection
6.1.5 Readability by drivers			

Issue	Yes	No	Comment
Is the road free of elements that may cause confusion? For example: - is alignment of the roadway clearly defined? - has disused pavement (if any) been removed or treated? - have old pavement markings been removed properly? - do tree lines follow the road alignment? - does the line of street lights or the poles follow the road alignment?	✓		
Is the road free of misleading curves or combinations of curves?	✓		
6.1.6 Widths			
Are medians and islands of adequate width for the likely users?	✓		
Are traffic lane and carriageway widths adequate for the traffic volume and mix?	✓		
Are bridge widths adequate?			N/A
6.1.7 Shoulders			
Are shoulders wide enough to allow drivers to regain control of errant vehicles?	✓		
Are shoulders wide enough for broken-down or emergency vehicles to stop safely?		✓	
Are shoulders sealed?			Not along north side or in Martin Road
Are shoulders trafficable for all vehicles and road users? (i.e. are shoulders in good condition)	✓		
Is the transition from road to shoulder safe? (no drop-offs)	✓		
6.1.8 Crossfalls			
Is appropriate superelevation provided on curves?	✓		
Is any adverse crossfall safely managed (for cars, trucks, etc.)?	✓		

Issue	Yes	No	Comment
Do crossfalls (carriageway and shoulder) provide adequate drainage?	✓		
6.1.9 Batter slopes			
Are batter slopes traversable by cars and trucks that run off the road?			N/A
6.1.10 Drains			
Are roadside drains and culvert end walls traversable?	✓		
6.2 Auxiliary lanes			
6.2.1 Tapers			
Are starting and finishing tapers located and aligned correctly?	✓		
Is there sufficient sight distance to the end of the auxiliary lane?	✓		
6.2.2 Shoulders			
Are appropriate shoulder widths provided at merges?	✓		
Have shoulder widths been maintained beside the auxiliary lane?	✓		
6.2.3 Signs and markings			
Have all signs been installed in accordance with the appropriate guidelines?	✓		
Are all signs conspicuous and clear?	✓		
Does all linemarking conform with these guidelines?	✓		
Is there advance warning of approaching auxiliary lanes?		✓	
6.2.4 Turning traffic			
Have right turns from the through lane been avoided?	✓		
Is there advance warning of turn lanes?		✓	
6.3 Intersections			
6.3.1 Location			
Are all intersections located safely with respect to the horizontal and vertical alignment?	✓		

Issue	Yes	No	Comment
Where intersections occur at the end of high-speed environments (for example, at approaches to towns), are there traffic control devices to alert drivers?			N/A
6.3.2 Visibility; sight distance			
Is the presence of each intersection obvious to all road users?	✓		
Is the sight distance appropriate for all movements and all road users?	✓		
Is there stopping sight distance to the rear of any queue or slow-moving turning vehicles?		✓	Eastbound RT lane
Has the appropriate sight distance been provided for entering and leaving vehicles?	✓		
6.3.3 Controls and delineation			
Are pavement markings and intersection control signs satisfactory?	✓		
Are vehicle paths through intersections delineated satisfactorily?	✓		
Are all lanes properly marked (including any arrows)?	✓		
6.3.4 Layout			
Are all conflict points between vehicles safely managed?	✓		
Is the intersection layout obvious to all road users?	✓		
Is the alignment of kerbs obvious and appropriate?	✓		
Is the alignment of traffic islands obvious and appropriate?	✓		
Is the alignment of medians obvious and appropriate?	✓		
Can all likely vehicle types be accommodated?	✓		
Are merge tapers long enough?	✓		
Is the intersection free of capacity problems that may produce safety problems?	✓		
6.3.5 Miscellaneous			
Particularly at rural sites, are all intersections free of loose gravel?	✓		
6.4 Signs and lighting			
6.4.1 Lighting			
Has lighting been adequately provided where required?	✓		

Issue	Yes	No	Comment
Is the road free of features that interrupt illumination? (for example, trees or overbridges)	✓		
Is the road free of lighting poles that are a fixed roadside hazard?	✓		
Are frangible or slip-base poles provided?		✓	
Ambient lighting: if it creates special lighting needs, have these been satisfied?			N/A
Is the lighting scheme free of confusing or misleading effects on signals or signs?	✓		
Is the scheme free of any lighting black patches?	✓		
6.4.2 General signs issues			
Are all necessary regulatory, warning and direction signs in place? Are they conspicuous and clear?	✓		
Are the correct signs used for each situation, and is each sign necessary?	✓		
Are all signs effective for all likely conditions? (for example, day, night, rain, fog, rising or setting sun, oncoming headlights, poor lighting)	✓		
If restrictions apply for any class of vehicle, are drivers adequately advised?			N/A
If restrictions apply for any class of vehicle, are drivers advised of alternative routes?			N/A
6.4.3 Sign legibility			
In daylight and darkness, are signs satisfactory regarding visibility and: - clarity of message? - readability/legibility at the required distance?	✓		
Is sign retroreflectivity or illumination satisfactory?	✓		
Are signs able to be seen without being hidden by their background or adjacent distractions?	✓		
Is driver confusion due to too many signs avoided?	✓		
6.4.4 Sign supports			
Are sign supports out of the clear zone?		✓	

Issue	Yes	No	Comment
If not, are they: - frangible? - shielded by barriers (for example, guard fence, crash cushions)?	✓		Signs mounted on 80mm pipe stems
6.5 Markings and delineation			
6.5.1 General issues			
Is the line marking and delineation: - appropriate for the function of the road? - consistent along the route? - likely to be effective under all expected conditions? (day, night, wet, dry, fog, rising and setting sun position, oncoming headlights, etc.)	✓		
Is the pavement free of excessive markings? (for example, unnecessary turn arrows, unnecessary barrier lines, etc.)	✓		
6.5.2 Centrelines, edgelines, lane lines	✓		
Are centrelines, edgelines, lane lines provided? If not, do drivers have adequate guidance?	✓		
Have RRPMs been installed where required?	✓		
If RRPMs are installed, are they correctly placed, correct colours, in good condition?	✓		
Are profiled (audible) edgelines provided where required?	✓		
Is the linemarking in good condition?	✓		
Is there sufficient contrast between linemarking and pavement colour?	✓		
6.5.3 Guideposts and reflectors			
Are guideposts appropriately installed?	✓		
Are delineators clearly visible?	✓		
Are the correct colours used for the delineators?	✓		
Are the delineators on guard fences, crash barriers and bridge railings consistent with those on guideposts?	✓		
6.5.4 Curve warning and delineation			
Are curve warning signs and advisory speed signs installed where required?			N/A

Issue	Yes	No	Comment
Are advisory speed signs consistent along the route?			N/A
Are the signs correctly located in relation to the curve? (i.e. not too far in advance)			N/A
Are the signs large enough?			N/A
Are chevron alignment markers (CAMs) installed where required?			N/A
Is the positioning of CAMs satisfactory to provide guidance around the curve?			N/A
Are the CAMs the correct size?			N/A
Are CAMs confined to curves? (not used to delineate islands, etc)			N/A
6.6 Crash barriers and clear zones			
6.6.1 Clear zones			
Is the clear zone width traversable? (i.e. drivable)	✓		
Is the clear zone width free of rigid fixtures? (if not, can all of these rigid fixtures be removed or shielded?)	✓		
Are all power poles, trees, etc., at a safe distance from the traffic paths?	✓		
Is the appropriate treatment or protection provided for any objects within the clear zone?			N/A
6.6.2 Crash barriers			
Are crash barriers installed where necessary?			N/A
Are crash barriers installed at all necessary locations in accordance with the relevant guidelines?			N/A
Are the barrier systems suitable for the purpose?			N/A
Are the crash barriers correctly installed?			N/A
Is the length of crash barrier at each installation adequate?			N/A
Is the guard fence attached correctly to bridge railings?			N/A
Is there sufficient width between the barrier and the edge line to contain a broken-down vehicle?			N/A

Issue	Yes	No	Comment
6.6.3 End treatments			
Are end treatments constructed correctly?			N/A
Is there a safe run-off area behind breakaway terminals?			N/A
6.6.4 Fences			
Are pedestrian fences frangible?			N/A
Are vehicles safe from being speared by horizontal fence railings located within the clear zone?			N/A
6.6.5 Visibility of barriers and fences			
Is there adequate delineation and visibility of crash barriers and fences at night?			N/A
6.7 Traffic signals			
6.7.1 Operations			
Are traffic signals operating correctly?			N/A
Are the number, location and type of signal displays appropriate for the traffic mix and traffic environment?			N/A
Where necessary, are there provisions for visually impaired pedestrians? (for example, audio-tactile push buttons, tactile markings)			N/A
Where necessary, are there provisions for elderly or disabled pedestrians? (for example, extended green or clearance phase)			N/A
Is the controller located in a safe position? (i.e. where it is unlikely to be hit, but maintenance access is safe)			N/A
Is the condition (especially skid resistance) of the road surface on the approaches satisfactory?			N/A
6.7.2 Visibility			
Are traffic signals clearly visible to approaching motorists?			N/A
Is there adequate stopping sight distance to the ends of possible vehicle queues?			N/A
Have any visibility problems that could be caused by the rising or setting sun been addressed?			N/A

Issue	Yes	No	Comment
Are signal displays shielded so that they can be seen only by the motorists for whom they are intended?			N/A
Where signal displays are not visible from an adequate distance, are signal warning signs and/or flashing lights installed?			N/A
Where signals are mounted high for visibility over crests, is there adequate stopping sight distance to the ends of traffic queues?			N/A
Is the primary signal free from obstructions on the nearside footway to approaching drivers? (trees, light poles, signs, bus stops, etc.)			N/A
6.8 Pedestrians and cyclists			
6.8.1 General issues			
Are there appropriate travel paths and crossing points for pedestrians and cyclists?	✓		Nil pedestrian and very low cyclist activity
Is a safety fence installed where necessary to guide pedestrians and cyclists to crossings or overpasses?			N/A
Is a safety barrier installed where necessary to separate vehicle, pedestrian and cyclist flows?			N/A
Are pedestrian and bicycle facilities suitable for night use?			N/A
6.8.2 Pedestrians			
Is there adequate separation distance between vehicular traffic and pedestrians on footways?			N/A
Is there an adequate number of pedestrian crossings along the route?			N/A
At crossing points is fencing oriented so pedestrians face oncoming traffic?			N/A
Is there adequate provision for the elderly, the disabled, children, wheelchairs and baby carriages? (for example, holding rails, kerb and median crossings, ramps)			N/A
Are adequate hand rails provided where necessary? (for example, on bridges, ramps)			N/A
Is signing about pedestrians near schools adequate and effective?			N/A
Is signing about pedestrians near any hospital adequate and effective?			N/A

Issue	Yes	No	Comment
Is the distance from the stop line to a cross walk sufficient for truck drivers to see pedestrians?			N/A
6.8.3 Cyclists			
Is the pavement width adequate for the number of cyclists using the route?	✓		
Is the bicycle route continuous? (i.e. free of squeeze points or gaps)	✓		
Are drainage pit grates bicycle safe?	✓		
6.8.4 Public transport			
Are bus stops safely located with adequate visibility and clearance to the traffic lane?	✓		
Are bus stops in rural areas signposted in advance?	✓		
Are shelters and seats located safely to ensure that sight lines are not impeded? Is clearance to the road adequate?			N/A
Is the height and shape of the kerb at bus stops suitable for pedestrians and bus drivers?			N/A
6.9 Bridges and culverts			
6.9.1 Design features			
Are bridges and culverts the full formation width?			N/A
Are bridge and culvert carriageway widths consistent with approach conditions?			N/A
Is the approach alignment compatible with the 85th percentile travel speed?			N/A
Have warning signs been erected if either of the above two conditions (i.e. width and speed) are not met?			N/A
6.9.2 Crash barriers			
Are there suitable traffic barriers on bridges and culverts and their approaches to protect errant vehicles?			N/A
Is the connection between barrier and bridge safe?			N/A
Is the bridge free of kerbing that would reduce the effectiveness of barriers or rails?			N/A

Issue	Yes	No	Comment
6.9.3 Miscellaneous			
Are pedestrian facilities on the bridge appropriate and safe?			N/A
Is fishing from the bridge prohibited? If not, has provision been made for safe fishing?			N/A
Does delineation continue over the bridge?			N/A
6.10 Pavement			
6.10.1 Pavement defects			
Is the condition of the pavement edges satisfactory?	✓		
Is the transition from pavement to shoulder free of dangerous edge drop offs?	✓		
Is the pavement free of defects (for example, excessive roughness or rutting, potholes, loose material, etc.) that could result in safety problems (for example, loss of steering control)?	✓		
6.10.2 Skid resistance			
Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades and approaches to intersections?			N/A
Has skid resistance testing been carried out where necessary?			N/A
6.10.3 Ponding			
Is the pavement free of areas where ponding or sheet flow of water could contribute to safety problems?			N/A
6.10.4 Loose stones/material			
Is the pavement free of loose stones and other material?	✓		
6.11 Parking			
6.11.1 General issues			
Are the provisions for, or restrictions on, parking satisfactory in relation to traffic safety?			N/A
Is the frequency of parking turnover compatible with the safety of the route?			N/A

Issue	Yes	No	Comment
Is there sufficient parking for delivery vehicles so that safety problems due to double parking do not occur?			N/A
Are parking manoeuvres along the route possible without causing safety problems? (for example, angle parking)			N/A
Is the sight distance at intersections and along the route, unaffected by parked vehicles?			N/A
6.12 Provision for heavy vehicles			
6.12.1 Design issues			
Are overtaking opportunities available for heavy vehicles where volumes are high?			N/A at intersection
Does the route generally cater for the size of vehicle likely to use it?	✓		
Is there adequate manoeuvring room for large vehicles along the route, at intersections, roundabouts, etc.?	✓		
Is access to rest areas and truck parking areas adequate for the size of vehicle expected? (consider acceleration, deceleration, shoulder widths, etc.)	✓		
6.12.2 Pavement/shoulder quality			
Are shoulders sealed at bends to provide additional pavement for long vehicles?			N/A
Is the pavement width adequate for heavy vehicles?	✓		
In general, is the pavement quality sufficient for the safe travel of heavy and oversized vehicles?	✓		
On truck routes, are reflective devices appropriate for truck drivers' eye heights?	✓		
6.13 Floodways and causeways			
6.13.1 Ponding, flooding			
Are all sections of the route free from ponding or flow across the road during wet weather?			N/A
If there is ponding or flow across the road during wet weather, is there appropriate signposting?			N/A
Are floodways and causeways correctly signposted?			N/A

Issue	Yes	No	Comment
6.13.2 Safety of devices			
Are all culverts or drainage structures located outside the clear roadside recovery area?			N/A
If not, are they shielded from the possibility of vehicle collision?			N/A
6.14 Miscellaneous			
6.14.1 Landscaping			
Is landscaping in accordance with guidelines? (for example, clearances, sight distance)			N/A
Will existing clearances and sight distances be maintained following future plant growth?			N/A
Does the landscaping at roundabouts avoid visibility problems?			N/A
6.14.2 Temporary works			
Are all locations free of construction or maintenance equipment that is no longer required?			N/A
Are all locations free of signs or temporary traffic control devices that are no longer required?			N/A
6.14.3 Headlight glare			
Have any problems that could be caused by headlight glare been addressed? (for example, a two-way service road close to main traffic lanes, the use of glare fencing or screening)	✓		
6.14.4 Roadside activities			
Are the road boundaries free of any activities that are likely to distract drivers?	✓		
Are all advertising signs installed so that they do not constitute a hazard?	✓		
6.14.5 Errant vehicles			
Is the roadside furniture on the verges and footways free of damage from errant vehicles that could indicate a possible problem, hazard or conflict at the site?	✓		

Issue	Yes	No	Comment
6.14.6 Other safety issues			
Is the embankment stability safe?	✓		
Is the route free of unsafe overhanging branches?	✓		
Is the route free of visibility obstructions caused by long grass?	✓		
Are any high-wind areas safely dealt with?	✓		
If back-to-back median kerbing is used is it: - adequately delineated? - obvious where it starts? - obvious at intersections? - unlikely to be a hazard to pedestrians?			N/A
6.14.7 Rest areas			
Is the location of rest areas and truck parking areas along the route appropriate?			N/A
Is there adequate sight distance to the exit and entry points from rest areas and truck parking areas at all times of the day?			N/A
6.14.8 Animals			
Is the route free from large numbers of animals? (for example, cattle, sheep, kangaroos, koalas, wombats, etc.)			N/A
If not, is it protected by animal-proof fencing?			N/A
6.14.9 Safety aspects for heavy vehicles not already covered			
Have all other matters which may have a bearing on safety for heavy vehicles been addressed?		✓	Expected growth in heavy vehicle volumes and consequent delays, queuing and increased conflicts are not addressed in existing layout.

APPENDIX 3

Austroads Risk Rating

C. Risk ranking of safety issues

The following tables may be useful to provide an indication of the level of risk and how to respond to it. Determine into which category in Table 4.1 and Table 4.2 the issue best fits. From this select the risk category in Table 4.3 and its suggested treatment approach in Table 4.4. This is not a scientific system and professional judgement should be used. Section 9.3 provides an evidence based approach to prioritising the treatment of works emanating from road safety audits of existing roads.

Table 4.1: How often is the problem likely to lead to a crash?

Frequency	Description
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five or ten years
Improbable	Less often than once every ten years

Table 4.2: What is the likely severity of the resulting crash type?

Severity	Description	Examples
Catastrophic	Likely multiple deaths	High-speed, multi-vehicle crash on a freeway. Car runs into crowded bus stop. Bus and petrol tanker collide. Collapse of a bridge or tunnel.
Serious	Likely death or serious injury	High or medium-speed vehicle/vehicle collision. High or medium-speed collision with a fixed roadside object. Pedestrian or cyclist struck by a car.
Minor	Likely minor injury	Some low-speed vehicle collisions. Cyclist falls from bicycle at low speed. Left-turn rear-end crash in a slip lane.
Limited	Likely trivial injury or property damage only	Some low-speed vehicle collisions. Pedestrian walks into object (no head injury). Car reverses into post.

Table 4.3: The resulting level of risk

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 4.4: Treatment approach

Risk	Suggested treatment approach
Intolerable	Must be corrected.
High	Should be corrected or the risk significantly reduced, even if the treatment costs is high.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
Low	Should be corrected or the risk reduced, if the treatment cost is low.

D. Implementing the agreed changes

Once the corrective action report has been finalised, the agreed actions need to be implemented. The designer has to develop design changes that address the safety problems. If one is at the pre-opening stage, the actions need to be implemented as soon as possible on site. Temporary warning, delineation or other treatment may be needed until the agreed solution is implemented.

Actions taken should be recorded (for example, description of work, by whom and when). This is to fully close out the road safety audit finding as well as to factual record what works were completed. Reasons for any variations from the proposed action must also be set out in writing.

Framing responses to audit findings or recommendations

When an audit finding or recommendation is not accepted, or is accepted only in part, care should be taken about framing the corrective action report, bearing in mind that it may become a public document in the event of a crash occurring.

Consider the following responses to findings or recommendations made during a pre-opening audit of a project to widen the carriageway of a two-lane, two-way road to provide an overtaking lane:

Safety issues:

‘Fixed objects within the new clear zone. These include a concrete bus shelter and stockpiles of aggregate and box culverts.’ Three sections of guard fence are now nearer the edge line, but do not have safe end treatments.

Findings or recommendations

Take action to reinstate appropriate clear zones for this road. Pay attention to the guard fence.

Responses:

‘The bus shelter was constructed before work on the overtaking lane. It is 4 m from the edge line. The expense of moving it is not considered justified. Most of this highway has objects within the clear zone, for example 3 km to the south there are 150 trees within 1.5 m to 6 m from the edge line. The stockpiles cannot be removed as there are few stockpile sites in the area. All the guard fence was constructed before construction of the overtaking lane. Compared with other guard fence in this region, it is not considered a priority and no action is planned to install the correct end treatment.’

APPENDIX 4

PHOTOGRAPHS



1. Martin Road view north



1A. Martin Road view west



2. Elizabeth Drive eastbound approach



2A.



3. Elizabeth Drive westbound approach



3A. Elizabeth Drive



4. Martin Road view south

**Elizabeth Drive and Martin Road Intersection at
Badgerys Creek**

Options Report for Upgrade of Intersection Controls

**ELIZABETH DRIVE/MARTIN ROAD
INTERSECTION
AT
BADGERYS CREEK**

**OPTIONS REPORT FOR UPGRADE OF
INTERSECTION CONTROLS**

Ref. 19010r

February 2019

Prepared By



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2.0 BACKGROUND	1
3.0 ROAD SAFETY AUDIT	2
4.0 ASSESSMENT OF INTERSECTION UPGRADE OPTIONS	2
4.1 Timing and Options	2
4.2 Design Volumes	3
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4.5 Assessment of Roundabout Option	3
4.6 Assessment of Traffic Signal Option	4
5.0 CONCLUSIONS	7

FIGURES

Figure 1	Intersection of Elizabeth Drive and Martin Road Badgerys Creek
Figure 2	Western Sydney Aerotropolis Stage 1 Structure Plan
Figure 3	Future 2026 AM and PM Intersection Design Volumes
Figures 4A-D	Conceptual Layout for Traffic Signal Control

REFERENCES

APPENDICES

Appendix 1	SIDRA Modelling Results
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1.0 INTRODUCTION

This report has details of the results of an investigation into available options to upgrade the intersection controls at the intersection of Elizabeth Drive and Martin Road at Badgerys Creek. **Figure 1** refers.

A separate Road Safety Audit report, as well as a Traffic Signal Warrant report has also been prepared for the Elizabeth Drive/Martin Road intersection. Both of these reports have been used to prepare this option report for the intersection upgrade works.

2.0 BACKGROUND

The intersection is located adjacent the new Western Sydney Airport at Badgerys Creek.

There are significant land use changes planned adjacent the new airport. The Western Sydney Aerotropolis Stage 1 Plan has been developed, to guide future development growth adjacent the airport. See **Figure 2**.

In addition, known proposed developments include CSR's Advanced Manufacturing Hub Modifications 3 and 4 in Martin Road and a new industrial development by Mirvac on land on the northern side of Elizabeth Drive opposite Martin Road. The Mirvac development based on RMS advice is proposing a new Access Road opposite Martin Road creating a cross junction intersection with Elizabeth Drive and Martin Road.

Future traffic volume increases at the intersection between 2019 and 2026 will be generated by the above developments as well as, construction traffic associated with Western Sydney Airport and other land use changes.

The existing Elizabeth Drive/Martin Road is a T-junction intersection under Give Way sign control in Martin Road. Auxiliary left and right turning lanes are provided in Elizabeth Drive. The speed limit in Elizabeth Drive is 80km/h.

The traffic assessment reports for CSR Modifications 3 and 4 identified that the existing traffic controls at the Elizabeth Drive/Martin Road with the intersection operating as a T-junction would be unsatisfactory, due to the level of vehicle delay for the right turn out of Martin Road. The assessment found the vehicle delays for the right turn out of Martin Road would be a Level of Service E/F in the weekday peak periods. The assessments recommended an intersection upgrade, which included new traffic signals.

At a meeting between CSR and its consultants and the RMS on 5 December 2018 to discuss the intersection upgrading for the CSR development, the RMS requested documentation showing that a warrant for traffic signals was met. The RMS also advised CSR about the Mirvac development and the proposed access off Elizabeth Drive opposite Martin Road.



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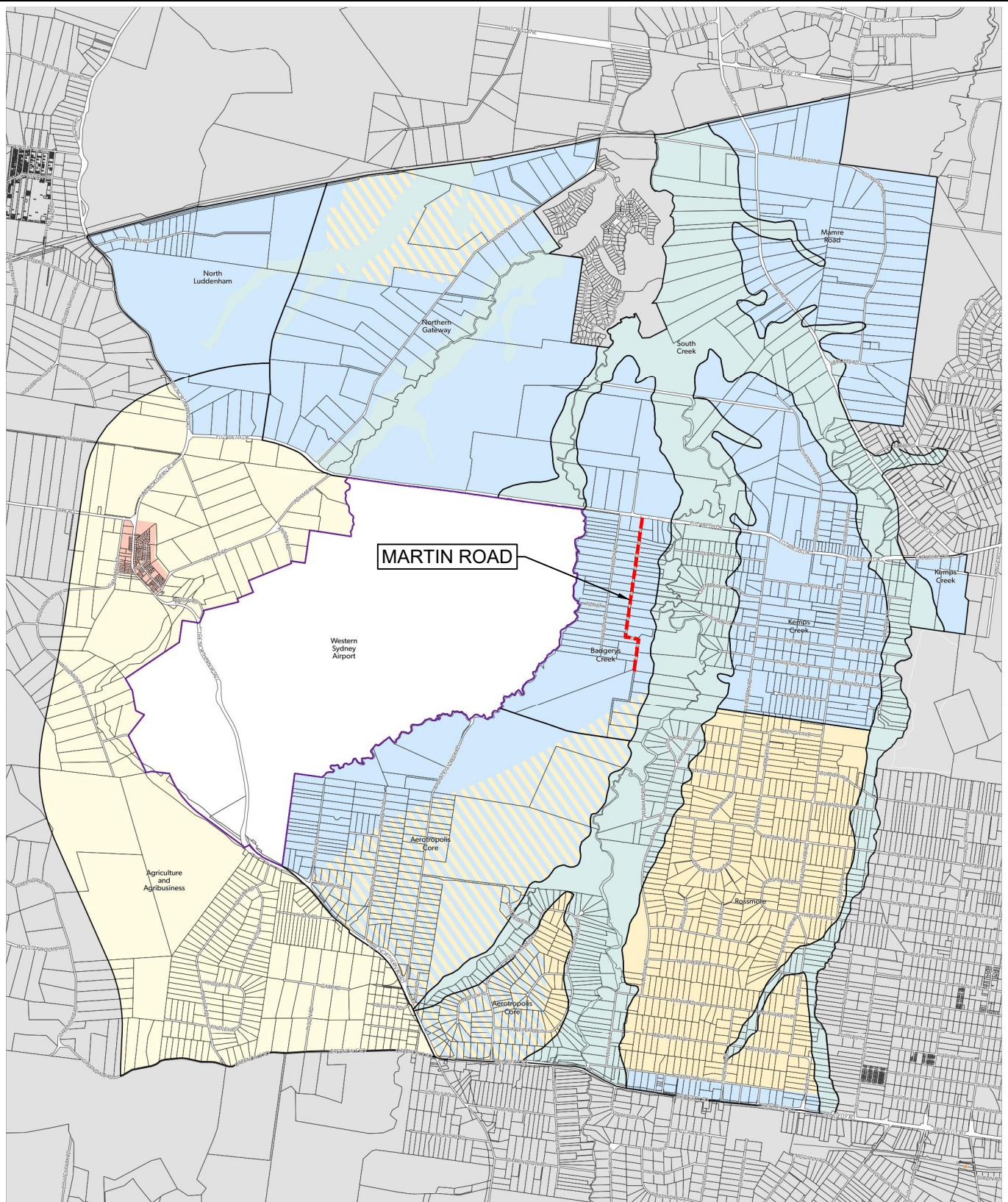
FIGURE 1

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERYS CREEK

ELIZABETH DRIVE/MARTIN ROAD EXISTING INTERSECTION

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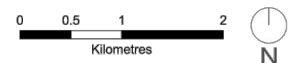
Please note that the precinct boundaries are for strategic planning purposes. The boundaries do not indicate future zone boundaries or commitments to the provision of infrastructure.



- Western Sydney Airport
- Precinct Boundary
- Cadastre Lot

- Agricultural
- Luddenham Village
- Flexible Employment
- Urban Land

- Non Urban Land
- Mixed Flexible Employment & Urban Land



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FIGURE 2

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERYS CREEK

WESTERN SYDNEY AEROTROPOLIS STAGE 1 STRUCTURE PLAN

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3.0 ROAD SAFETY AUDIT

Tranpact Pty Ltd was engaged to undertake an independent road safety audit and safety review of the Elizabeth Drive/Martin Road intersection, with regard to the future traffic volumes increases at the intersection associated with the new developments and the planned changes.

The Audit identified that the existing Give Way sign control should be upgraded due to a forecast increase in vehicle delays and queuing. In particular, right turning vehicles out of Martin Road would experience significant delays (Level of Service F).

Given the limited SISD for eastbound traffic on Elizabeth Drive and the likelihood that delayed trucks turning right from Martin Road will utilise inadequate gaps in traffic, the Audit ranked this road safety risk as “intolerable”, meaning the situation “must be corrected” as a priority.

The road safety audit and safety review report recommended that the traffic controls at the intersection be upgraded to cater for the future traffic volumes.

4.0 ASSESSMENT OF INTERSECTION UPGRADE OPTIONS

4.1 Timing and Options

The RMS are proposing to upgrade Elizabeth Drive at Badgerys Creek, but no details are publicly available on what the upgrade works will be. Based on the existing volumes in Elizabeth Drive and the amount of future development as well as Sydney Western Airport, Elizabeth Drive may ultimately require upgrading to a six lane divided road.

Recent discussions with RMS has indicated the upgrade proposes to include a 4 lane divided road with provision for a future 6 lanes. However there is no confirmed date for the upgrade works and no funding.

Therefore, the intersection upgrade of Elizabeth Drive/Martin Road for the proposed developments will be an interim arrangement until such time as the RMS upgrades Elizabeth Drive.

The interim intersection would require sufficient capacity until 2026 (which is the year the M12 is planned to be operational). However, the upgrade works would need to be completed in 2021 to cater for CSR's Modification 3 and 4 developments and Stage 1 of the Mirvac development.

The Tranpact Pty Ltd road safety audit and safety review identified potential options listed below, although Options 1 and 2 were ruled out by the auditors as unsuitable.

- i. Eliminating the right turn out of Martin Road (i.e. a median);
- ii. Seagull channelization;
- iii. A roundabout;
- iv. Signalisation.

Based on this, the provision of a roundabout or traffic signals are the available options for further investigation.

4.2 Design Volumes

Figure 3 shows the forecasted 2026 weekday AM and PM peak hour volumes at the intersection which includes:

- Existing traffic volumes at the intersection;
- Background traffic growth and airport construction traffic in Elizabeth Drive;
- CSR's Modifications 4 traffic volumes (i.e. Mods 3 and 4), plus other approved developments in Martin Road;
- Mirvac's development traffic for Stages 1 and 2.

4.4 Constraints

The existing road reserve in Elizabeth Drive is 40 metres wide. The road reserve in Martin Road is 20 metres wide with 3 metre corner splays at Elizabeth Drive.

Subject to design requirements it would be desirable if the interim intersection could be constructed within the existing road reserves of these roads. Other constraints include adjoining property boundaries of the Suez land to the Mirvac site on the northern side of Elizabeth Drive, west of Martin Road.

4.5 Assessment of Roundabout Option

SIDRA traffic modelling of a single lane circulating roundabout showed that a single lane roundabout would not have sufficient capacity to cater for the design volumes shown in **Figure 3** and would be oversaturated. Therefore, based on the design volumes, a two lane circulating roundabout would be required with two approach and departure lanes in Elizabeth Drive, and two approach lanes in the Mirvac Access Road and in Martin Road. The two lane roundabout option has been investigated.

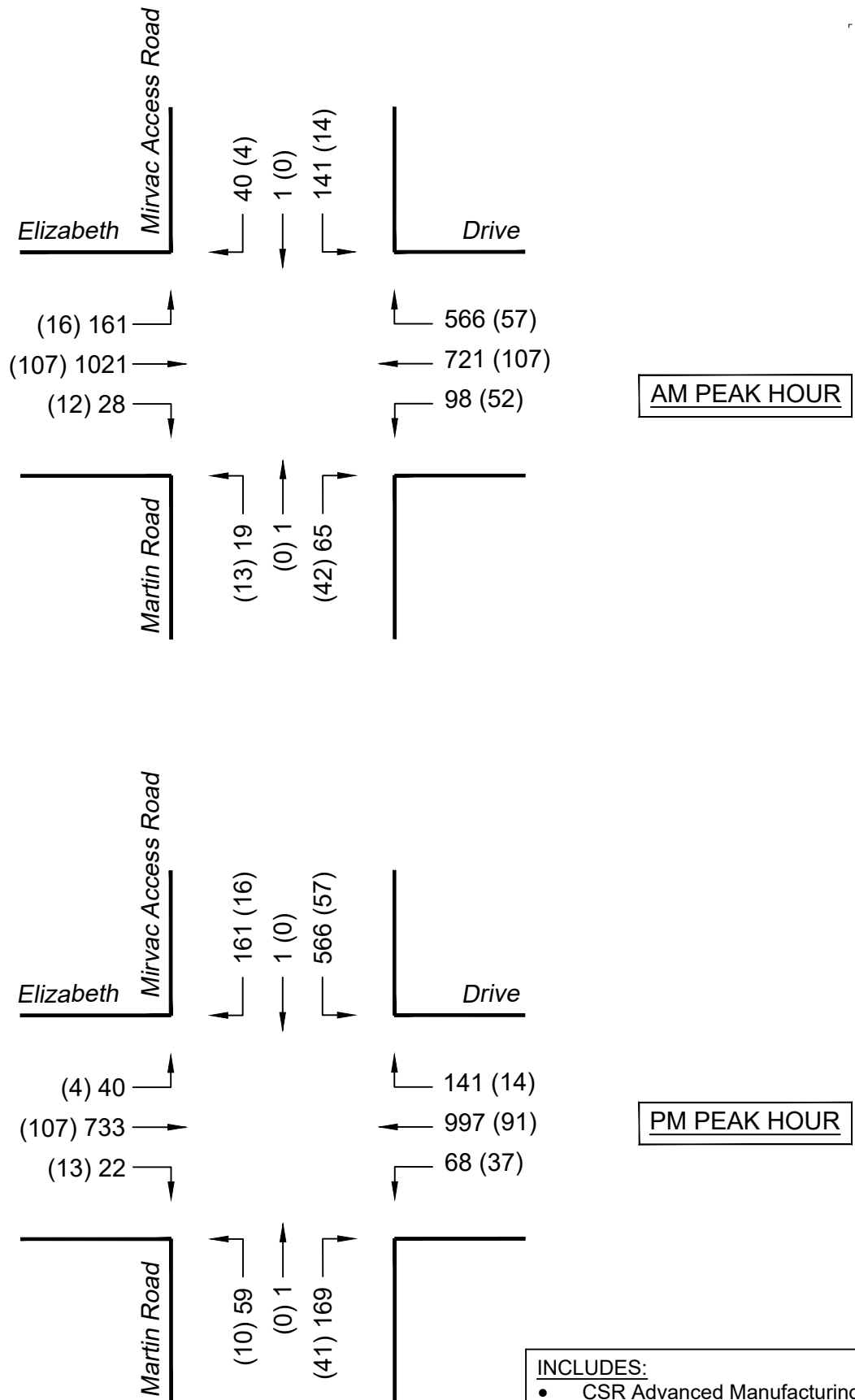
A preliminary review of the design requirements for a two lane roundabout in an 80km/h speed zone (i.e. the speed limit in Elizabeth Drive) based on Austroads Guide to Road Design Part 4B: Roundabouts, is that a minimum road reserve of 67.6 metres in Elizabeth Drive would be required to accommodate a 2 lane roundabout. This is based on:

- Minimum central island radius of 20 metres (i.e. 40 metre diameter);
- 10.2 metre wide circulating road; and
- Two 3.6 metre wide footpath verges on both sides of Elizabeth Drive.

At this time it is unknown what services will be required in Elizabeth Drive to cater for the future development.

Apart from the large land footprint of the roundabout, other disadvantages of a roundabout include:

- (i) The non provision of safe pedestrian crossing facilities at the intersection (when compared to traffic signals);
- (ii) Conflicts for cyclists using the roundabout, due to high levels of heavy vehicles and circulating traffic;



KEY
 344 TOTAL VEHICLES
 (27) HEAVY VEHICLES

- INCLUDES:**
- CSR Advanced Manufacturing
 - HUB Modifications 3 & 4
 - Mirvac Development Stages 1 & 2

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FIGURE 3

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
 BADGERYS CREEK

FUTURE 2026 AM & PM INTERSECTION DESIGN VOLUMES

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Currently there is limited pedestrian and cycle activity at the intersection, but this will increase with the future planned development, particularly with increased bus services using Elizabeth Drive and the overall levels of future development that is planned for Badgerys Creek.

- (iii) The staging difficulties of operating the two lane roundabout when ultimate road construction works are being undertaken; and
- (iv) A two lane roundabout may not have sufficient capacity as volumes increase in Elizabeth Drive. In this regard roundabouts typically have less capacity than intersections controlled by traffic signals.

Roundabouts are suited to intersections where there is a balance between right turn movements on the major road, as this creates gaps in the opposing traffic flows that allows the minor road movements to enter the roundabout. Where there are large volume right turn movements at roundabouts in one approach, this right turn can dominate the opposing through movement.

SIDRA traffic modelling for the 2 lane roundabout based on the volumes in **Figure 3**, shows that this will occur in the AM peak hour in 2026 where the right turn movement from Elizabeth Drive into the Mirvac Access Road which will number 566vph dominates the eastbound traffic in the western approach of Elizabeth Drive. The western approach of Elizabeth Drive will have a Level of Service F operation with long vehicle delays and long queues.

Signalising the roundabout may distribute vehicle delays (through the metering of approach volumes in the eastern approach), however this would be counter productive as the modelling shows that a 2 lane roundabout will not have sufficient capacity for the 2026 traffic volumes, or for the future volumes up to 2031, likely to use the intersection.

Based on the above a roundabout is ruled out as an option as it:

- (i) will not have sufficient future intersection capacity;
- (ii) does not cater for safe pedestrian crossing facilities;
- (iii) will increase conflicts with cyclists using Elizabeth Drive and the intersection; and
- (iv) Requires a large land footprint.

The SIDRA modelling outputs for the 2 lane roundabout option are contained in Appendix 1.

4.6 Assessment of Traffic Signal Option

Traffic signals are the recommended option based on a conventional intersection layout.

Traffic signals would/can:

- Provide for future pedestrian and cyclist activity at the intersection;
- Provide sufficient capacity at the intersection based on a smaller intersection footprint; and
- Are relatively simple to keep operating when the future road upgrading occurs in Elizabeth Drive.

As an interim option, traffic signals are considered to be a better option for the intersection upgrade, when compared to a roundabout.

A separate Traffic Signal Warrant Report has identified that based on the range of factors taken into account for the provision of traffic signals including future traffic volumes, vehicle delays, safety and future planning that the Elizabeth Drive/Martin Road/Mirvac Access Road intersection would meet the RMS traffic signal warrant.

Figures 4A-D show a conceptual intersection layout for traffic signals which would cater for the design volumes shown in **Figure 3**.

The conceptual layout includes:

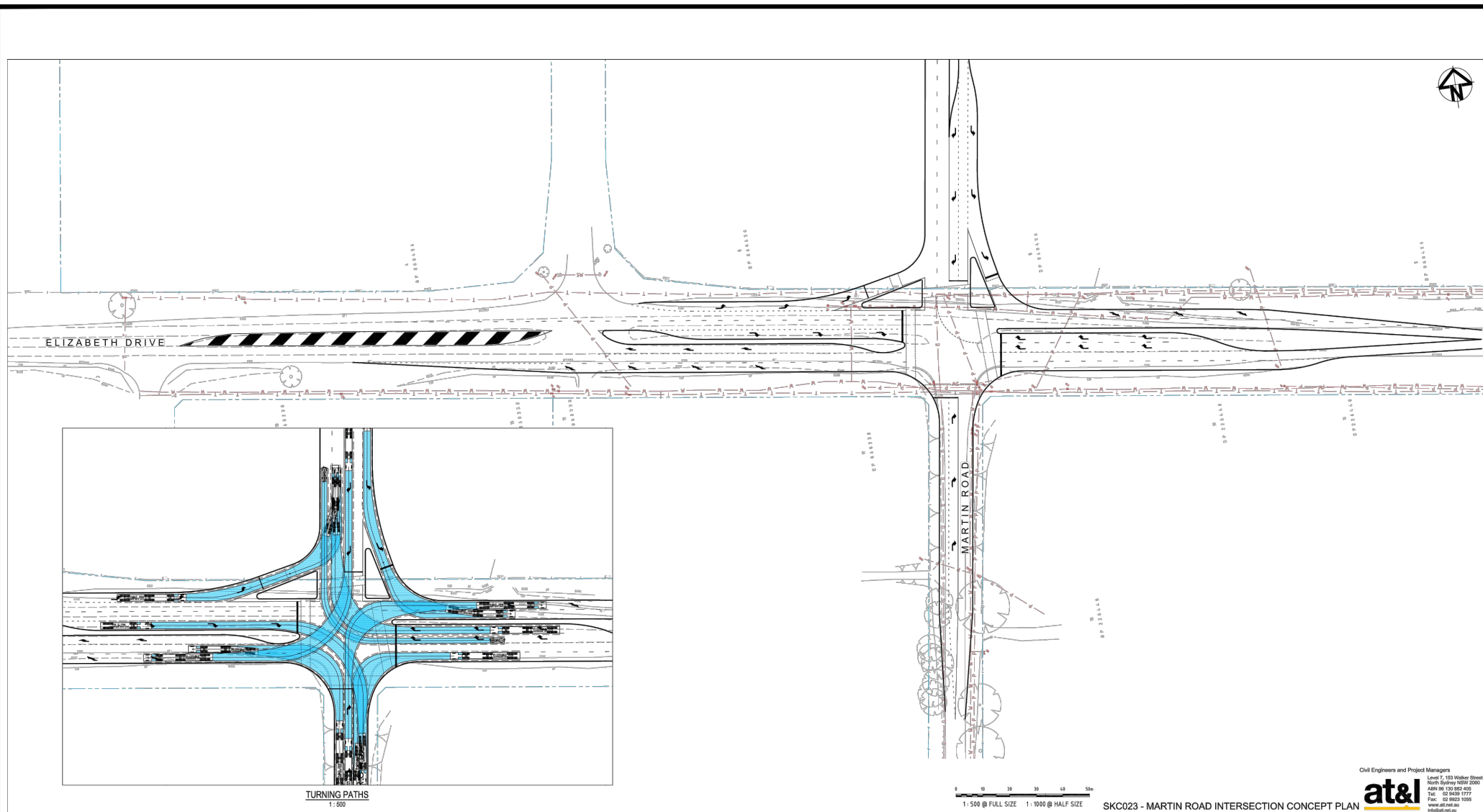
- Two through lanes in eastern approach (left left lane shared/through lane) in Elizabeth Drive and two right turn bays into Mirvac site. Two (2) departure lanes are provided in Elizabeth Drive on the western side of the intersection.
- Two through lanes in western approach of Elizabeth Drive plus a left turn slip lane and a right turn bay. Two (2) departure lanes are provided in Elizabeth Drive on the eastern side of the intersection.
- A minimum 2 metre wide median in the eastern approach of Elizabeth Drive and a variable width (2 to 4 metres) in the western approach.
- Two approach lanes in Martin Road and one (1) departure lane.
- Three approach lanes in the Mirvac Access Road which includes a left turn slip lane; and 2 departure lanes.

This layout requires considerably less road space than the roundabout option and provides safe facilities for all road users.

The SIDRA modelling for the intersection incorporated a Single Diamond Overlap phasing (SDO) with signalised pedestrian on all legs. The SIDRA modelling shows that this layout under traffic signal control would have a satisfactory operation in the AM and PM peak hours (Level of Service C operation in the AM and PM peak hours in 2026).

While the above modelling incorporated the left turn slip lanes in the phasing and being under signal control, these signalised crossings on the slip lanes would probably operate as independent signalised crossings with give way control on the slip lanes. The modelling for the option with the slip lanes operating as independent signalised crossings shows a Level of Service B/C operation.

Additional traffic modelling for 2031 based on estimated future volumes in Elizabeth Drive which include background traffic growth, but no airport construction traffic



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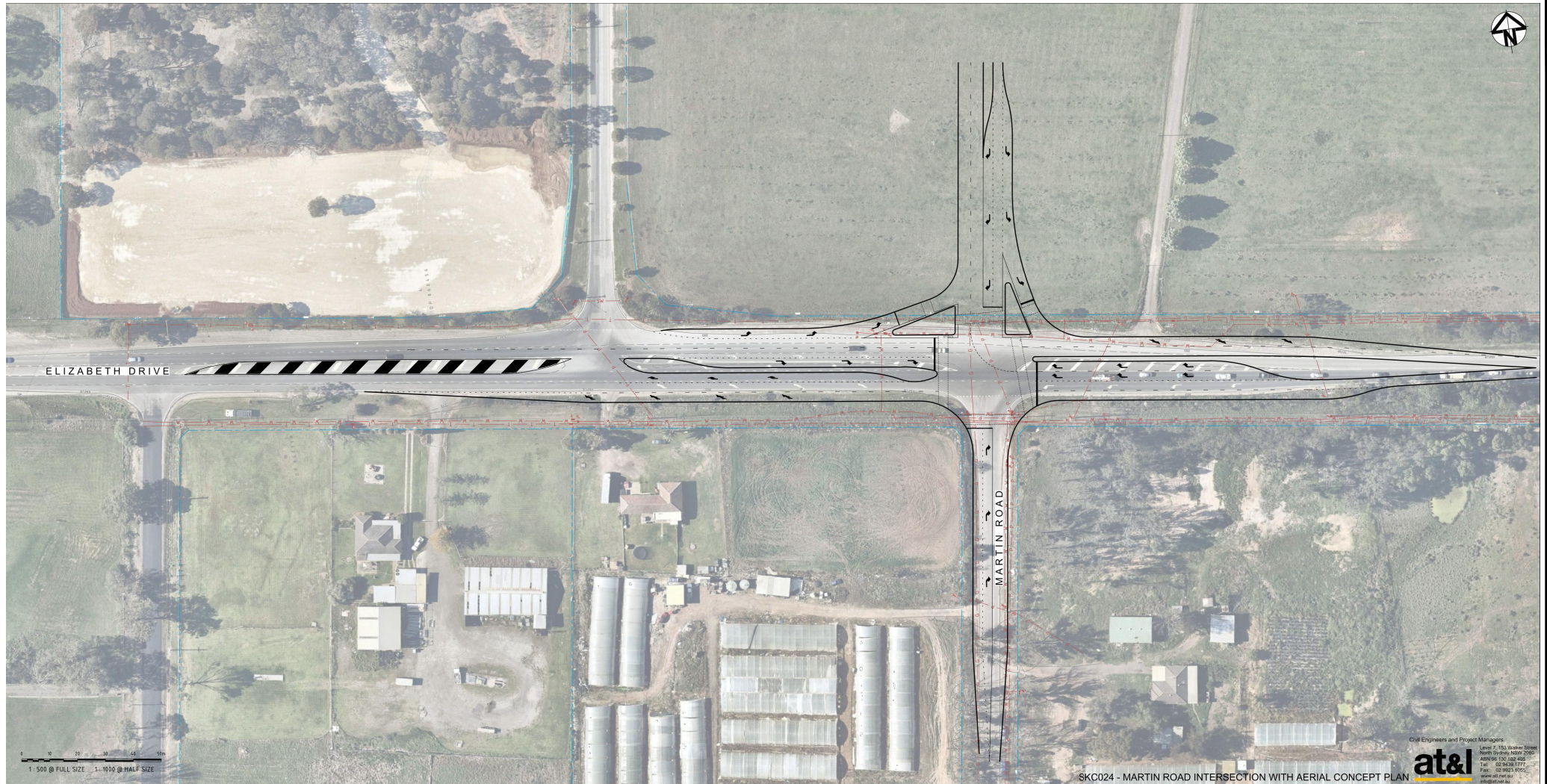
FIGURE 4A

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERYS CREEK

**CONCEPT INTERSECTION LAYOUT AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL**

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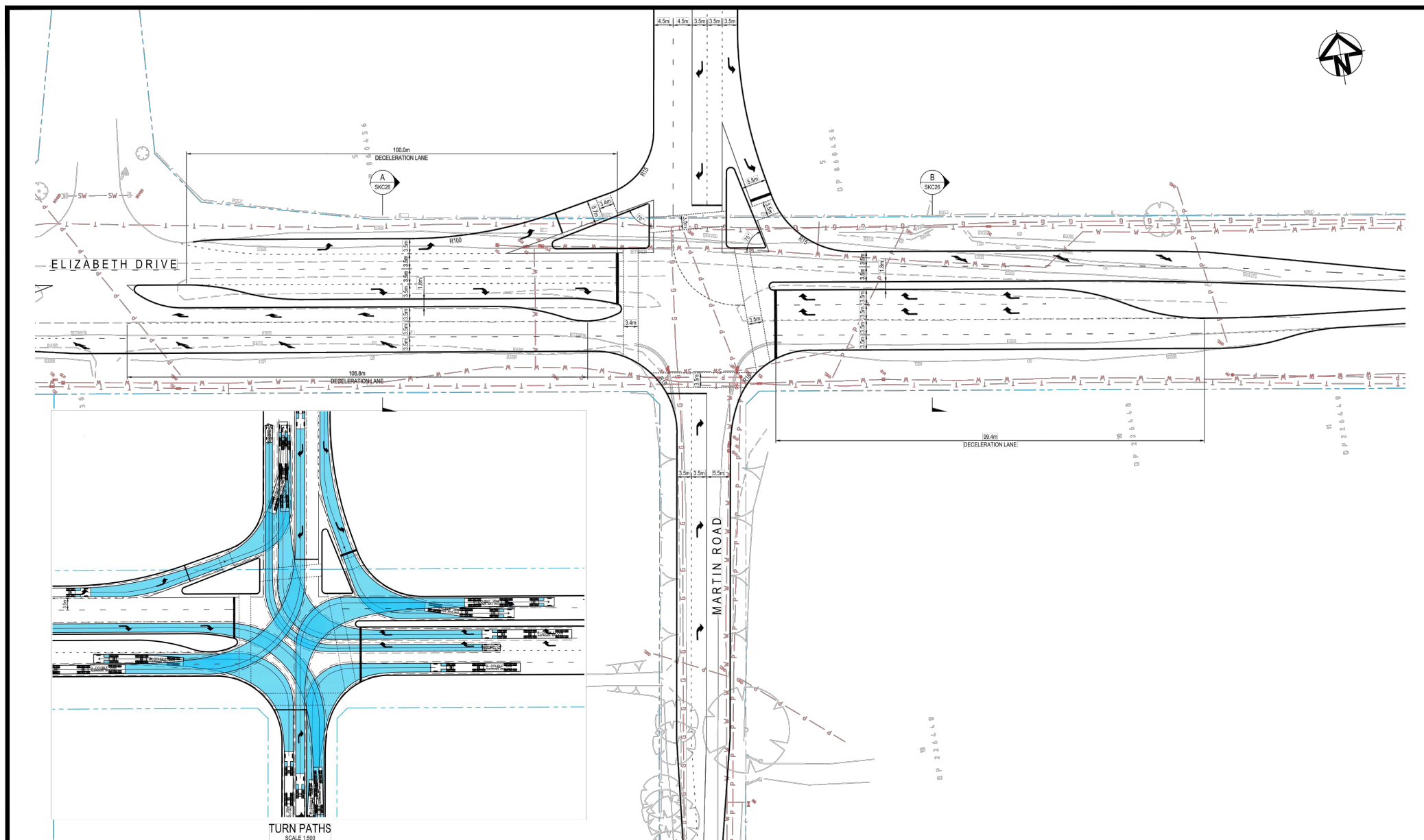
FIGURE 4B

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERYS CREEK

**CONCEPT INTERSECTION LAYOUT WITH AERIAL AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL**

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FIGURE 4C

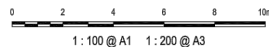
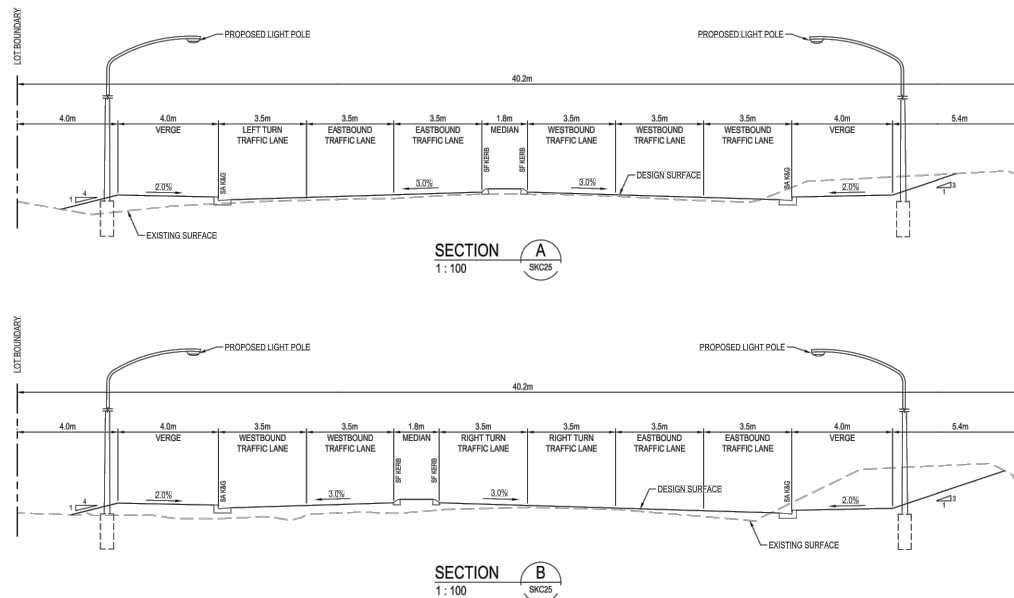
ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERY'S CREEK

**CONCEPT INTERSECTION LAYOUT WITH AERIAL AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL**

SITE WORKS

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FIGURE 4D

ELIZABETH DRIVE / MARTIN ROAD INTERSECTION
BADGERYS CREEK

**CONCEPT INTERSECTION LAYOUT WITH AERIAL AT
ELIZABETH DRIVE/MARTIN ROAD/MIRVAC ACCESS RD
WITH TRAFFIC SIGNAL CONTROL**

TYPICAL SECTIONS

JOB NO.19010

25/02/19

indicates that a Level of Service C operation in the AM and PM peak hours should be retained beyond 2026.

SIDRA modelling outputs for the traffic signal operation are contained in Appendix 1.

The final intersection layout would need to be confirmed when Mirvac and their traffic consultant Ason Group finalise the traffic assessment report for Stages 1 and 2 of the Mirvac development and submit the development application.

Mirvac will consult with the RMS regarding the final intersection layout for the cross junction intersection as part of finalising its development application.

5.0 CONCLUSIONS

In summary it is concluded that the provision of traffic signals with associated upgrading work at the Elizabeth Drive/Martin Road intersections is the best option to safely cater for the future higher traffic volumes that will use the intersection, including those volumes generated by the CSR and Mirvac development proposals.

REFERENCES

1. Traffic Signal Warrant Report for Elizabeth Drive/Martin Road Intersection, Badgerys Creek. Transport and Urban Planning Pty Ltd February 2019.
2. Road Safety Audit and Safety Review of Elizabeth Drive and Martin Road Badgerys Creek. Tranpact Pty Ltd, 30 January 2019.
3. Western Sydney Aerotropolis Stage 1 Plan. Department of Planning and Environment, August 2018.
4. Austroads Guide to Road Design Part 4B; Roundabouts.
5. Traffic Volumes from Ason Group for Mirvac Development, 18 January 2018.
6. Traffic Volumes for CSR's Badgerys Creek Advanced Manufacturing Hub Modification 4. Traffic Assessment Report 235 Martin Road Badgerys Creek.

APPENDIX 1

SIDRA Modelling Results

SITE LAYOUT

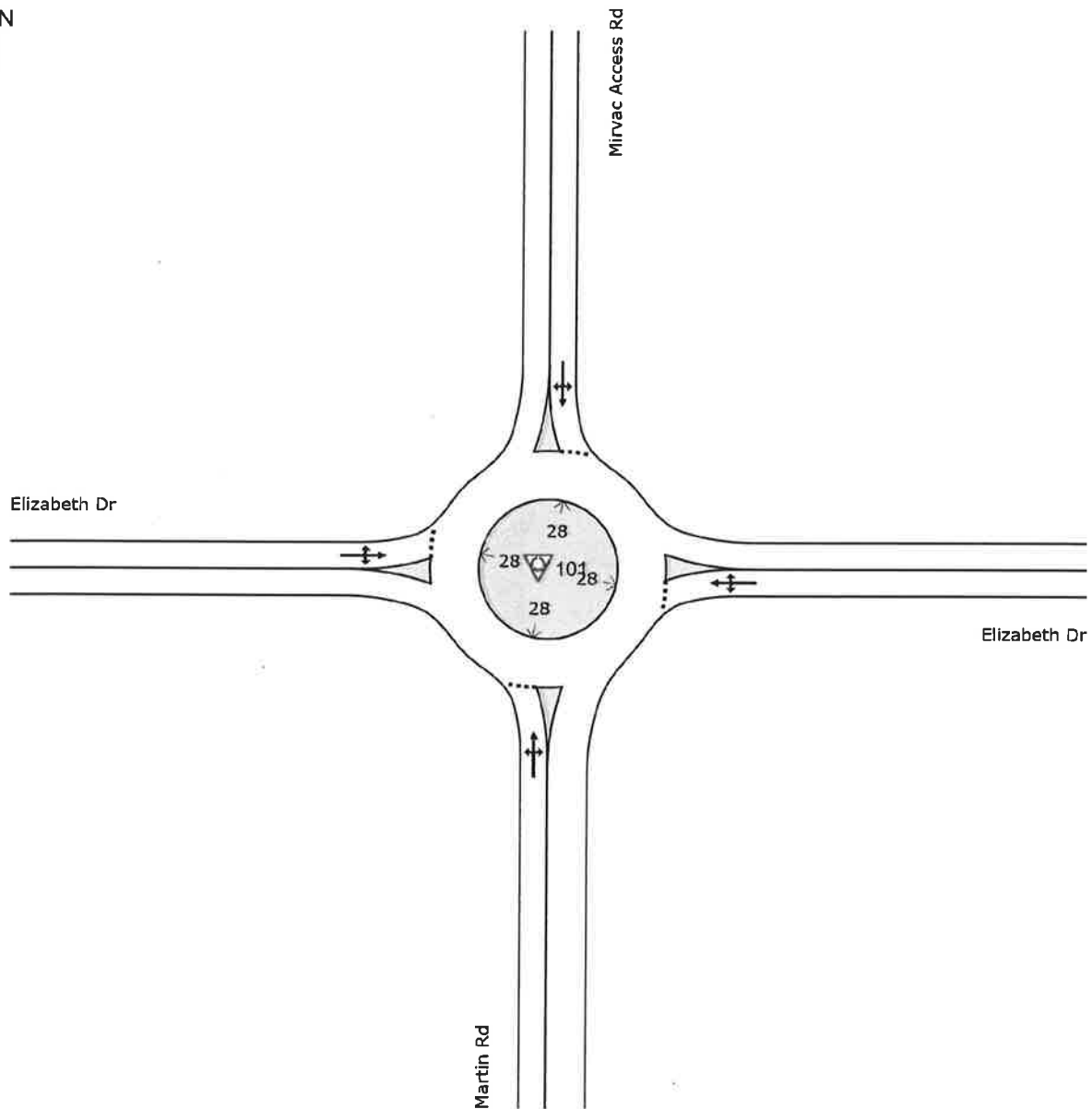


Site: 101 [2026 AM Mod 3&4 & MirvacGA - 1 Lane RAB]

1 Lane RAB

Site Category: (None)

Roundabout



MOVEMENT SUMMARY

 Site: 101 [2026 AM Mod 3&4 & MirvacGA - 1 Lane RAB]

1 Lane RAB
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	19	68.4	0.798	110.3	LOS F	6.6	109.7	1.00	1.41	1.90	20.2
2	T1	1	0.0	0.798	99.2	LOS F	6.6	109.7	1.00	1.41	1.90	21.7
3	R2	65	64.6	0.798	115.3	LOS F	6.6	109.7	1.00	1.41	1.90	20.2
Approach		85	64.7	0.798	114.0	LOS F	6.6	109.7	1.00	1.41	1.90	20.2
East: Elizabeth Dr												
4	L2	98	53.1	1.113	216.3	LOS F	245.1	2288.8	1.00	1.81	3.73	13.8
5	T1	721	14.8	1.113	215.0	LOS F	245.1	2288.8	1.00	1.81	3.73	14.1
6	R2	566	10.1	1.113	220.4	LOS F	245.1	2288.8	1.00	1.81	3.73	14.0
Approach		1385	15.6	1.113	217.3	LOS F	245.1	2288.8	1.00	1.81	3.73	14.0
North: Mirvac Access Rd												
7	L2	141	9.9	0.310	8.7	LOS A	2.1	17.6	0.83	0.85	0.83	54.0
8	T1	1	0.0	0.310	8.3	LOS A	2.1	17.6	0.83	0.85	0.83	52.9
9	R2	40	10.0	0.310	14.3	LOS A	2.1	17.6	0.83	0.85	0.83	54.9
Approach		182	9.9	0.310	9.9	LOS A	2.1	17.6	0.83	0.85	0.83	54.2
West: Elizabeth Dr												
10	L2	161	9.9	1.944	1713.1	LOS F	753.8	6538.1	1.00	15.56	43.06	2.1
11	T1	1021	10.5	1.944	1713.6	LOS F	753.8	6538.1	1.00	15.56	43.06	2.1
12	R2	28	42.9	1.944	1720.8	LOS F	753.8	6538.1	1.00	15.56	43.06	2.1
Approach		1210	11.2	1.944	1713.7	LOS F	753.8	6538.1	1.00	15.56	43.06	2.1
All Vehicles		2862	14.8	1.944	833.7	LOS F	753.8	6538.1	0.99	7.55	20.12	4.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay per movement.
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 Site: 101 [2026 PM Mod 3&4 & MirvacGA - 1 Lane RAB]

1 Lane RAB
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	59	16.9	1.466	910.7	LOS F	104.0	1075.3	1.00	5.26	11.85	3.8
2	T1	1	0.0	1.466	908.9	LOS F	104.0	1075.3	1.00	5.26	11.85	3.8
3	R2	169	24.3	1.466	917.1	LOS F	104.0	1075.3	1.00	5.26	11.85	3.8
Approach		229	22.3	1.466	915.4	LOS F	104.0	1075.3	1.00	5.26	11.85	3.8
East: Elizabeth Dr												
4	L2	68	54.4	1.012	47.9	LOS D	72.9	639.3	1.00	1.11	1.94	36.4
5	T1	997	9.1	1.012	46.0	LOS D	72.9	639.3	1.00	1.11	1.94	39.1
6	R2	141	9.9	1.012	51.7	LOS D	72.9	639.3	1.00	1.11	1.94	37.7
Approach		1206	11.8	1.012	46.7	LOS D	72.9	639.3	1.00	1.11	1.94	38.7
North: Mirvac Access Rd												
7	L2	566	10.1	2.015	1847.2	LOS F	475.9	4047.0	1.00	13.56	33.20	1.9
8	T1	1	0.0	2.015	1846.8	LOS F	475.9	4047.0	1.00	13.56	33.20	1.9
9	R2	161	9.9	2.015	1852.8	LOS F	475.9	4047.0	1.00	13.56	33.20	1.9
Approach		728	10.0	2.015	1848.5	LOS F	475.9	4047.0	1.00	13.56	33.20	1.9
West: Elizabeth Dr												
10	L2	40	10.0	0.811	12.6	LOS A	12.8	119.9	0.93	0.90	1.18	54.9
11	T1	733	14.6	0.811	13.3	LOS A	12.8	119.9	0.93	0.90	1.18	58.6
12	R2	22	59.1	0.811	21.1	LOS B	12.8	119.9	0.93	0.90	1.18	54.7
Approach		795	15.6	0.811	13.5	LOS A	12.8	119.9	0.93	0.90	1.18	58.3
All Vehicles		2958	13.2	2.015	548.5	LOS F	475.9	4047.0	0.98	4.44	10.20	6.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay per movement.
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

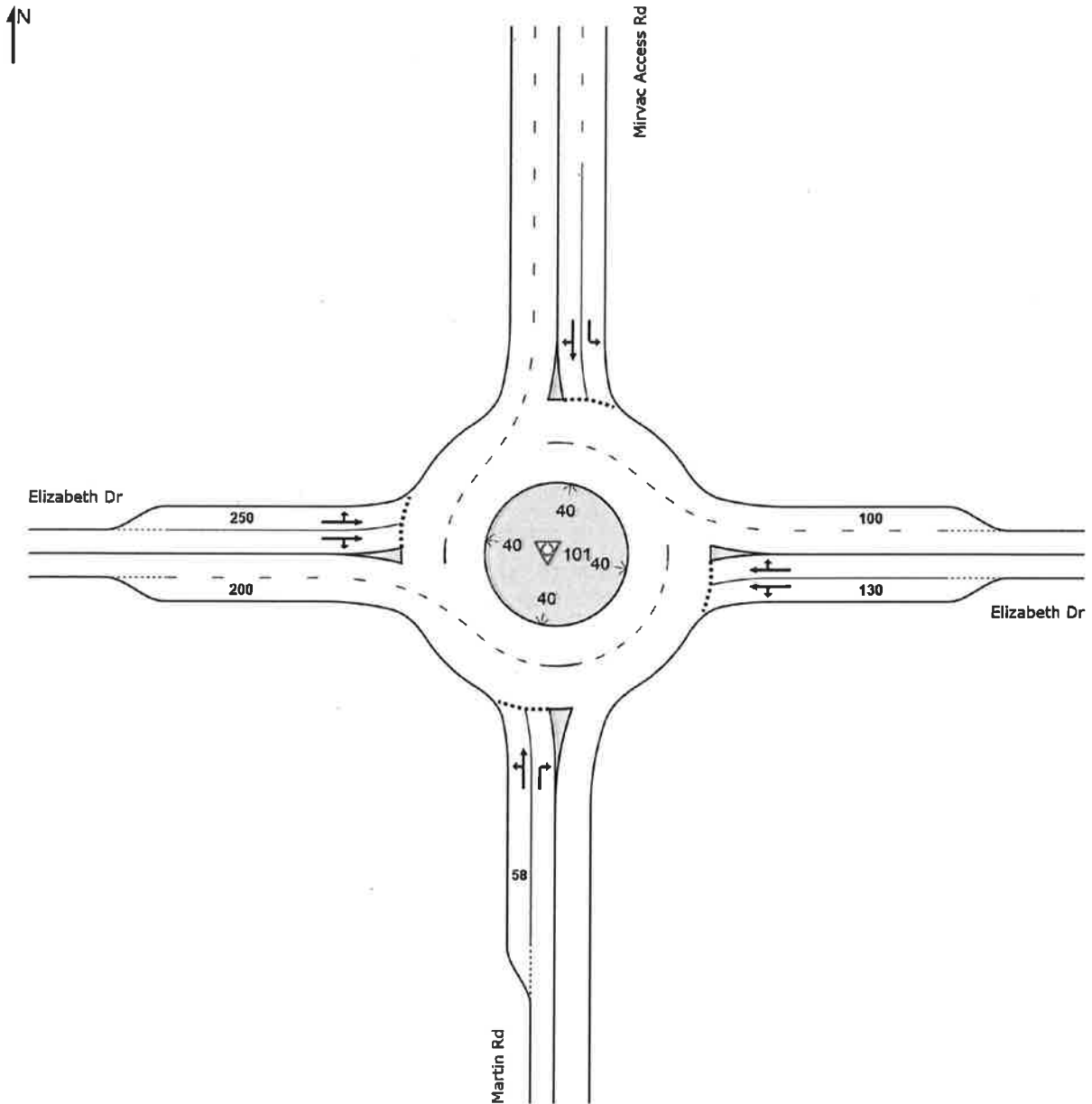
SITE LAYOUT

 Site: 101 [2026 AM Mod 3&4 & MirvacGA]

New Site

Site Category: (None)

Roundabout



MOVEMENT SUMMARY

 Site: 101 [2026 AM Mod 3&4 & MirvacGA]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	19	68.4	0.093	19.4	LOS B	0.4	6.4	0.82	0.89	0.82	40.9
2	T1	1	0.0	0.093	11.2	LOS A	0.4	6.4	0.82	0.89	0.82	47.9
3	R2	65	64.6	0.301	27.7	LOS B	1.3	22.0	0.85	0.98	0.94	38.9
Approach		85	64.7	0.301	25.7	LOS B	1.3	22.0	0.85	0.96	0.91	39.4
East: Elizabeth Dr												
4	L2	98	53.1	0.564	6.8	LOS A	5.0	50.0	0.39	0.47	0.39	59.2
5	T1	721	14.8	0.564	6.4	LOS A	5.0	43.3	0.39	0.49	0.39	64.4
6	R2	566	10.1	0.564	13.2	LOS A	5.0	43.3	0.38	0.60	0.38	59.5
Approach		1385	15.6	0.564	9.2	LOS A	5.0	50.0	0.39	0.54	0.39	61.9
North: Mirvac Access Rd												
7	L2	141	9.9	0.406	13.1	LOS A	2.4	20.3	0.89	0.97	1.01	52.1
8	T1	1	0.0	0.118	9.6	LOS A	0.6	5.2	0.83	0.94	0.83	49.7
9	R2	40	10.0	0.118	16.9	LOS B	0.6	5.2	0.83	0.94	0.83	51.6
Approach		182	9.9	0.406	13.9	LOS A	2.4	20.3	0.87	0.97	0.97	52.0
West: Elizabeth Dr												
10	L2	161	9.9	0.806	23.8	LOS B	11.8	100.5	1.00	1.27	1.82	48.1
11	T1	1021	10.5	1.049	100.8	LOS F	71.9	630.8	1.00	2.61	5.78	25.3
12	R2	28	42.9	1.049	153.6	LOS F	71.9	630.8	1.00	3.37	8.01	19.3
Approach		1210	11.2	1.049	91.7	LOS F	71.9	630.8	1.00	2.45	5.30	26.8
All Vehicles		2862	14.8	1.049	44.9	LOS D	71.9	630.8	0.69	1.39	2.52	39.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 Vehicle movement LOS values are based on average delay per movement.
 Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Roundabout Capacity Model: SIDRA Standard.
 SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
 Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 Site: 101 [2026 PM Mod 3&4 & Mirvac GA]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	59	16.9	0.188	13.3	LOS A	0.9	8.5	0.81	0.89	0.81	50.8
2	T1	1	0.0	0.188	11.3	LOS A	0.9	8.5	0.81	0.89	0.81	51.5
3	R2	169	24.3	0.567	28.1	LOS B	3.4	36.5	0.89	1.09	1.27	43.1
Approach		229	22.3	0.567	24.2	LOS B	3.4	36.5	0.87	1.04	1.15	44.8
East: Elizabeth Dr												
4	L2	68	54.4	0.555	8.2	LOS A	4.6	42.3	0.61	0.58	0.61	57.8
5	T1	997	9.1	0.555	7.2	LOS A	4.7	39.2	0.61	0.59	0.61	64.5
6	R2	141	9.9	0.555	14.2	LOS A	4.7	39.2	0.60	0.61	0.60	61.2
Approach		1206	11.8	0.555	8.1	LOS A	4.7	42.3	0.61	0.59	0.61	63.7
North: Mirvac Access Rd												
7	L2	566	10.1	1.165	328.3	LOS F	114.9	977.8	1.00	6.53	16.19	9.5
8	T1	1	0.0	0.333	9.2	LOS A	1.8	15.3	0.80	0.94	0.84	49.9
9	R2	161	9.9	0.333	16.5	LOS B	1.8	15.3	0.80	0.94	0.84	51.8
Approach		728	10.0	1.165	258.9	LOS F	114.9	977.8	0.96	5.29	12.77	11.8
West: Elizabeth Dr												
10	L2	40	10.0	0.374	7.6	LOS A	2.4	21.7	0.61	0.63	0.61	58.9
11	T1	733	14.6	0.486	8.2	LOS A	3.4	32.5	0.64	0.64	0.64	63.4
12	R2	22	59.1	0.486	17.0	LOS B	3.4	32.5	0.67	0.66	0.67	59.6
Approach		795	15.6	0.486	8.4	LOS A	3.4	32.5	0.64	0.64	0.64	63.0
All Vehicles		2958	13.2	1.165	71.1	LOS F	114.9	977.8	0.72	1.80	3.65	30.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

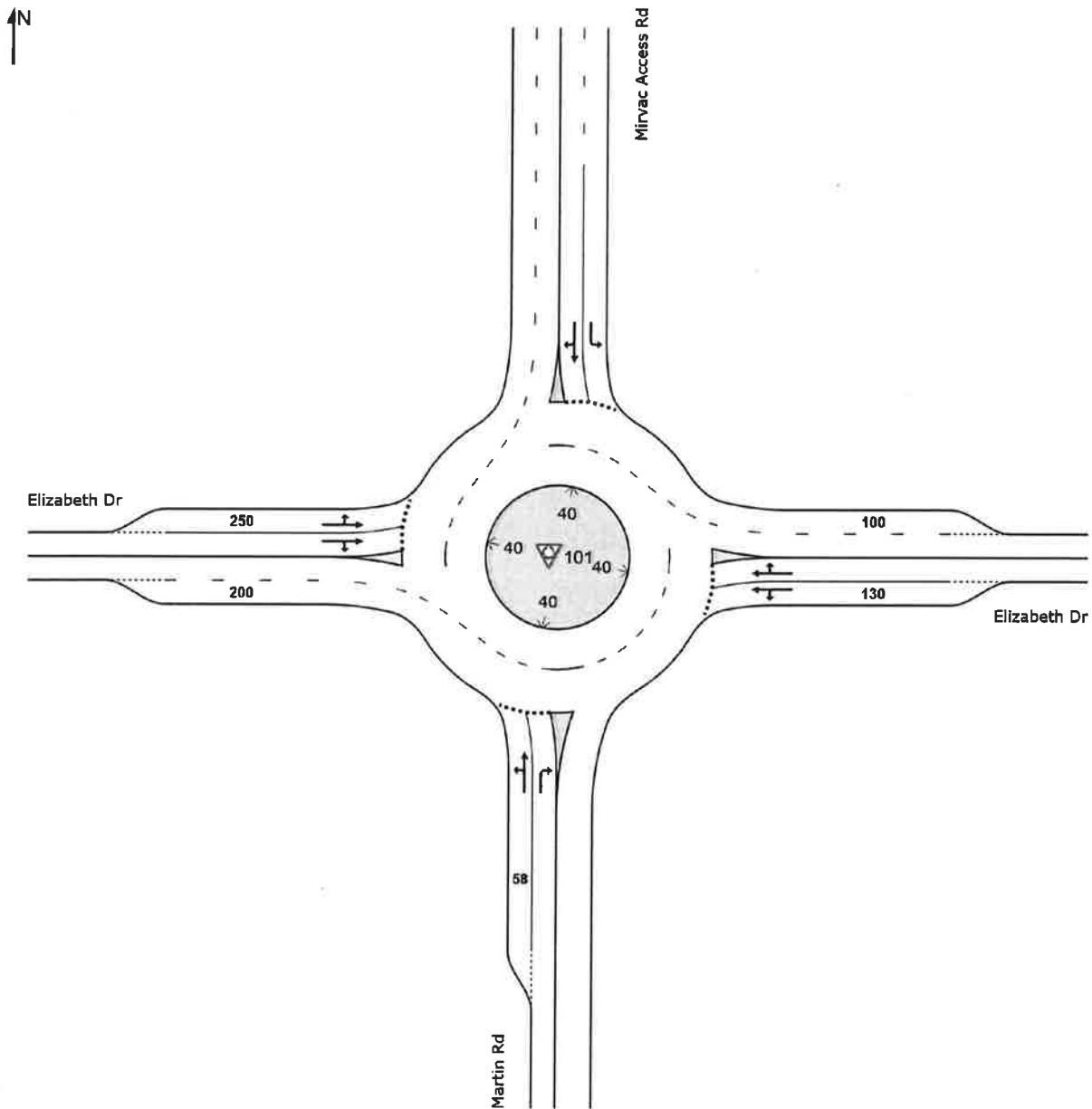
SITE LAYOUT

 Site: 101 [2031 AM Mod 3&4 & MirvacGA]

2031 AM

Site Category: (None)

Roundabout



MOVEMENT SUMMARY

 Site: 101 [2031 AM Mod 3&4 & MirvacGA]

2031 AM

Site Category: (None)

Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	19	68.4	0.074	15.9	LOS B	0.3	5.1	0.77	0.85	0.77	42.5
2	T1	1	0.0	0.074	9.4	LOS A	0.3	5.1	0.77	0.85	0.77	50.1
3	R2	65	64.6	0.238	22.8	LOS B	1.0	17.0	0.80	0.92	0.80	40.8
Approach		85	64.7	0.238	21.1	LOS B	1.0	17.0	0.79	0.90	0.79	41.3
East: Elizabeth Dr												
4	L2	98	53.1	0.488	6.7	LOS A	3.9	37.1	0.34	0.46	0.34	59.6
5	T1	550	10.4	0.488	6.2	LOS A	3.9	33.0	0.34	0.47	0.34	66.3
6	R2	566	10.1	0.488	13.1	LOS A	3.9	33.0	0.33	0.62	0.33	59.0
Approach		1214	13.7	0.488	9.4	LOS A	3.9	37.1	0.34	0.54	0.34	62.1
North: Mirvac Access Rd												
7	L2	141	9.9	0.457	15.2	LOS B	2.7	23.0	0.90	1.00	1.08	50.6
8	T1	1	0.0	0.133	10.3	LOS A	0.7	5.7	0.84	0.94	0.84	49.2
9	R2	40	10.0	0.133	17.7	LOS B	0.7	5.7	0.84	0.94	0.84	51.0
Approach		182	9.9	0.457	15.7	LOS B	2.7	23.0	0.89	0.99	1.03	50.7
West: Elizabeth Dr												
10	L2	161	9.9	0.916	39.6	LOS C	21.9	181.5	1.00	1.60	2.80	40.1
11	T1	1222	8.0	1.193	251.4	LOS F	181.9	1525.5	1.00	4.74	12.23	12.6
12	R2	28	42.9	1.193	386.2	LOS F	181.9	1525.5	1.00	6.60	17.80	8.8
Approach		1411	8.9	1.193	229.9	LOS F	181.9	1525.5	1.00	4.42	11.26	13.6
All Vehicles		2892	12.6	1.193	117.7	LOS F	181.9	1525.5	0.71	2.47	5.72	22.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 Site: 101 [2031 PM Mod 3&4 & Mirvac GA]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Rd												
1	L2	59	16.9	0.240	15.9	LOS B	1.1	10.7	0.85	0.91	0.85	49.1
2	T1	1	0.0	0.240	13.6	LOS A	1.1	10.7	0.85	0.91	0.85	49.6
3	R2	169	24.3	0.725	42.5	LOS C	4.9	51.7	0.94	1.23	1.64	37.2
Approach		229	22.3	0.725	35.5	LOS C	4.9	51.7	0.92	1.14	1.44	39.6
East: Elizabeth Dr												
4	L2	68	54.4	0.637	8.6	LOS A	5.9	52.1	0.67	0.59	0.67	57.4
5	T1	1190	7.6	0.637	7.4	LOS A	5.9	48.8	0.67	0.60	0.67	64.5
6	R2	141	9.9	0.637	14.4	LOS A	5.9	48.8	0.67	0.61	0.67	60.9
Approach		1399	10.2	0.637	8.2	LOS A	5.9	52.1	0.67	0.60	0.67	63.8
North: Mirvac Access Rd												
7	L2	566	10.1	0.988	68.1	LOS E	30.9	262.7	1.00	2.44	4.79	29.3
8	T1	1	0.0	0.282	7.7	LOS A	1.5	12.5	0.75	0.91	0.75	50.9
9	R2	161	9.9	0.282	14.8	LOS B	1.5	12.5	0.75	0.91	0.75	52.9
Approach		728	10.0	0.988	56.2	LOS D	30.9	262.7	0.94	2.10	3.89	32.7
West: Elizabeth Dr												
10	L2	40	10.0	0.311	7.4	LOS A	1.9	17.3	0.58	0.62	0.58	59.1
11	T1	595	14.8	0.404	8.0	LOS A	2.6	25.4	0.61	0.63	0.61	63.6
12	R2	22	59.1	0.404	16.7	LOS B	2.6	25.4	0.63	0.64	0.63	59.8
Approach		657	16.0	0.404	8.3	LOS A	2.6	25.4	0.61	0.63	0.61	63.1
All Vehicles		3013	12.3	0.988	21.9	LOS B	30.9	262.7	0.74	1.01	1.49	50.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

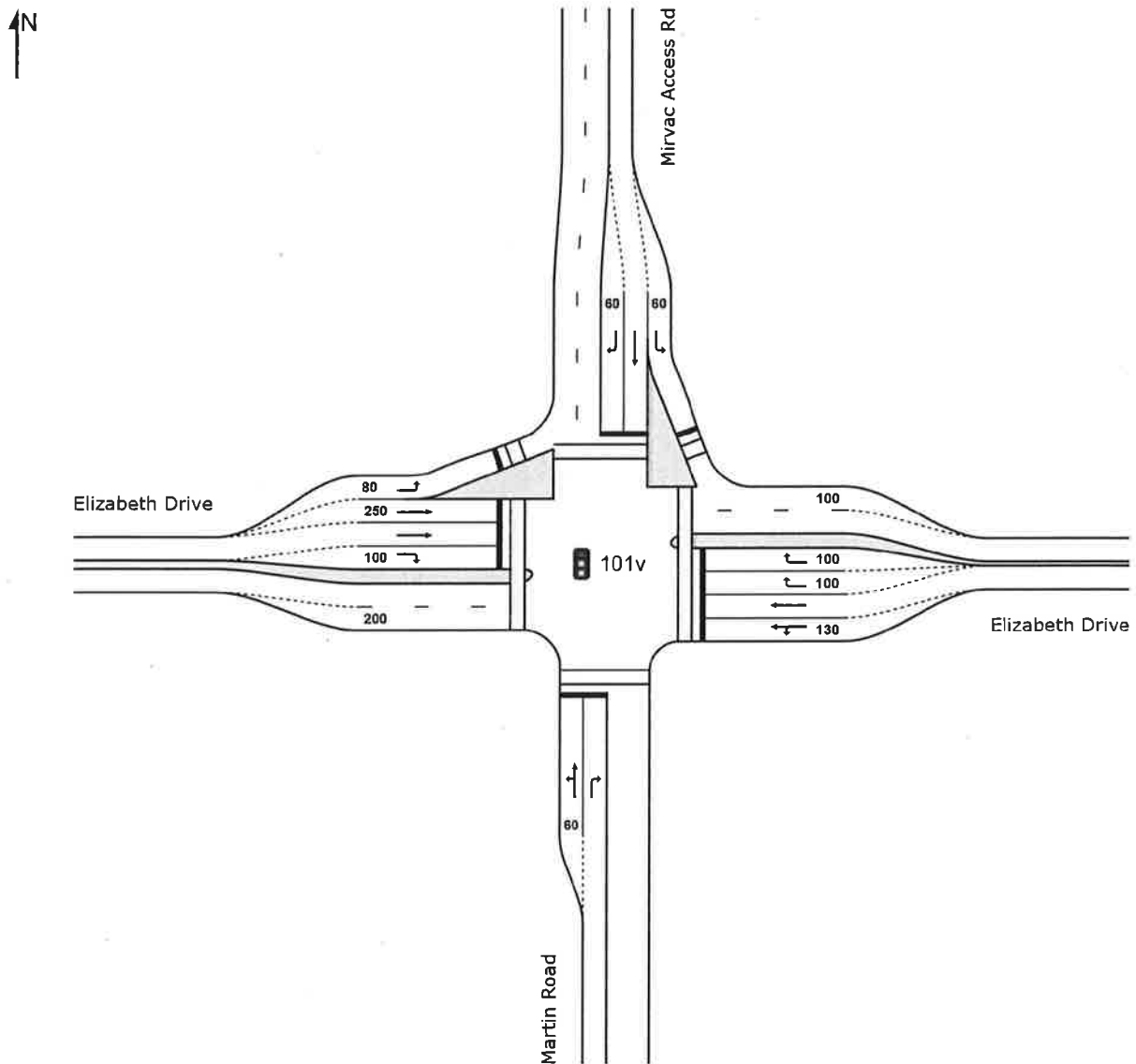
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.060	43.4	LOS D	0.9	15.3	0.78	0.69	0.78	33.8
2	T1	1	0.0	0.060	37.1	LOS C	0.9	15.3	0.78	0.69	0.78	35.6
3	R2	65	64.6	0.334	58.2	LOS E	3.6	60.8	0.93	0.77	0.93	29.9
Approach		85	64.7	0.334	54.7	LOS D	3.6	60.8	0.89	0.75	0.89	30.8
East: Elizabeth Drive												
4	L2	98	53.1	0.388	20.7	LOS B	12.8	112.9	0.54	0.55	0.54	51.2
5	T1	721	14.8	0.388	12.8	LOS A	12.8	112.9	0.54	0.51	0.54	62.1
6	R2	566	10.1	0.851	45.6	LOS D	13.2	97.7	1.00	0.91	1.22	36.4
Approach		1385	15.6	0.851	26.8	LOS B	13.2	132.6	0.73	0.68	0.82	47.7
North: Mirvac Access Rd												
7	L2	141	9.9	0.423	33.3	LOS C	5.2	44.0	0.92	0.78	0.92	38.4
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	40	10.0	0.181	56.6	LOS E	2.2	18.5	0.91	0.74	0.91	30.8
Approach		182	9.9	0.423	38.5	LOS C	5.2	44.0	0.92	0.77	0.92	36.4
West: Elizabeth Drive												
10	L2	161	9.9	0.215	31.1	LOS C	6.1	51.5	0.66	0.76	0.66	42.9
11	T1	1021	10.5	0.841	34.0	LOS C	36.8	315.7	0.88	0.82	0.92	46.0
12	R2	28	42.9	0.308	72.2	LOS F	1.7	23.4	0.99	0.73	0.99	28.5
Approach		1210	11.2	0.841	34.5	LOS C	36.8	315.7	0.85	0.81	0.89	44.9
All Vehicles		2862	14.8	0.851	31.6	LOS C	36.8	315.7	0.80	0.74	0.86	44.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	13.5	LOS B	0.1	0.1	0.46	0.46	
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	56.8	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	19.6	LOS B	0.1	0.1	0.56	0.56	
All Pedestrians		300	42.9	LOS E			0.80	0.80	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCS]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

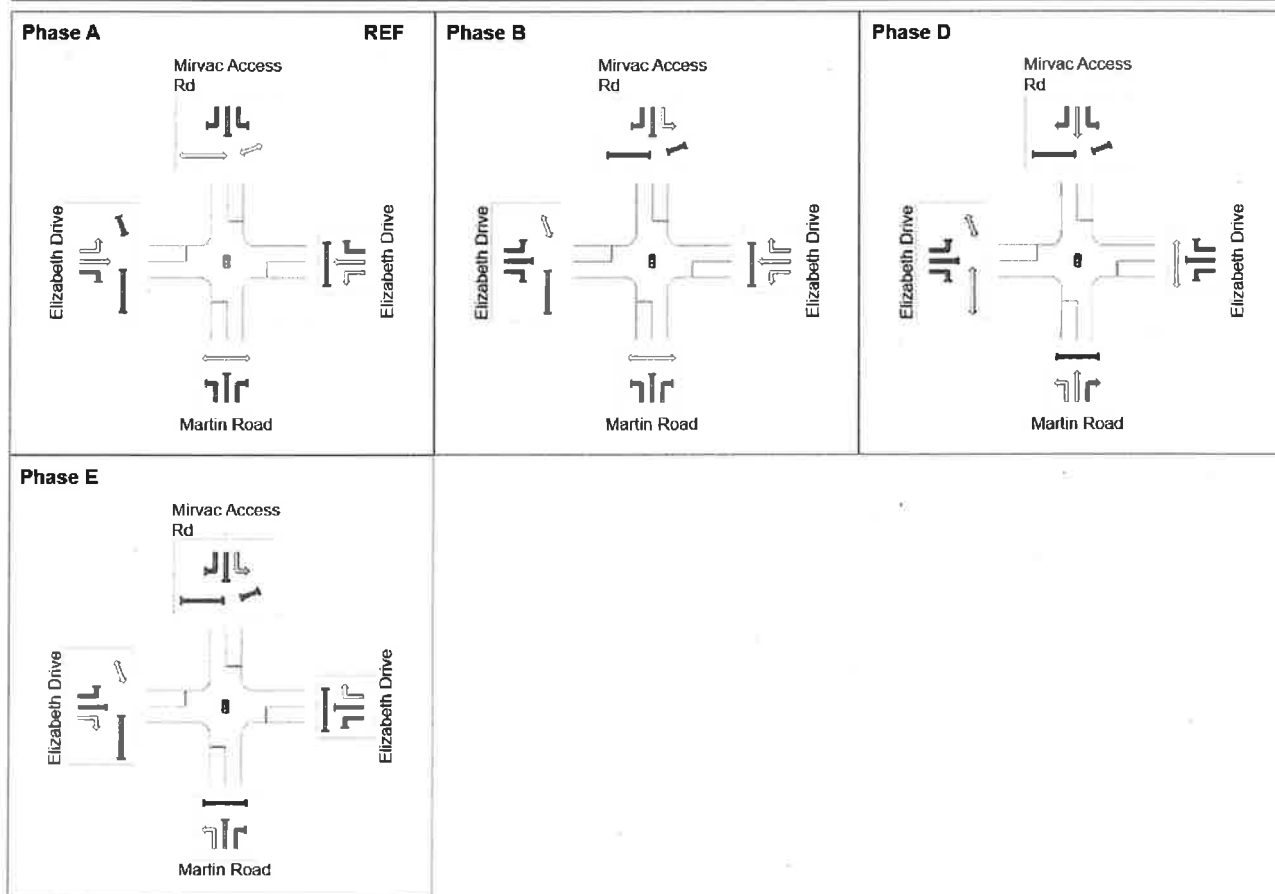
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	60	83	110
Green Time (sec)	54	16	20	8
Phase Time (sec)	61	23	27	14
Phase Split	49%	18%	22%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCS]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.151	48.7	LOS D	3.1	29.4	0.82	0.74	0.82	32.6
2	T1	1	0.0	0.151	43.0	LOS D	3.1	29.4	0.82	0.74	0.82	33.4
3	R2	169	24.3	0.833	75.4	LOS F	12.1	128.7	1.00	0.95	1.27	26.5
Approach		229	22.3	0.833	68.4	LOS E	12.1	128.7	0.95	0.89	1.15	27.9
East: Elizabeth Drive												
4	L2	68	54.4	0.449	19.7	LOS B	17.0	136.6	0.52	0.51	0.52	52.3
5	T1	997	9.1	0.449	11.7	LOS A	17.0	136.6	0.52	0.49	0.52	63.5
6	R2	141	9.9	0.114	23.8	LOS B	1.9	16.2	0.70	0.73	0.70	46.4
Approach		1206	11.8	0.449	13.6	LOS A	17.0	155.9	0.54	0.52	0.54	60.2
North: Mirvac Access Rd												
7	L2	566	10.1	0.919	50.2	LOS D	30.8	262.4	1.00	1.00	1.26	32.7
8	T1	1	0.0	0.003	51.8	LOS D	0.1	0.4	0.87	0.52	0.87	32.5
9	R2	161	9.9	0.910	88.7	LOS F	12.7	108.3	1.00	1.06	1.52	24.3
Approach		728	10.0	0.919	58.7	LOS E	30.8	262.4	1.00	1.01	1.31	30.3
West: Elizabeth Drive												
10	L2	40	10.0	0.078	43.8	LOS D	1.9	15.9	0.75	0.72	0.75	37.4
11	T1	733	14.6	0.899	56.0	LOS D	34.3	315.0	0.96	0.94	1.11	36.0
12	R2	22	59.1	0.379	82.1	LOS F	1.5	24.5	1.00	0.72	1.00	26.4
Approach		795	15.6	0.899	56.1	LOS D	34.3	315.0	0.95	0.92	1.09	35.7
All Vehicles		2958	13.2	0.919	40.4	LOS C	34.3	315.0	0.80	0.78	0.93	39.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P2	East Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	61.8	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	60.8	LOS F	0.2	0.2	0.95	0.95	
All Pedestrians		300	61.0	LOS F			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCS]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 135 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

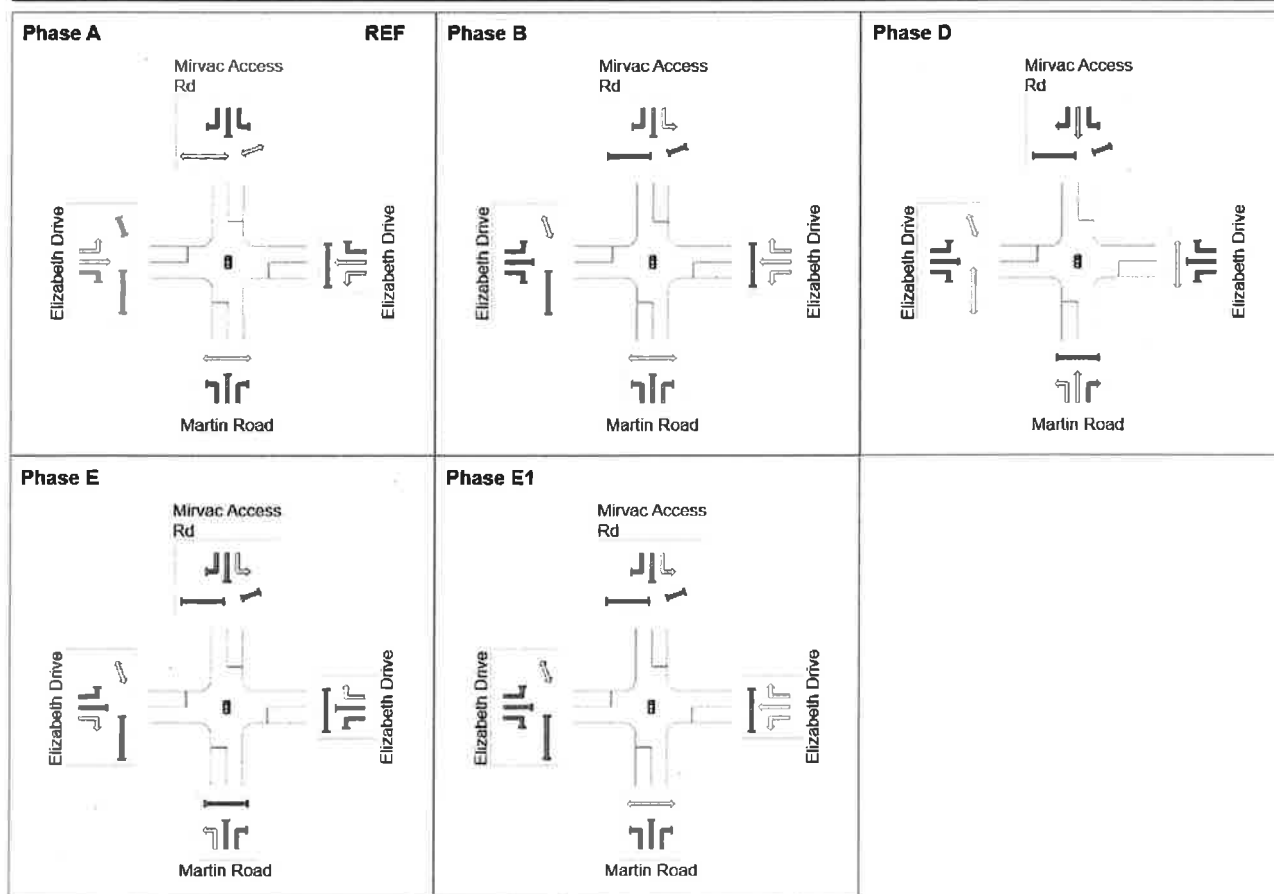
Output Phase Sequence: A, B, D, E, E1

Phase Timing Summary

Phase	A	B	D	E	E1
Phase Change Time (sec)	0	46	79	106	119
Green Time (sec)	40	26	20	6	10
Phase Time (sec)	47	33	27	12	16
Phase Split	35%	24%	20%	9%	12%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



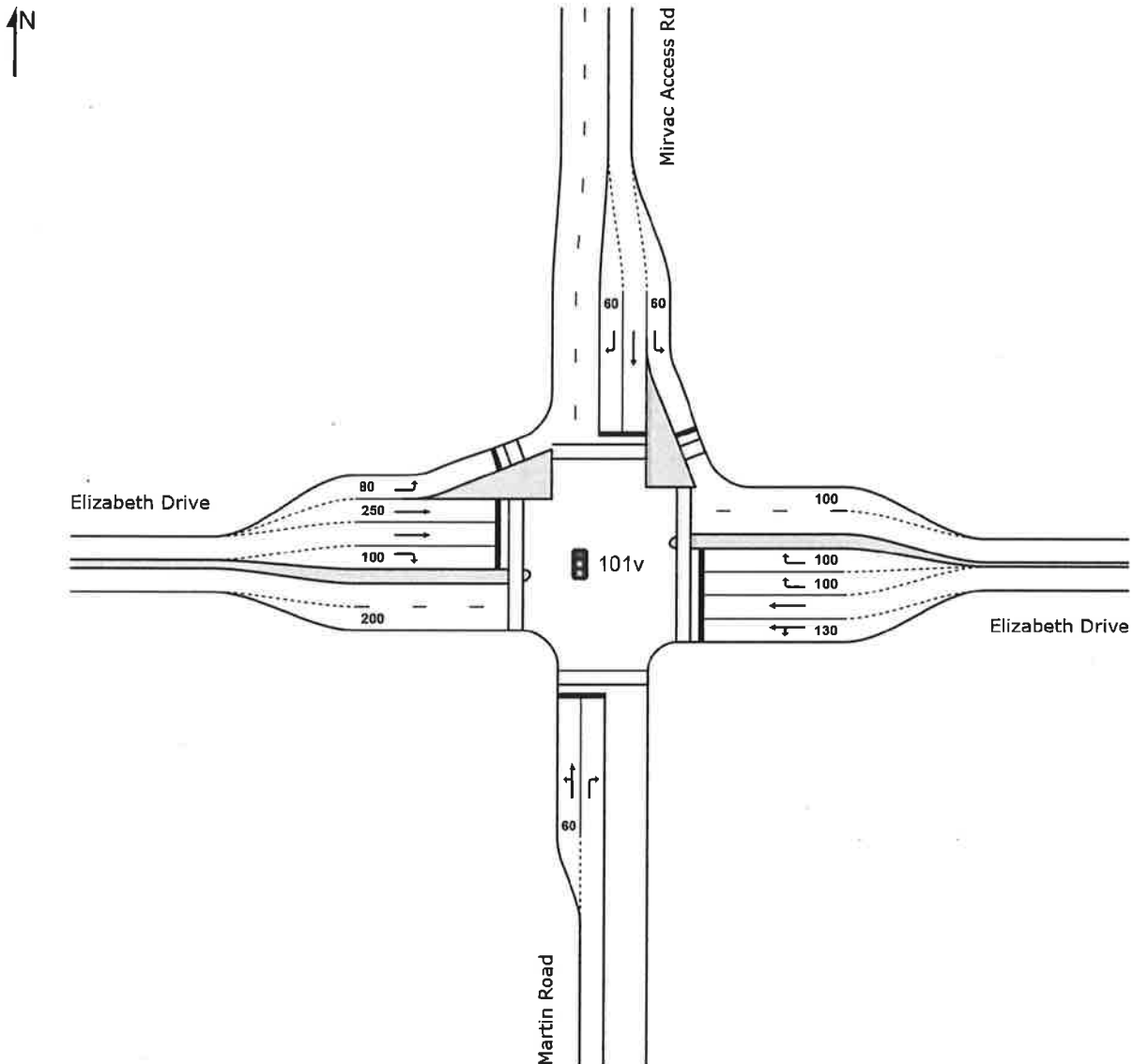
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.059	46.9	LOS D	1.0	16.9	0.77	0.69	0.77	32.8
2	T1	1	0.0	0.059	40.5	LOS C	1.0	16.9	0.77	0.69	0.77	34.4
3	R2	65	64.6	0.358	65.8	LOS E	4.1	68.8	0.94	0.77	0.94	28.2
Approach		85	64.7	0.358	61.2	LOS E	4.1	68.8	0.90	0.75	0.90	29.2
East: Elizabeth Drive												
4	L2	98	53.1	0.315	21.5	LOS B	10.6	99.4	0.51	0.54	0.51	50.5
5	T1	550	17.3	0.315	13.6	LOS A	10.6	99.4	0.51	0.49	0.51	61.2
6	R2	566	10.1	0.915	68.7	LOS E	17.0	125.8	1.00	1.01	1.52	29.6
Approach		1214	16.8	0.915	39.9	LOS C	17.0	125.8	0.74	0.74	0.98	40.4
North: Mirvac Access Rd												
7	L2	141	9.9	0.455	39.2	LOS C	6.3	53.4	0.94	0.79	0.94	36.2
8	T1	1	0.0	0.003	53.4	LOS D	0.1	0.4	0.87	0.52	0.87	32.1
9	R2	40	10.0	0.195	63.9	LOS E	2.5	20.9	0.92	0.74	0.92	29.0
Approach		182	9.9	0.455	44.7	LOS D	6.3	53.4	0.93	0.77	0.93	34.3
West: Elizabeth Drive												
10	L2	161	9.9	0.194	29.6	LOS C	6.2	52.6	0.61	0.75	0.61	43.7
11	T1	1222	8.0	0.914	42.2	LOS C	58.0	476.0	0.89	0.89	0.99	41.7
12	R2	28	42.9	0.212	73.6	LOS F	1.8	24.7	0.96	0.73	0.96	28.2
Approach		1411	8.9	0.914	41.4	LOS C	58.0	476.0	0.86	0.87	0.95	41.5
All Vehicles		2892	13.9	0.915	41.6	LOS C	58.0	476.0	0.82	0.80	0.96	40.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	14.7	LOS B	0.1	0.1	0.46	0.46	
P2	East Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	24.7	LOS C	0.1	0.1	0.59	0.59	
All Pedestrians		300	48.9	LOS E			0.81	0.81	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCS]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

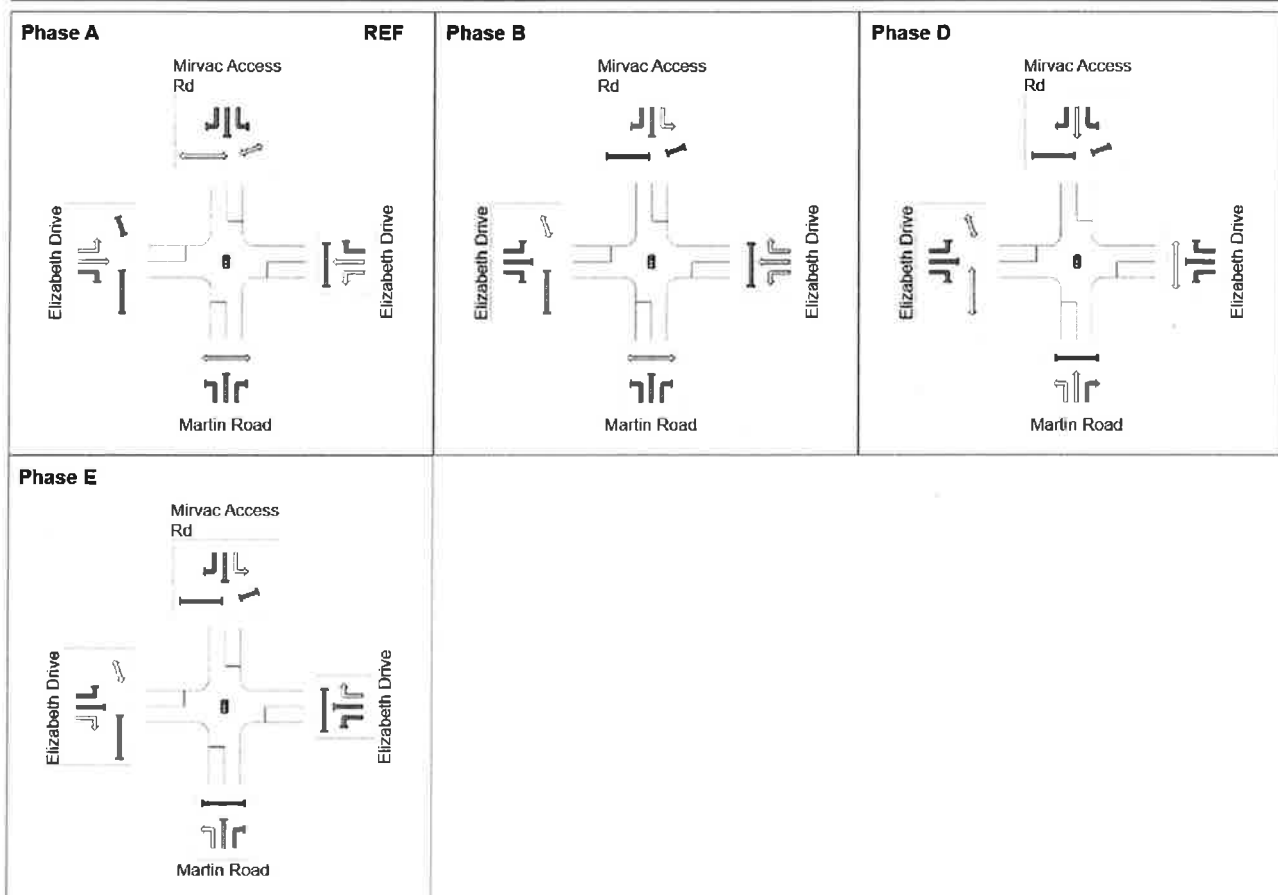
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	73	92	120
Green Time (sec)	67	12	21	13
Phase Time (sec)	74	19	28	19
Phase Split	53%	14%	20%	14%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 PM Mirvac & Mod 4 TCS]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.140	43.5	LOS D	2.8	26.5	0.80	0.74	0.80	34.2
2	T1	1	0.0	0.140	37.8	LOS C	2.8	26.5	0.80	0.74	0.80	35.1
3	R2	169	24.3	0.748	64.5	LOS E	10.6	112.6	1.00	0.88	1.13	28.8
Approach		229	22.3	0.748	59.0	LOS E	10.6	112.6	0.95	0.85	1.04	30.1
East: Elizabeth Drive												
4	L2	68	54.4	0.557	21.7	LOS B	22.3	174.7	0.61	0.59	0.61	50.8
5	T1	1190	5.9	0.557	13.6	LOS A	22.3	174.7	0.61	0.56	0.61	61.5
6	R2	141	9.9	0.108	21.2	LOS B	1.6	13.4	0.68	0.73	0.68	48.0
Approach		1399	8.6	0.557	14.8	LOS B	22.3	174.7	0.61	0.58	0.61	59.3
North: Mirvac Access Rd												
7	L2	566	10.1	0.869	35.3	LOS C	22.7	193.4	0.99	0.95	1.13	37.6
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	161	9.9	0.826	71.3	LOS F	10.7	91.2	1.00	0.94	1.28	27.4
Approach		728	10.0	0.869	43.3	LOS D	22.7	193.4	0.99	0.95	1.16	34.8
West: Elizabeth Drive												
10	L2	40	10.0	0.093	46.2	LOS D	1.9	15.9	0.80	0.73	0.80	36.5
11	T1	595	14.8	0.870	53.2	LOS D	25.0	230.2	0.97	0.92	1.10	37.0
12	R2	22	59.1	0.351	76.1	LOS F	1.4	22.6	1.00	0.72	1.00	27.6
Approach		657	16.0	0.870	53.6	LOS D	25.0	230.2	0.96	0.90	1.08	36.6
All Vehicles		3013	11.6	0.870	33.5	LOS C	25.0	230.2	0.81	0.76	0.88	42.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	12.6	LOS B	0.1	0.1	0.45	0.45	
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P3B	North Slip/Bypass Lane Crossing	50	56.8	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95	
P4S	West Slip/Bypass Lane Crossing	50	8.9	LOS A	0.1	0.1	0.38	0.38	
All Pedestrians		300	40.9	LOS E			0.77	0.77	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 PM Mirvac & Mod 4 TCS]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

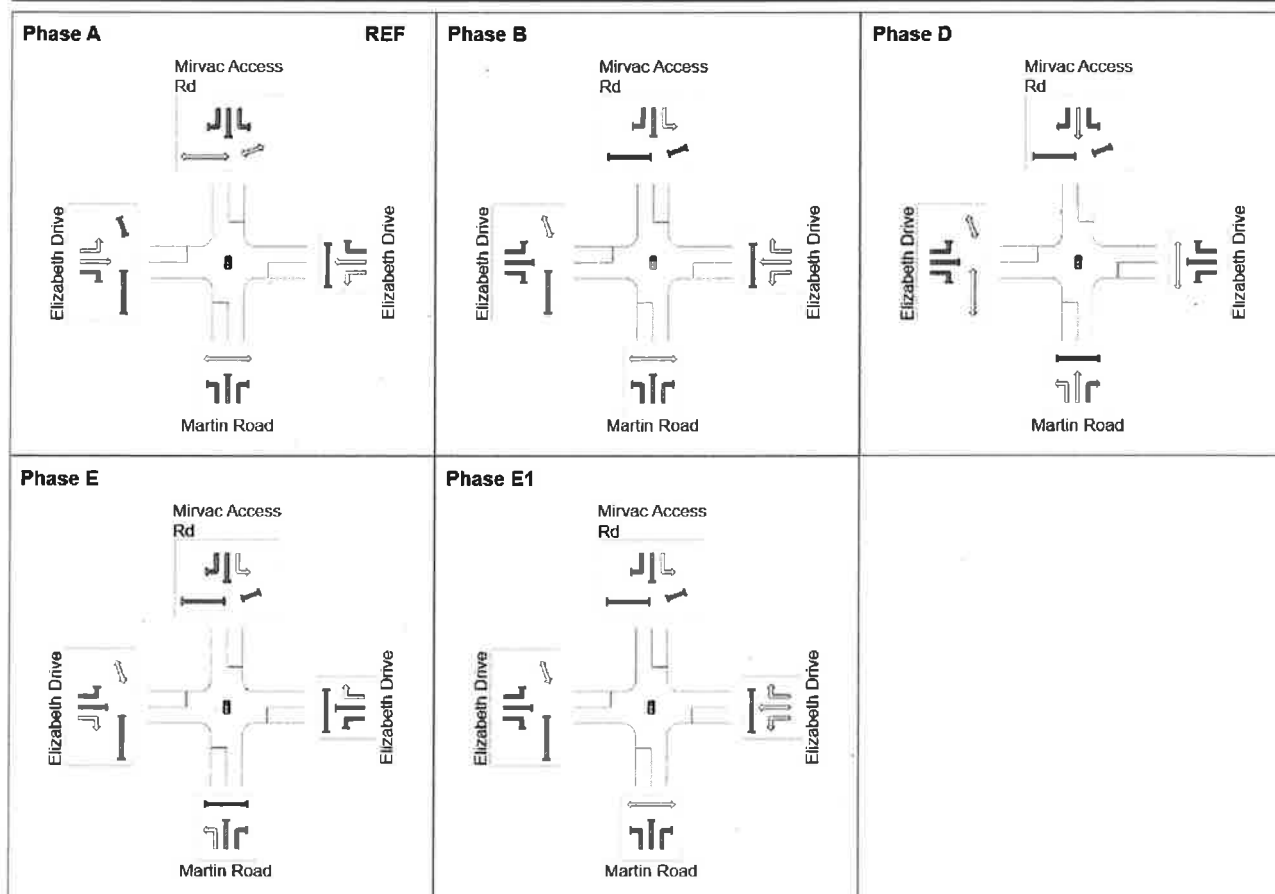
Output Phase Sequence: A, B, D, E, E1

Phase Timing Summary

Phase	A	B	D	E	E1
Phase Change Time (sec)	0	37	71	98	111
Green Time (sec)	31	27	20	6	8
Phase Time (sec)	38	34	27	12	14
Phase Split	30%	27%	22%	10%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



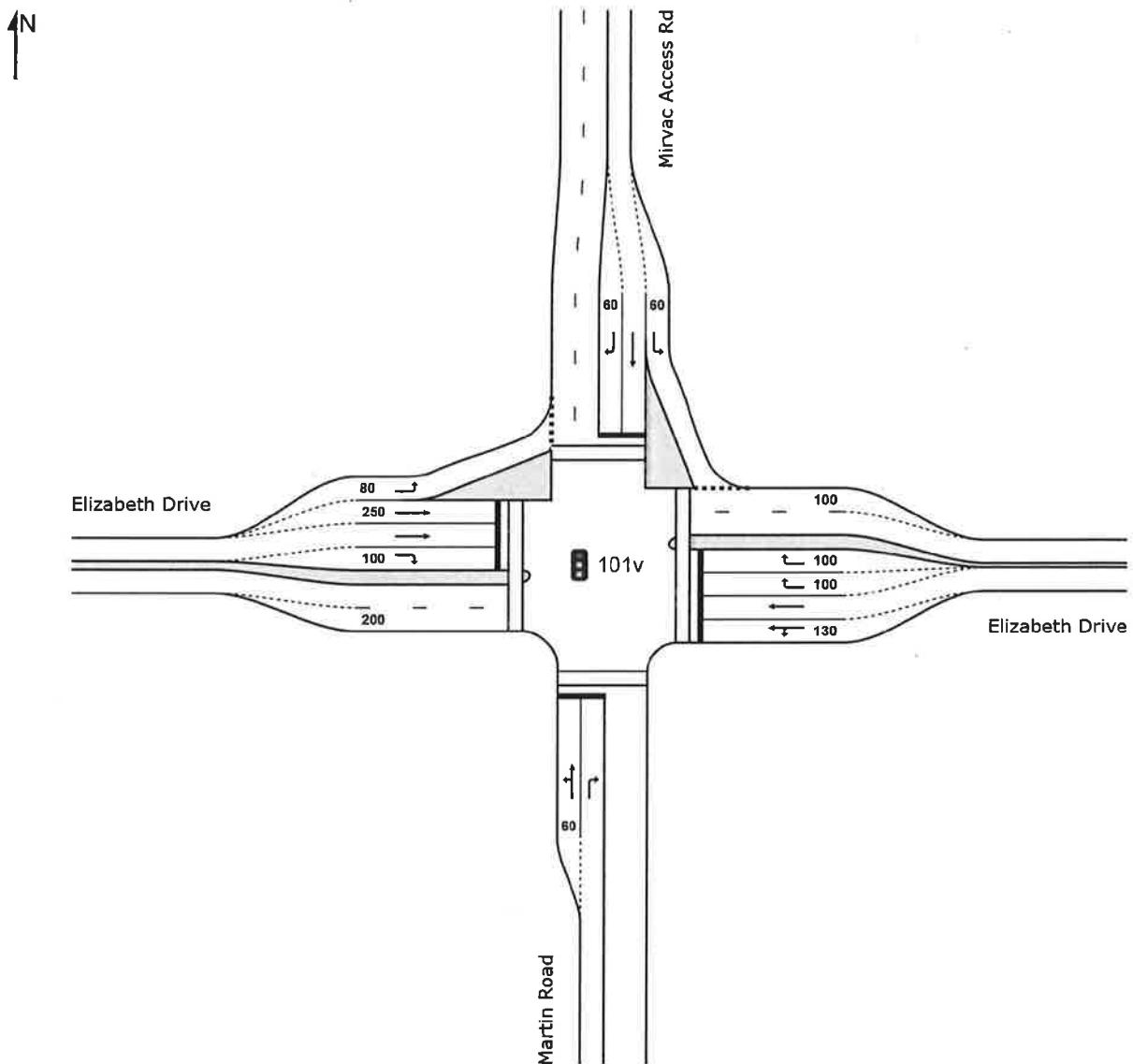
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	19	68.4	0.060	43.4	LOS D	0.9	15.3	0.78	0.69	0.78	33.8
2	T1	1	0.0	0.060	37.1	LOS C	0.9	15.3	0.78	0.69	0.78	35.6
3	R2	65	64.6	0.334	58.2	LOS E	3.6	60.8	0.93	0.77	0.93	29.9
Approach		85	64.7	0.334	54.7	LOS D	3.6	60.8	0.89	0.75	0.89	30.8
East: Elizabeth Drive												
4	L2	98	53.1	0.388	20.7	LOS B	12.8	112.9	0.54	0.55	0.54	51.2
5	T1	721	14.8	0.388	12.8	LOS A	12.8	112.9	0.54	0.51	0.54	62.1
6	R2	566	10.1	0.851	45.6	LOS D	13.2	97.7	1.00	0.91	1.22	36.4
Approach		1385	15.6	0.851	26.8	LOS B	13.2	132.6	0.73	0.68	0.82	47.7
North: Mirvac Access Rd												
7	L2	141	9.9	0.189	15.9	LOS B	3.4	29.3	0.53	0.70	0.53	46.9
8	T1	1	0.0	0.003	46.6	LOS D	0.1	0.4	0.86	0.51	0.86	34.1
9	R2	40	10.0	0.181	56.6	LOS E	2.2	18.5	0.91	0.74	0.91	30.8
Approach		182	9.9	0.189	25.0	LOS B	3.4	29.3	0.62	0.70	0.62	42.0
West: Elizabeth Drive												
10	L2	161	9.9	0.175	21.6	LOS B	4.8	40.9	0.55	0.72	0.55	48.2
11	T1	1021	10.5	0.841	34.0	LOS C	36.8	315.7	0.88	0.82	0.92	46.0
12	R2	28	42.9	0.308	72.2	LOS F	1.7	23.4	0.99	0.73	0.99	28.5
Approach		1210	11.2	0.841	33.2	LOS C	36.8	315.7	0.84	0.80	0.87	45.6
All Vehicles		2862	14.8	0.851	30.2	LOS C	36.8	315.7	0.77	0.74	0.83	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	13.5	LOS B	0.1	0.1	0.46	0.46
P2	East Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	50	55.8	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		200	45.2	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 AM Mirvac & Mod 4 TCSA]

2026 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

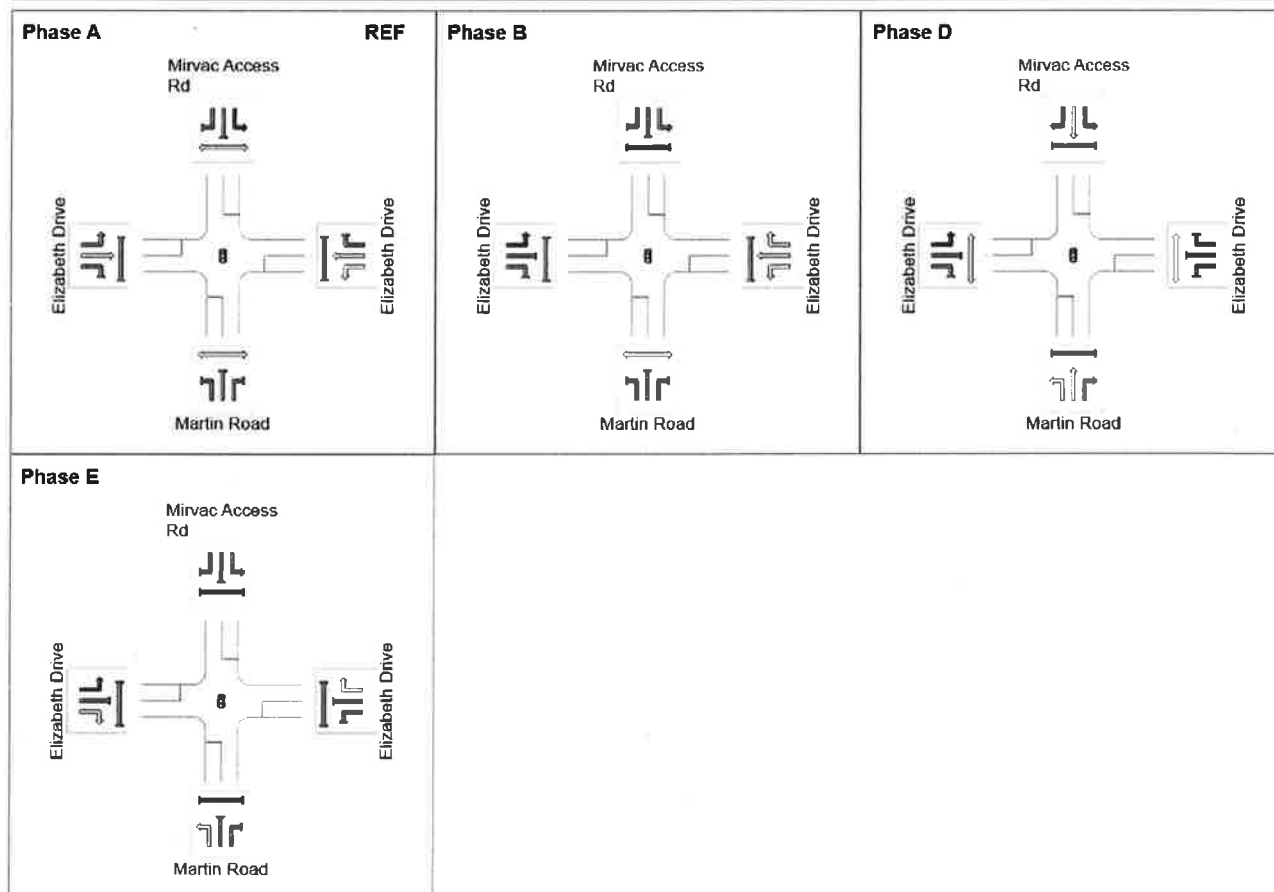
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	60	83	110
Green Time (sec)	54	16	20	8
Phase Time (sec)	61	23	27	14
Phase Split	49%	18%	22%	11%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



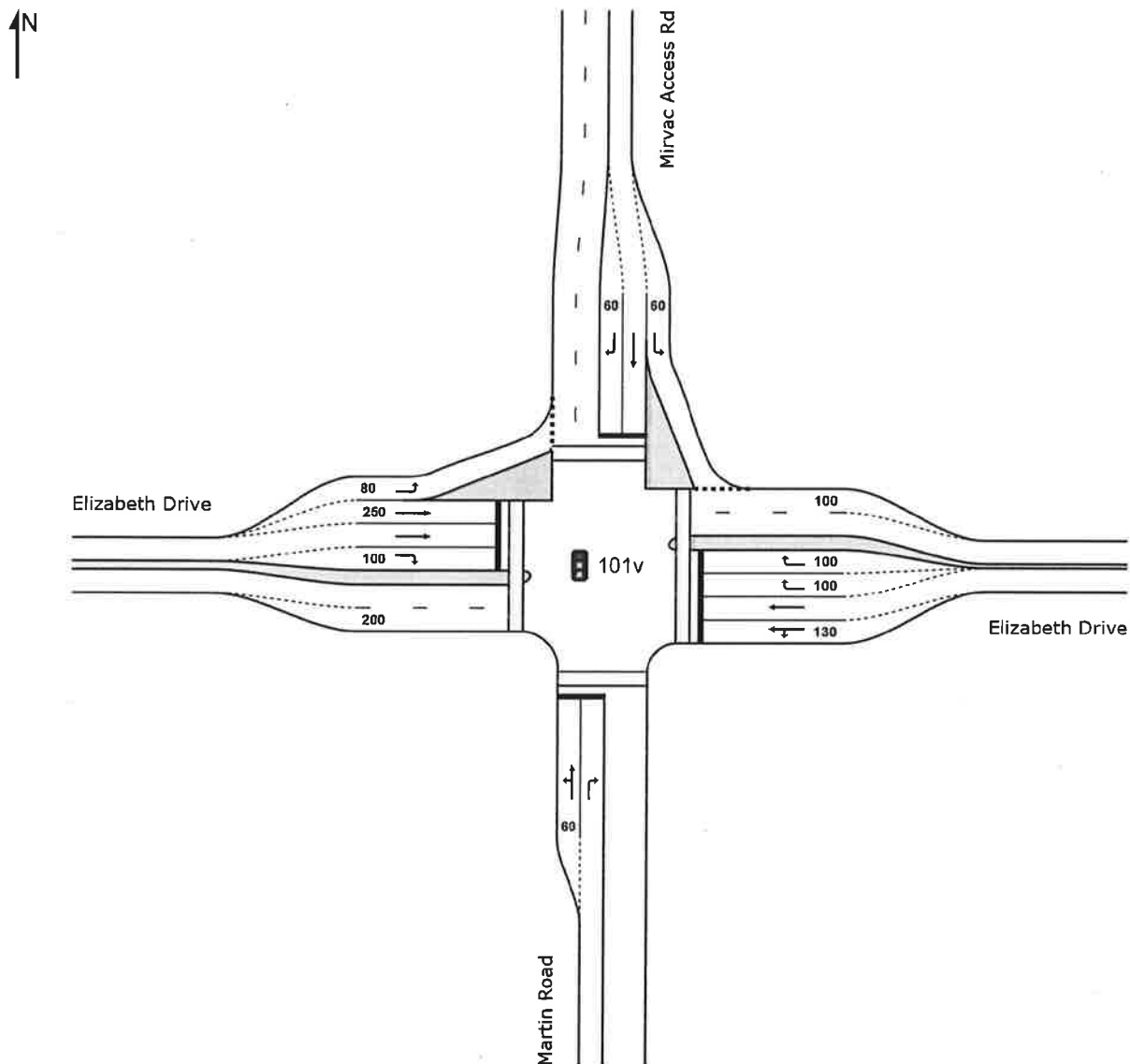
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Martin Road												
1	L2	59	16.9	0.115	26.3	LOS B	1.7	15.7	0.73	0.72	0.73	40.8
2	T1	1	0.0	0.115	20.5	LOS B	1.7	15.7	0.73	0.72	0.73	42.1
3	R2	169	24.3	0.689	43.1	LOS D	6.8	72.0	0.99	0.87	1.11	34.6
Approach		229	22.3	0.689	38.7	LOS C	6.8	72.0	0.93	0.83	1.01	36.0
East: Elizabeth Drive												
4	L2	68	54.4	0.578	22.5	LOS B	14.8	118.5	0.74	0.68	0.74	50.3
5	T1	997	9.1	0.578	14.6	LOS B	14.8	118.5	0.74	0.67	0.74	60.5
6	R2	141	9.9	0.271	25.6	LOS B	1.6	13.6	0.92	0.75	0.92	45.4
Approach		1206	11.8	0.578	16.3	LOS B	14.8	135.4	0.76	0.68	0.76	57.6
North: Mirvac Access Rd												
7	L2	566	10.1	0.749	16.5	LOS B	12.5	106.3	0.86	0.86	0.89	46.5
8	T1	1	0.0	0.003	30.1	LOS C	0.0	0.2	0.85	0.51	0.85	40.3
9	R2	161	9.9	0.737	45.8	LOS D	6.7	56.7	1.00	0.90	1.19	33.9
Approach		728	10.0	0.749	23.0	LOS B	12.5	106.3	0.89	0.86	0.96	43.0
West: Elizabeth Drive												
10	L2	40	10.0	0.042	13.6	LOS A	0.6	5.0	0.47	0.68	0.47	53.8
11	T1	733	14.6	0.748	24.9	LOS B	17.0	156.2	0.89	0.80	0.93	51.9
12	R2	22	59.1	0.224	49.2	LOS D	0.9	14.1	0.97	0.71	0.97	34.5
Approach		795	15.6	0.748	25.0	LOS B	17.0	156.2	0.88	0.79	0.91	51.3
All Vehicles		2958	13.2	0.749	22.0	LOS B	17.0	156.2	0.84	0.77	0.87	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian	m			
					ped				
P1	South Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91	
P2	East Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91	
P3	North Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91	
P4	West Full Crossing	50	33.4	LOS D	0.1	0.1	0.91	0.91	
All Pedestrians		200	33.4	LOS D			0.91	0.91	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2026 PM Mirvac & Mod 4 TCSA]

2026 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd (phase reduction applied)

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

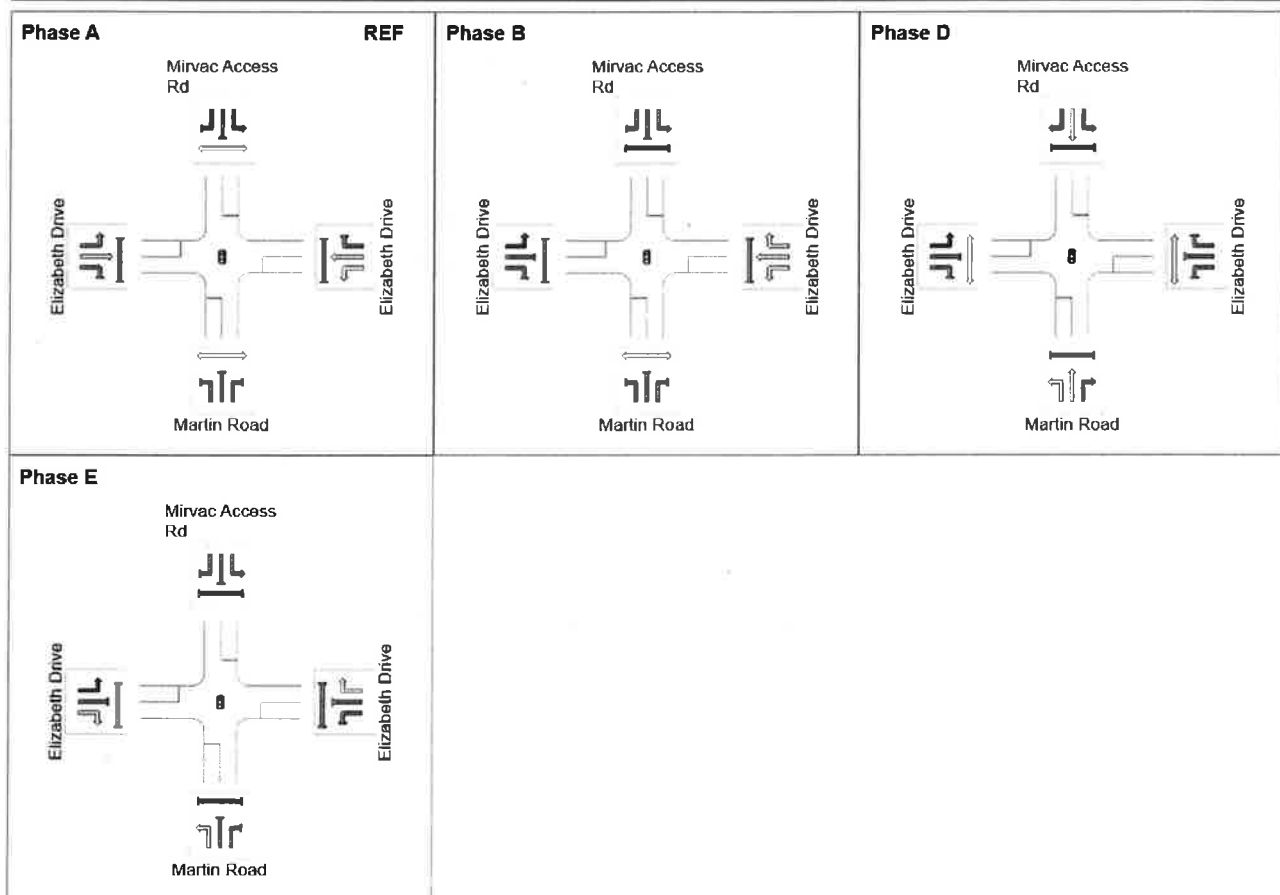
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	34	47	67
Green Time (sec)	28	6	13	6
Phase Time (sec)	35	13	20	12
Phase Split	44%	16%	25%	15%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase

Normal Movement
Slip/Bypass-Lane Movement

Permitted/Opposed
Opposed Slip/Bypass-Lane

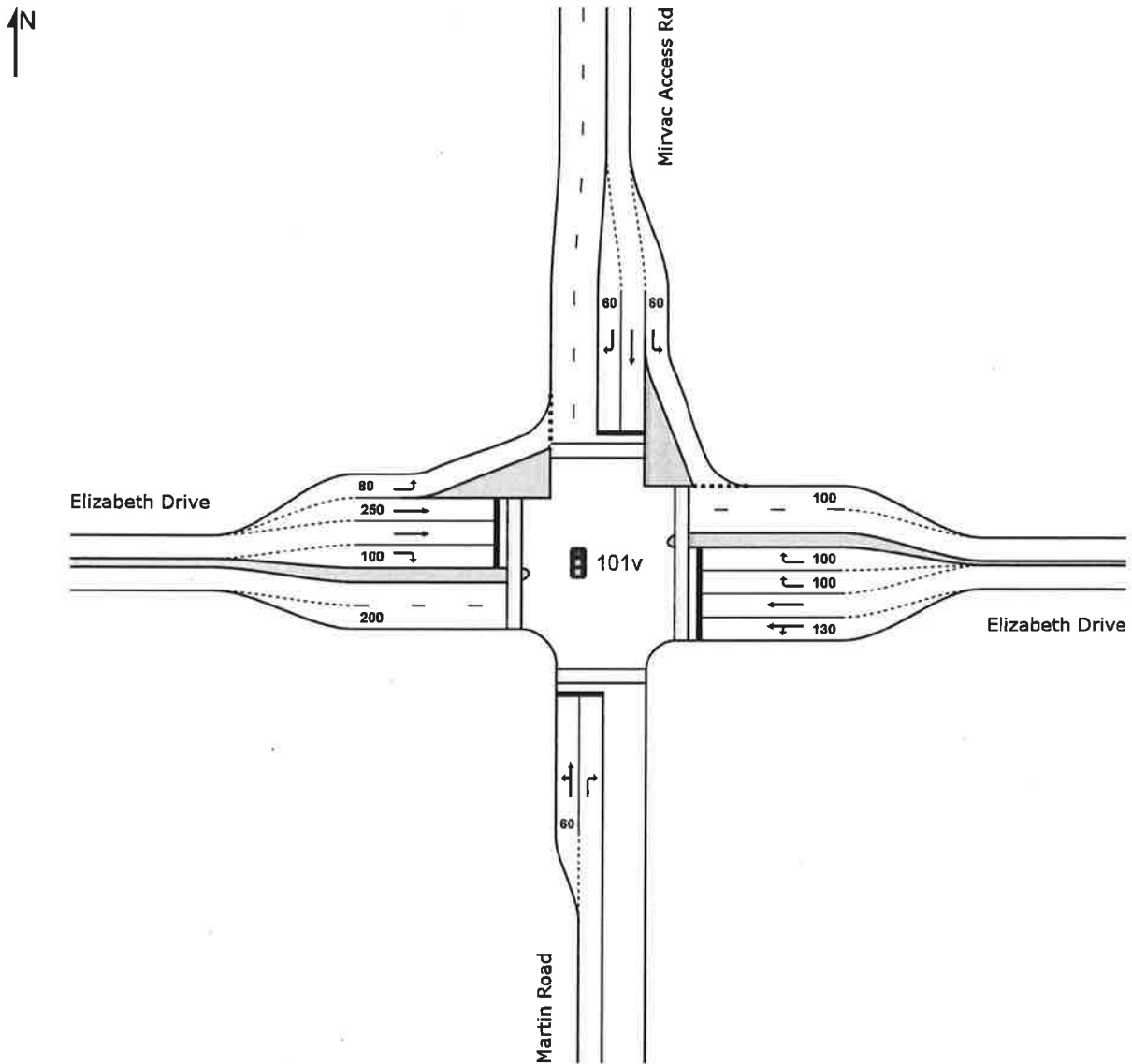
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Martin Road												
1	L2	19	68.4	0.060	47.7	LOS D	1.0	17.1	0.78	0.69	0.78	32.5
2	T1	1	0.0	0.060	41.3	LOS C	1.0	17.1	0.78	0.69	0.78	34.2
3	R2	65	64.6	0.358	65.8	LOS E	4.1	68.8	0.94	0.77	0.94	28.2
Approach		85	64.7	0.358	61.4	LOS E	4.1	68.8	0.90	0.75	0.90	29.1
East: Elizabeth Drive												
4	L2	98	53.1	0.311	21.0	LOS B	10.4	97.5	0.50	0.54	0.50	50.8
5	T1	550	17.3	0.311	13.1	LOS A	10.4	97.5	0.50	0.48	0.50	61.7
6	R2	566	10.1	0.915	66.9	LOS E	17.1	126.4	1.00	1.00	1.48	30.1
Approach		1214	16.8	0.915	38.8	LOS C	17.1	126.4	0.73	0.73	0.96	40.9
North: Mirvac Access Rd												
7	L2	141	9.9	0.215	21.8	LOS B	4.7	39.7	0.61	0.72	0.61	43.6
8	T1	1	0.0	0.003	53.4	LOS D	0.1	0.4	0.87	0.52	0.87	32.1
9	R2	40	10.0	0.195	63.9	LOS E	2.5	20.9	0.92	0.74	0.92	29.0
Approach		182	9.9	0.215	31.2	LOS C	4.7	39.7	0.68	0.72	0.68	39.2
West: Elizabeth Drive												
10	L2	161	9.9	0.167	22.1	LOS B	5.2	44.0	0.52	0.71	0.52	47.9
11	T1	1222	8.0	0.914	42.2	LOS C	58.0	476.0	0.89	0.89	0.99	41.7
12	R2	28	42.9	0.230	74.9	LOS F	1.9	25.0	0.97	0.73	0.97	27.9
Approach		1411	8.9	0.914	40.5	LOS C	58.0	476.0	0.85	0.87	0.94	41.9
All Vehicles		2892	13.9	0.915	39.8	LOS C	58.0	476.0	0.79	0.80	0.93	40.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Back of Queue Distance	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	m			
P1	South Full Crossing	50	14.2	LOS B	0.1	0.1	0.45	0.45	
P2	East Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P3	North Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
P4	West Full Crossing	50	63.3	LOS F	0.2	0.2	0.95	0.95	
All Pedestrians		200	51.0	LOS E			0.83	0.83	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 2031 AM Mirvac & Mod 4 TCSA]

2031 AM with Mod 3 & 4 & Mirvac & Traffic Signals. Slip Lane Crossings modelled as Independent

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E

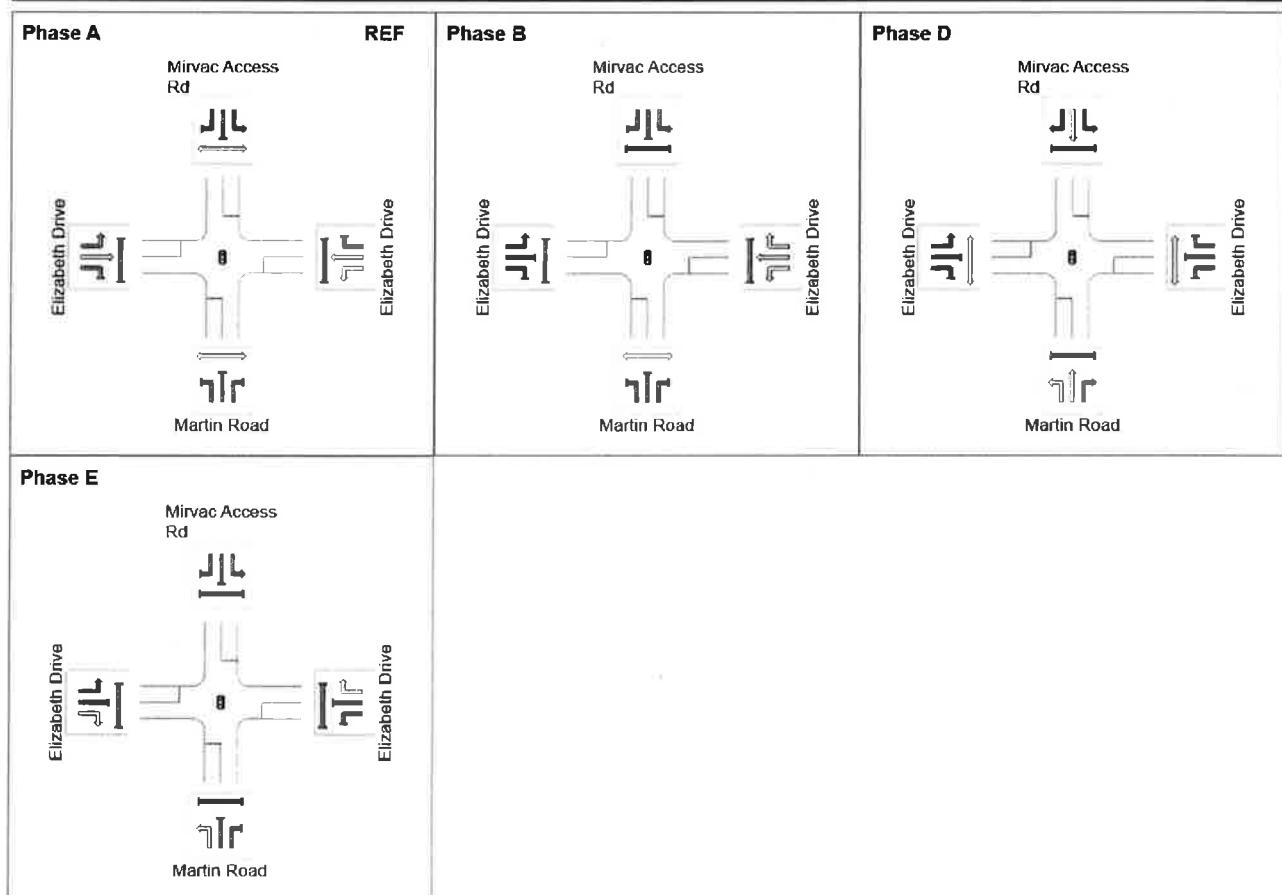
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	73	93	121
Green Time (sec)	67	13	21	12
Phase Time (sec)	74	20	28	18
Phase Split	53%	14%	20%	13%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



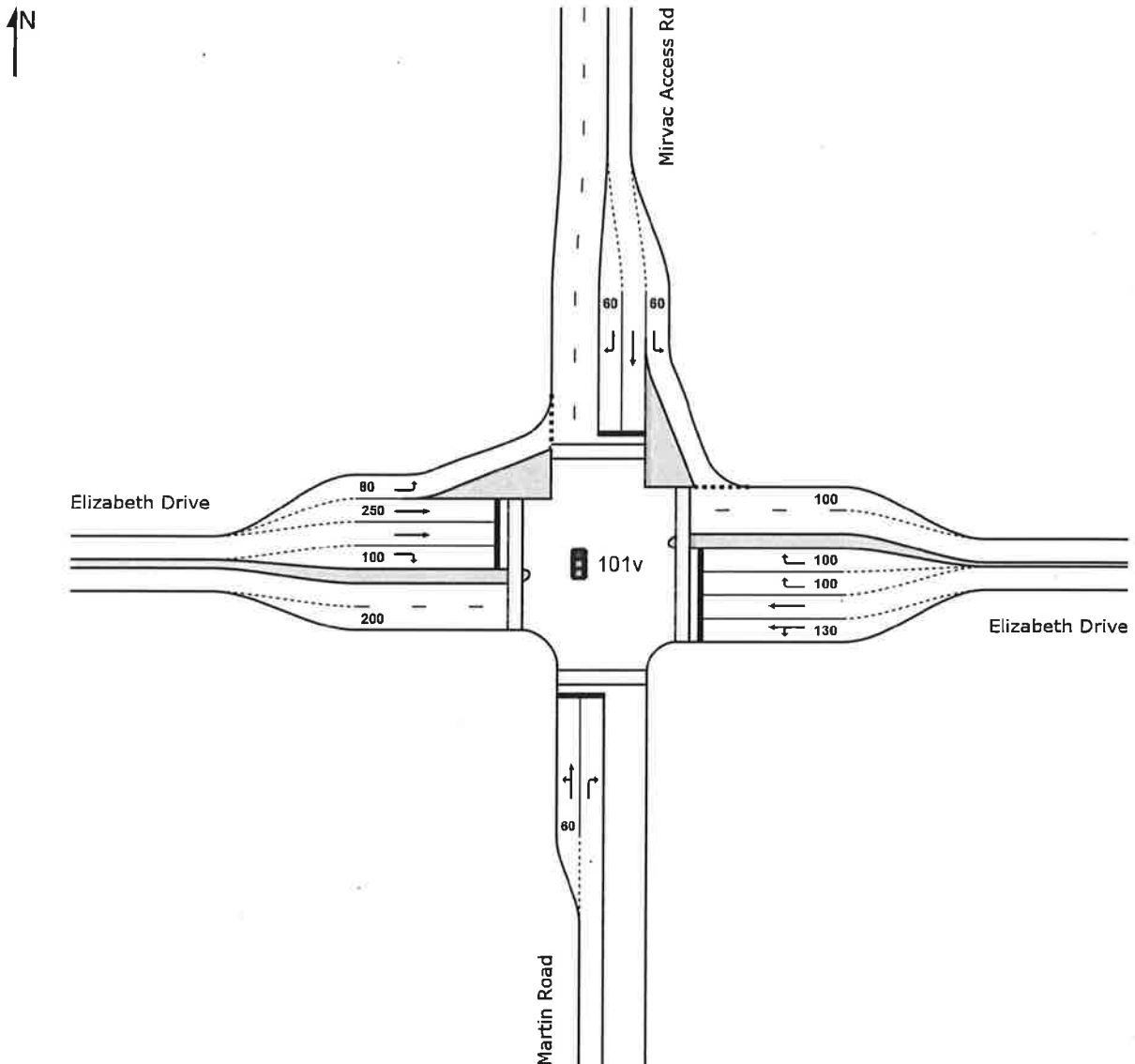
SITE LAYOUT

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

20231 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 75 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Martin Road												
1	L2	59	16.9	0.107	23.8	LOS B	1.5	14.3	0.71	0.71	0.71	42.0
2	T1	1	0.0	0.107	18.0	LOS B	1.5	14.3	0.71	0.71	0.71	43.3
3	R2	169	24.3	0.646	39.4	LOS C	6.2	65.9	0.98	0.84	1.05	35.9
Approach		229	22.3	0.646	35.3	LOS C	6.2	65.9	0.91	0.81	0.96	37.3
East: Elizabeth Drive												
4	L2	68	54.4	0.713	24.6	LOS B	18.5	145.8	0.85	0.77	0.85	48.9
5	T1	1190	5.9	0.713	16.7	LOS B	18.5	145.8	0.85	0.77	0.85	58.5
6	R2	141	9.9	0.254	23.7	LOS B	1.4	11.9	0.91	0.75	0.91	46.5
Approach		1399	8.6	0.713	17.8	LOS B	18.5	157.4	0.86	0.76	0.86	56.5
North: Mirvac Access Rd												
7	L2	566	10.1	0.691	12.9	LOS A	9.4	80.1	0.78	0.81	0.78	48.8
8	T1	1	0.0	0.003	27.5	LOS B	0.0	0.2	0.84	0.50	0.84	41.5
9	R2	161	9.9	0.682	40.9	LOS C	6.1	51.6	0.99	0.87	1.12	35.5
Approach		728	10.0	0.691	19.1	LOS B	9.4	80.1	0.83	0.82	0.86	45.0
West: Elizabeth Drive												
10	L2	40	10.0	0.044	14.0	LOS A	0.6	5.0	0.50	0.68	0.50	53.5
11	T1	595	14.8	0.694	24.7	LOS B	12.7	117.3	0.90	0.78	0.92	52.0
12	R2	22	59.1	0.210	46.2	LOS D	0.8	13.1	0.97	0.71	0.97	35.5
Approach		657	16.0	0.694	24.7	LOS B	12.7	117.3	0.88	0.77	0.90	51.3
All Vehicles		3013	11.6	0.713	21.0	LOS B	18.5	157.4	0.86	0.78	0.87	50.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P2	East Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P3	North Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
P4	West Full Crossing	50	30.9	LOS D	0.1	0.1	0.91	0.91	
All Pedestrians		200	30.9	LOS D			0.91	0.91	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

Site: 101v [Elizabeth Drive & Martin Rd - 20231 PM Mirvac & Mod 4 TCSA]

2031 PM with Mod 3 & 4 & Mirvac & Traffic Signals with Slip lanes modelled as independent crossings

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 75 seconds (Site Optimum Cycle Time - Minimum Delay)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times determined by the program

Green Split Priority has been specified

Phase Sequence: SDO In Elizabeth & Cross Phase in Martin/Access Rd (phase reduction applied)

Reference Phase: Phase A

Input Phase Sequence: A, B, D, E, E1

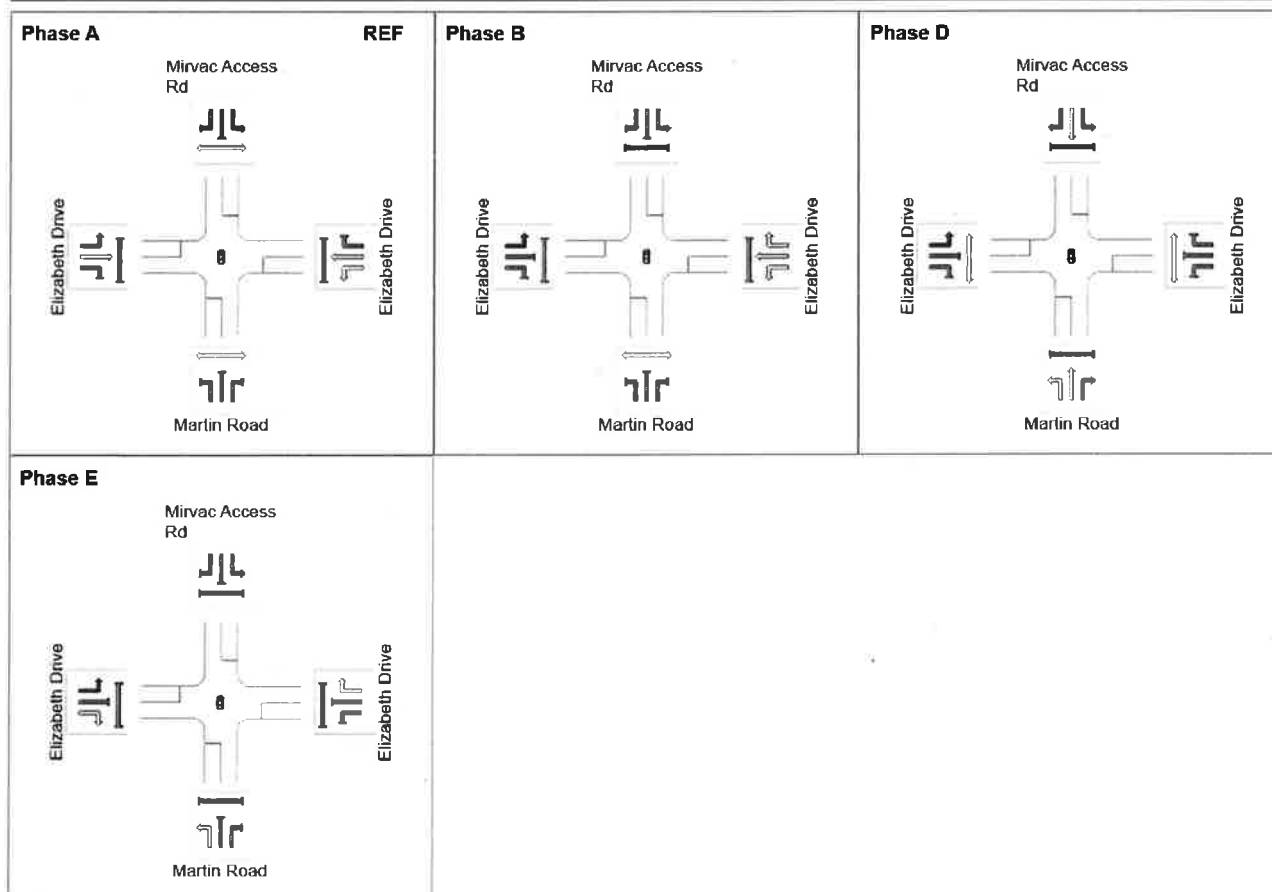
Output Phase Sequence: A, B, D, E

Phase Timing Summary

Phase	A	B	D	E
Phase Change Time (sec)	0	29	42	62
Green Time (sec)	23	6	13	6
Phase Time (sec)	30	13	20	12
Phase Split	40%	17%	27%	16%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase

VAR: Variable Phase



Traffic Signal Warrant Report
for Elizabeth Drive and Martin Road Intersection at
Badgerys Creek

TRAFFIC SIGNAL WARRANT REPORT
FOR
ELIZABETH DRIVE/MARTIN ROAD
INTERSECTION
AT
BADGERYS CREEK

Ref. 19007r

February 2019

Prepared By



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REFERENCES

FIGURES

- Figure 1 Intersection of Elizabeth Drive and Martin Road Badgerys Creek
 Figure 2 2026 AM and PM Hourly Intersection Volumes with CSR's Modifications 3 and 4
 Figure 3 2026 AM and PM Hourly Intersection Volumes with CSR's Modifications 3 and 4 and Mirvac Development

APPENDICES

- Appendix 1 Western Sydney Aerotropolis Stage 1 Structure Plan

1.0 INTRODUCTION

This report documents the assessment of a traffic signal warrant for the provision of traffic signals at the intersection of Elizabeth Drive and Martin Road, Badgerys Creek.

The assessment examines the future traffic volumes and traffic conditions at the intersection based on the existing and proposed future development that will be located in Martin Road, as well as proposed development adjacent Martin Road that requires vehicle access to Elizabeth Drive.

The traffic signal warrant report has been prepared for CSR's Badgerys Creek Advanced Manufacturing Hub Proposed Modifications 3 and 4. The CSR site is located in Martin Road at its southern end.

The other specific development considered in the warrant report is the proposed Mirvac Industrial Development at Badgerys Creek which is located on land on the northern side of Elizabeth Drive opposite Martin Road.

In addition to these developments, all land serviced by Martin Road and Lawson Roads is to be zoned flexible employment land and will be subject to future redevelopment, as a range of employment uses including industrial/warehouse uses.

2.0 EXISTING ROAD NETWORK AND CURRENT PLANNING

The Elizabeth Drive/Martin Road intersection at Badgerys Creek is a sign controlled intersection with Martin Road subject to Give Way control.

Elizabeth Drive is an east west state (RMS) arterial road, and in this section at Badgerys Creek is currently a two lane road with an 80km/h speed limit.

At the Martin Road intersection, left and right turn auxiliary lanes are provided in Elizabeth Drive for turning traffic, into Martin Road. Vehicles turning left or right out of Martin Road are required to select a suitable safe gap in the Elizabeth Drive traffic flow.

Adjacent intersections that also intersect with Elizabeth Drive include Lawson Road and the Access Road to the Suez Resource Recovery Facility which are both west of Martin Road.

Figure 1 shows the existing channelisation at the Elizabeth Drive/Martin Road intersection and at the adjacent intersections.

Sight distance to and from the east provides adequate sight distance to the Martin Road intersection (both Stopping Sight Distance and Safe Intersection Sight Distance). A crest in Elizabeth Drive west of Martin Road limits sight distance to and from the west. Although sight distance in the western approach meets Stopping Sight Distance, it does not meet Austroads requirements for Safe Intersection Sight Distance for the 80km/h speed limit.

Martin Road is currently a dead end at the CSR site, although Liverpool Council has indicated that it may be extended in the future associated with the proposed land use changes for the new airport. RMS has indicated that Martin Road will be the main access road (ie. collector road) from the Martin Road / Lawson Road precinct.

The Western Sydney Airport at Badgerys Creek is being constructed and is planned to open in 2026. As part of the Western Sydney Airport, the Western Sydney Aerotropolis Stage 1 Plan has been developed for the future development of land adjacent the airport. The land adjacent Elizabeth Drive/Martin Road intersection is identified as flexible employment land. A copy of the Western Sydney Aerotropolis Stage 1 Structure Plan showing the future land uses at Badgerys Creek and the adjacent areas is included in Appendix 1.

RMS planned road upgrades include the M12, as well as a package of other works. While upgrades to Elizabeth Drive at Badgerys Creek from a two lane road are proposed, this is unlikely to occur before 2026 as there is no funding. While no details of the future road upgrades are publicly available, the RMS has indicated that Elizabeth Drive will be upgraded to a 4 lane divided road with future provision for a 6 lane divided road.

Subject to approval, the proposed CSR Modifications 3 and 4 are expected to be operational in 2021.

Mirvac have also advised that Stage 1 of the proposed industrial development opposite Martin Road is expected to be operational in 2021. The full development Stages 1 and 2 is expected to be operational around 2026.

The year 2021, will be before any road upgrades will occur in Elizabeth Drive and before the completion of the M12 which is expected to coincide with the opening of Western Sydney Airport in 2026.



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FIGURE 1

TRAFFIC SIGNAL WARRANT FOR
ELIZABETH DR/MARTIN RD INTERSECTION AT BADGERYS CREEK
ELIZABETH DRIVE/MARTIN ROAD
EXISTING INTERSECTION

JOB NO.19007

11/02/19

3.0 RMS SIGNAL WARRANTS

3.1 Factors Influencing the Provision of Traffic Signals

The RMS Traffic Signal Design Guide, Section 2 Warrants (2010) provides information on general warrants for the installation of traffic signals in NSW, although this publication also emphasises that the general warrants are a guide only.

The RMS Traffic Signal Design Guide states that traffic signals are installed at intersections for the following reasons.

- To provide traffic control at a site with a traffic capacity or road safety problem
- To control conflicting movements with high traffic flows
- To facilitate access to and from local areas in a major/minor road system, including pedestrian movements
- As part of an area wide system of traffic management

Factors influencing the provision of traffic signals include;

- Traffic flows
- Traffic conflicts
- Traffic accident statistics
- Pedestrian requirements
- Access to major roads
- Cost of installation
- Availability of funds
- Maintenance costs
- Practicality
- Feasibility
- The signposted speed limit is not more than 80km/h

3.2 Signalised Intersections General Warrants

General Warrants

The RMS Traffic Signal Design Guide indicates that a signalised intersection may be considered if one of the following warrants is met.

- (a) Traffic demand:
For each of four one-hour periods of an average day:
- (i) the major road flow exceeds 600 vehicles/hour in each direction; and
 - (ii) the minor road flow exceeds 200 vehicles/hour in one direction.
- OR
- (b) Continuous traffic:
For each of four one-hour periods of an average day:
- (i) the major road flow exceeds 900 vehicles/hour in each direction; and
 - (ii) the minor road flow exceeds 100 vehicles/hour in one direction; and
 - (iii) the speed of traffic on the major road or limited sight distance from the minor road causes undue delay or hazard to the minor road vehicles; and

- (iv) there is no other nearby traffic signal site easily accessible to the minor road vehicles.

OR

- (c) Pedestrian safety:

For each of four one-hour periods of an average day:

- (i) the pedestrian flow crossing the major road exceeds 150 persons/hour; and
- (ii) the major road flow exceeds 600 vehicles/hour in each direction or, where there is a central median of at least 1.2m wide, 1000 vehicles/hour in each direction.

OR

- (d) Pedestrian safety – high speed road:

For each of four one-hour periods of an average day:

- (i) the pedestrian flow crossing the major road exceeds 150 persons/hour; and
- (ii) the major road flow exceeds 450 vehicles/hour in each direction or, where there is a central median of at least 1.2m wide, 750 vehicles/hour in each direction; and
- (iii) the 85th percentile speed on the major road exceeds 75km/h.

OR

- (e) Crashes:

- (i) The intersection has been the site of an average of three or more reported tow-away or casualty traffic accidents per year over a three year period, where the traffic accidents could have been prevented by traffic signals; and
- (ii) the traffic flows are at least 80% of the appropriate flow warrants.

Comment

Traffic signal warrants were originally developed to assist road authorities in determining the most efficient allocation of scarce public funding (i.e. economic reasons), where road improvements such as traffic signals were fully funded by government (ie. public funding).

In this case, the proposed intersection improvements including traffic signals at the Elizabeth Drive / Martin Road / Mirvac Access Road intersection will be fully funded by private sector finance (ie. no public money).

The general traffic volume warrants used in NSW have existed in some form for over 50 years and all publications including the current RMS Traffic Signal Design Guide emphasises that the general warrants are a guide only.

The general warrants predate modern advancements in traffic engineering where computer based traffic modelling has been further developed and is now used and relied upon when examining and comparing appropriate types of traffic control for intersections.

3.3 Critical Criteria Not Included in General Traffic Signal Warrants

There are a number of critical factors which are not taken into account in the General Traffic Signal Warrants, which make these warrants a blunt tool when assessing an intersection for traffic signal control.

Volume warrants for the side or minor road take no account of the intersection geometry (i.e. how many lanes the major and minor roads have), nor the number of heavy vehicles and vehicle delays at the intersection.

For intersections controlled by signs the required safe gap (i.e. time interval) for a vehicle turning right out of a minor road into the major road increases with the number of lanes in the major road and this reduces the number of safe gaps that occur in the major road. In addition, the higher the traffic volumes on the major road, the less gaps there are in the traffic flow to allow the minor traffic flow to join the major road, regardless of minor road traffic volume.

Heavy vehicles depending on their size, require gaps in the major traffic flow of between 1.5 to 2.0 times greater than a car (i.e. 150% - 200% higher) to turn right out of a minor road into the major road. Austroads notes that heavy vehicles are typically the equivalent of 2-4 cars and these car equivalents are used in capacity calculations for heavy vehicles. Austroads states that semi trailers (i.e. 16-19 metres long) are equivalent to 3 (three) passenger cars and 25 metres long B doubles, the equivalent to 4 (four) passenger cars.

Vehicle delay for vehicles in the minor road which is subject to sign or priority control is a critical factor that is normally considered in evaluating if the traffic management/traffic controls at the intersection, need to be upgraded. The RMS Level of Service Criteria for Intersections (Table 4.2 of Guide to Traffic Generating Developments) states for intersections controlled by Give Way/Sign Control, average vehicle delays on the minor movement that equate to Level of Service E (i.e. 57 to 70 seconds) indicates that the intersection/movement is at capacity and requires another control mode. A Level of Service E or F on the minor traffic stream indicates that there are insufficient gaps in the major traffic stream to allow the minor stream to be absorbed safely into the major stream and hence produces long vehicle delays to the minor stream.

Traffic signal warrants take no account of these factors and therefore decisions on the need for traffic signals should look beyond the strict application of traffic signal warrant based on traffic volumes only.

Factors that support the provision of traffic signal at the Elizabeth Drive/Martin Road intersection include;

- Future land use changes in the area adjacent Western Sydney Airport which are identified in Western Sydney Aerotropolis Stage 1 Land Use and Infrastructure Implementation Plan;
- Future traffic growth along Elizabeth Drive associated with the new airport and land use changes and the need to provide safe vehicle access to Elizabeth Drive from the Martin Road/Lawson Road precinct particularly for those vehicles that wish to exit the precinct to travel east. Both intersections are currently under sign control on Martin Road and Lawson Road. Martin Road will be the principal access road for these properties contained within the Martin Road / Lawson Road precinct.

- The need to manage traffic conflicts associated with the traffic volume increases at Elizabeth Drive/Martin Road intersection due to the proposed CSR and Mirvac developments to avoid long vehicle delays and a consequent deterioration in road safety. The vehicle delays for the CSR Modification 3 proposal with the intersection operating under sign control, have been identified in the traffic modelling undertaken for CSR's Modification 3 traffic assessment report.

4.0 ASSESSMENT OF TRAFFIC SIGNAL WARRANT FOR TRAFFIC CONDITIONS WITH MODIFICATIONS 3 AND 4

4.1 General Volume Warrant

While the intersection upgrade and traffic signals will be required in 2021, it has been agreed with the RMS that future 2026 volumes would be examined as part of the warrant assessment.

The future AM and PM peak period approach volumes for 2026 (prior to the M12) for the Elizabeth Drive/Martin road intersection are shown in Table 4.1. These volumes are derived from the traffic assessment reports for Modifications 3 and 4 and are based on the intersection operating as a T-junction intersection.

Figure 2 shows the 2026 AM and PM period traffic volumes using the intersection with Modifications 3 and 4.

These volumes include the existing volumes, the background traffic growth plus the airport construction traffic in Elizabeth Drive.

For Martin Road the volumes include the existing traffic volumes, plus current approved developments, plus additional traffic from Modifications 3 and 4. For Martin Road it is likely that there will be other additional future development volumes associated with the development of other lands in the Martin Road/Lawson Street precinct that is zoned for flexible employment.

Excluding the Australian Native Landscape (ANL) and CSR sites, there is approximately 230 hectares of land in the Martin Road/Lawson Road precinct that can be developed as flexible employment (i.e. light industrial/warehousing etc). It is likely a portion of this land will be developed in the near future, prior to 2026.

Reference to Table 4.1 shows that the 600vph major volumes figure is exceeded in both approaches of Elizabeth Drive in 2026.

The 200vph is exceeded in Martin Road in the PM period, but not in the AM period.

However, as shown in the table, a very large proportion of the vehicles in Martin Road will be heavy vehicles with the majority being articulated vehicles (i.e. 19 metre semis and some 25 metre B Doubles).

When converting the heavy vehicles to car equivalents and adopting 3 car equivalents per heavy vehicle, the traffic volume in the AM period for Martin Road are 156vph for Modification 3 and 194vph for Modification 3 and 4.

In addition, it is considered there will be additional approach traffic volumes in Martin Road generated by other development (currently not approved) in the Martin Road/Lawson Road precinct between 2019 and 2026).

Based on future industrial type uses being developed in the precinct with 28 employee trips per developed hectare and a driver rate of 68% total employee trips for the 230 hectares would be in the order of 4,379 vehicle trips, most of which would occur in the weekday 2 hour peak AM and 2 hour peak PM periods.

The redevelopment of this land will occur over a 10-20 year period. However, some proportion of this land in the Martin Road/Lawson Road precinct is likely to be developed before 2026 which will increase traffic volumes in Martin Road.



← 819 (159)

Martin Road

$(55)_{83}^*$ $\uparrow$

↓
*(64) 126

Elizabeth Drive

← 1065 (128)

Martin Road

$(61)_{228}^*$ $\rightarrow$

90 (50) *

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Based on Martin Road's role of being the access road from the precinct it can be safely assumed that the traffic volumes in Martin Road will increase and be higher than the volumes shown in Table 4.1 for the year 2026, and continue to increase in the future as the land in the precinct is progressively developed.

TABLE 4.1**2026 AM PERIOD – HOURLY APPROACH VOLUMES**

Approach	Total Volumes including heavy vehicles	
	Mod 3	Mod 3 & 4
Elizabeth Drive Eastbound	1045 (115)	1049 (119)
Elizabeth Drive Westbound	802 (147)	819 (159)
Martin Road	66 (45) *	84 (55) *

2026 PM PERIOD – HOURLY APPROACH VOLUMES

Approach	Total Volumes including heavy vehicles	
	Mod 3	Mod 3 & 4
Elizabeth Drive Eastbound	750 (114)	755 (120)
Elizabeth Drive Westbound	1030 (108)	1065 (128)
Martin Road	208 (35) *	228 (51) *

Where: 924 Total Approach Traffic Volumes
(104) Number of Heavy Vehicles

* this volume likely to be increased due to the development of other land use sites in the Martin Road/Lawson Road precinct between 2019 and 2026.

4.2 Other Critical Criteria

The traffic modelling undertaken for Modification 3 in 2021 showed that the Elizabeth Drive/Martin Road intersection would have an unsatisfactory operation with a Level of Service E operation in the AM peak (i.e. at capacity) and Level of Service F operation (oversaturated) in the PM peak.

This poor level of service is due to the level of delay to the right turn out of Martin Road which is calculated to be 69 seconds per vehicle in the AM peak and 167 seconds per vehicle in the PM peak.

This Level of delay shows that there will be insufficient gaps in the Elizabeth Drive traffic flow to safely accommodate the right turn movement out of Martin Road which includes a large proportion of articulated heavy vehicles.

As there is no safe alternative route to Martin Road that can be used to join Elizabeth Drive to travel east towards the M7, the trucks and some cars will force their way out, rather than wait for periods ranging between 69 to 167 seconds to turn right. As the traffic volumes increase in Elizabeth Drive, the delays in Martin Road will also increase.

This will increase the conflicts at the intersection and create unsafe traffic conditions for intersection users.

The provision of intersection upgrades works which includes intersection traffic signals will ameliorate the unsatisfactory impacts associated with sign control of the existing T-junction intersection. Traffic modelling for Modification 3 and Modification 4 for 2021 and 2026 shows that the intersection would have a good operation with a Level of Service A/B operation and low average vehicle delays, under traffic signal control.

The provision of the traffic signals at the intersection of Elizabeth Drive/Martin Road will address the increased traffic conflict, adverse vehicle delay and ameliorate adverse road safety outcomes, which would occur if the intersection remains under sign control.

4.3 Summary

The provision of traffic signals at the intersection aligns with the RMS Traffic Signal Design Guide's stated reasons for the provision of traffic signals which includes;

- Address a traffic capacity and potential road safety problem;
- Control conflicting movements with high traffic flows and a large proportion of heavy vehicles; and
- Facilitate safe vehicle access to and from the Martin Road/Lawson Road precinct (local area) to Elizabeth Drive for those vehicles wishing to travel east.

Therefore it is concluded that a traffic signal warrant is met for the provision of traffic signals based on future intersection volumes, vehicle delays, road safety considerations and future planning.

5.0 ASSESSMENT OF TRAFFIC SIGNAL WARRANT FOR TRAFFIC CONDITIONS WITH MIRVAC DEVELOPMENT AND MODIFICATIONS 3 AND 4

5.1 General Volume Warrant

Mirvac are proposing an industrial development on land located on the northern side of Elizabeth Drive opposite Martin Road.

In discussion with the RMS concerning access to Elizabeth Drive, the RMS suggested/advised Mirvac to locate the Access Road to the subdivision opposite Martin Road at Elizabeth Drive, which would create a cross junction intersection.

Mirvac are proposing 2 stages with Stage 1 for 193, 530m² GFA to be operational by 2021 and full development of Stages 1 and 2 for a total of 450,000m² GFA, which is expected to be operational by 2026.

Mirvac's traffic consultant (Ason Group) have provided a high level traffic assessment for the industrial development based on established RMS trip rates for similar business parks. Mirvac and Ason Group have indicated they will further refine the traffic generation and trip assignment to the road network in consultation with the RMS. However for the purpose of examining the traffic signal warrant, the preliminary traffic estimates are sufficient.

Tables 5.1 shows the estimated traffic generation for both stages, as determined by Ason Group.

TABLE 5.1

TRAFFIC GENERATION OF MIRVAC DEVELOPMENT

Stage	Peak Periods	Building Area (GFA)	Adopted Rates	Total Generation	In (veh/hr)	Out (veh/hr)
Stage 1	AM	200,000m ²	0.202	404 veh/hr	323	81
	PM				81	323
Stage 1 + Stage 2	AM	450,000m ²	0.20	909 veh/hr	727	182
	PM				182	727

Stage 1 will generate some 405 vehicles/hour during the peak periods.

The combined Stages 1 and 2 development will generate in the order of 909 vehicles/hour during peak periods. These trips have been assumed to occur with an 80:20 split in the direction of peak flow with a 10% heavy vehicle component.

Ason's Group trip assignment for Stage 1 and Stages 1 and 2 are as follows.

Direction	Vehicle Trips Stage 1		Vehicle Trips Stage 1 and 2	
	AM	PM	AM	PM
Arrivals from the West	72	18	161	40
Arrivals from the East	251	63	566	141
Departures to the West	18	72	40	161
Departures to the East	63	251	141	566

Tables 5.2 shows the estimated 2026 AM and PM period approach traffic volumes using the Elizabeth Drive/Martin Road/Mirvac Access Road intersection with CSR's Modification 3 and Modification 4 developments and the Mirvac Industrial development.

Figure 3 shows the 2026 AM and PM volumes at the intersection, with the above developments and includes both Modifications 3 and 4.

A review of the approach volumes at the intersection indicates that this level of traffic volumes could not be safely accommodated at the intersection under sign control.

Reference to Table 5.2 shows that the traffic signal volume warrant will be easily met, both on Elizabeth Drive and on the side streets of Martin Road and Mirvac Access Road.

TABLE 5.2

**2026 AM PERIOD – HOURLY APPROACH VOLUMES
WITH MODIFICATIONS 3 AND 4 AND MIRVAC STAGES 1 AND 2
DEVELOPMENT**

Approach	Total Volumes including heavy vehicles	
	Mod 3	Mod 3 & 4
Elizabeth Drive Eastbound	1206 (131)	1210 (135)
Elizabeth Drive Westbound	1368 (204)	1385 (216)
Martin Road	66 (45) *	84 (55) *
Mirvac Access Road	181 (18)	181 (18)

**2026 PM PERIOD – HOURLY APPROACH VOLUMES
WITH MODIFICATIONS 3 AND 4 AND MIRVAC STAGES 1 AND 2
DEVELOPMENT**

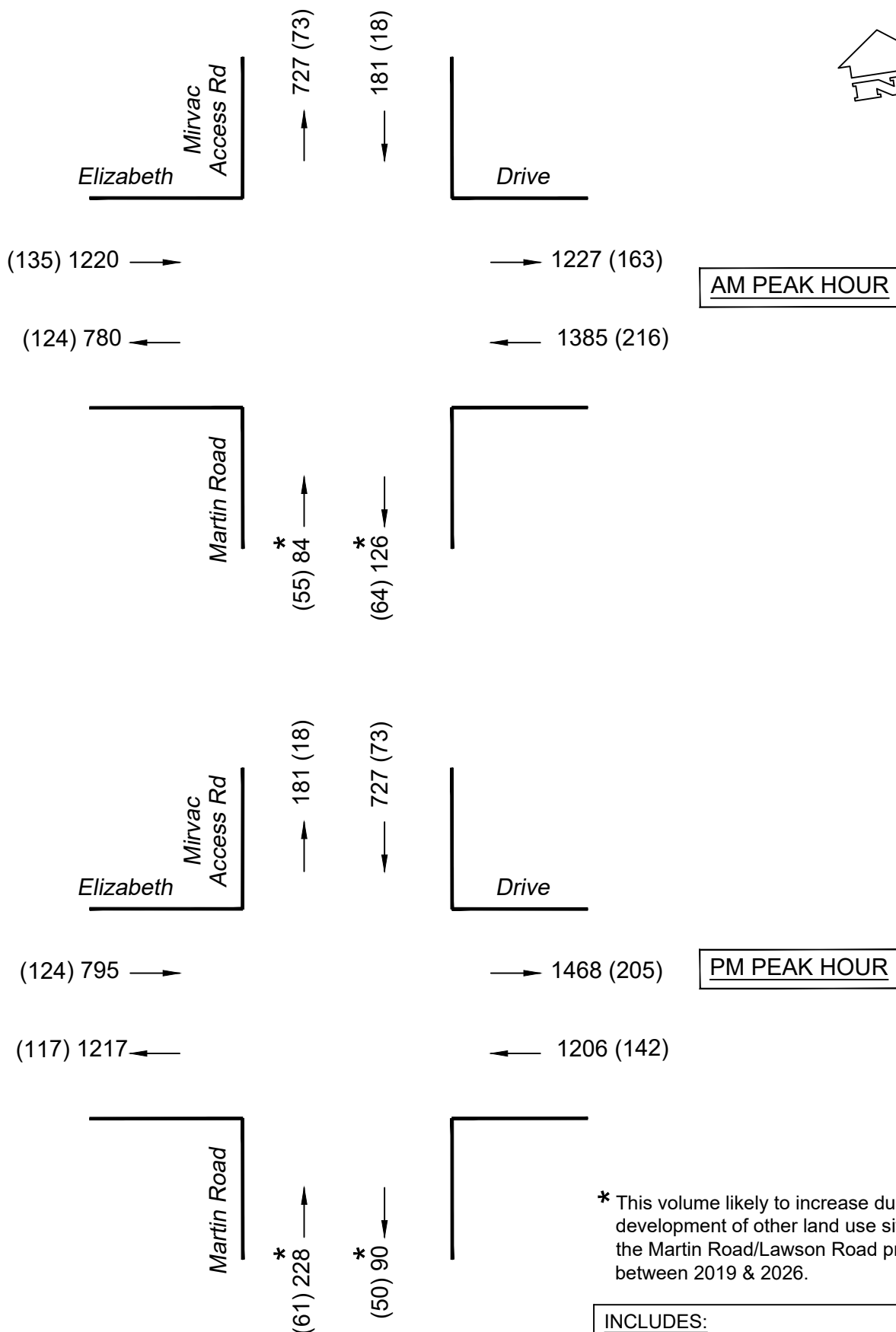
Approach	Total Volumes including heavy vehicles	
	Mod 3	Mod 3 & 4
Elizabeth Drive Eastbound	790 (118)	795 (124)
Elizabeth Drive Westbound	1171 (122)	1206 (142)
Martin Road	208 (35) *	228 (51) *
Mirvac Access Road	181 (18)	727 (73)

Where: 924 Total Approach Traffic Volumes
(104) Number of Heavy Vehicles

** this volume likely to be increased due to the development of other land use sites in the Martin Road/Lawson Road precinct between 2019 and 2026.*

5.2 Summary

The Mirvac Development will increase traffic volumes using the Elizabeth Drive/Martin Road intersection by a significant factor and reinforces that a traffic signal warrant is met for the intersection.



KEY

344 TOTAL VEHICLES
(27) HEAVY VEHICLES

INCLUDES:

- CSR's Modifications 3 & 4
- Mirvac Development Stages 1 & 2

TRANSPORT AND URBAN PLANNING

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FIGURE 3

TRAFFIC SIGNAL WARRANT FOR
ELIZABETH DR/MARTIN RD INTERSECTION AT BADGERYS CREEK
**FUTURE 2026 AM & PM HOURLY APPROACH VOLUMES
WITH CSR's MODIFICATIONS 3 & 4 AND MIRVAC**

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6.0 CONCLUSIONS

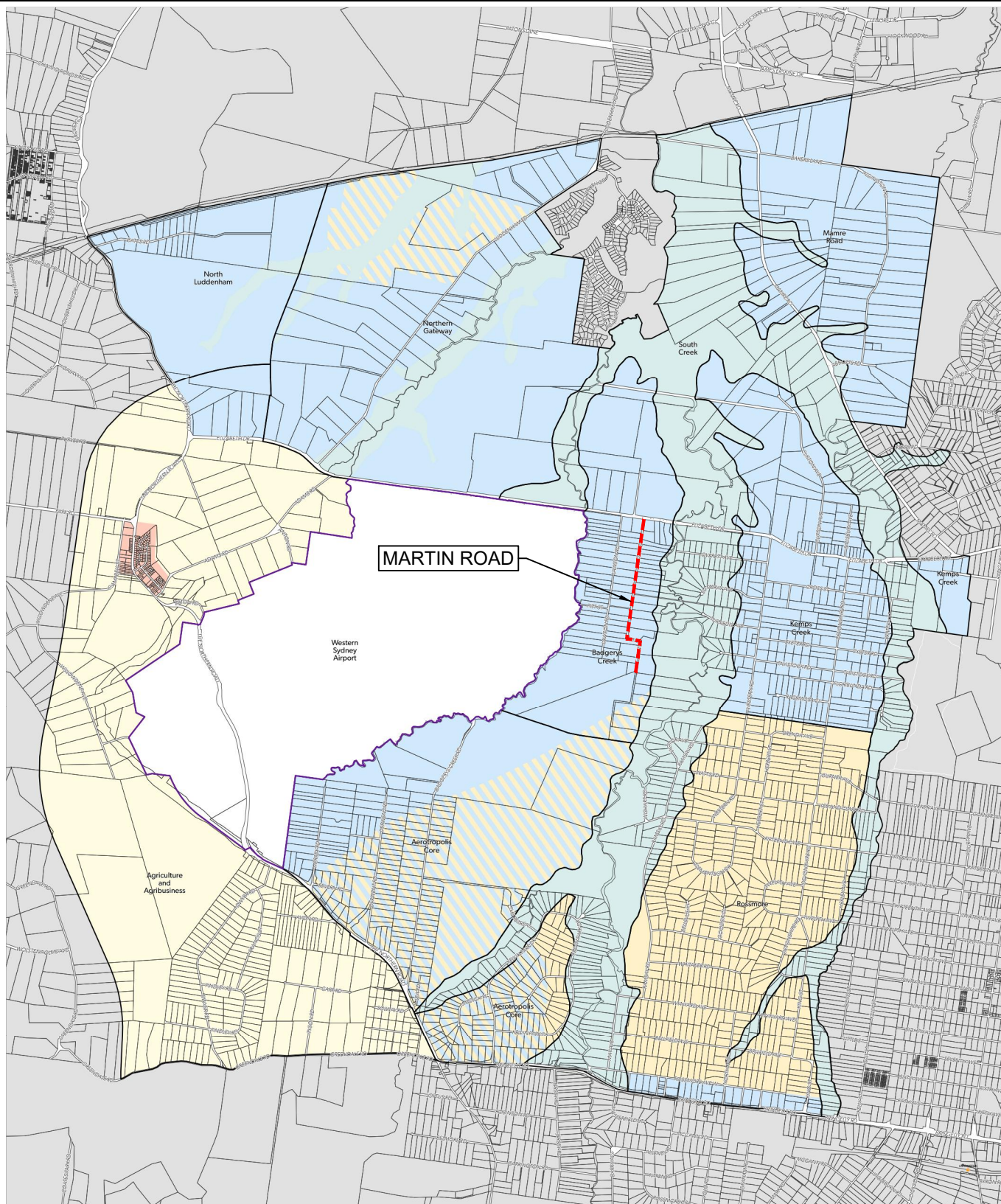
This report documents the assessment of a traffic signal warrant for the intersection of Elizabeth Drive/Martin Road.

The assessment has examined the future volume increases at the intersection associated with the construction of Western Sydney Airport, background traffic growth, as well as for CSR's Badgerys Creek Advanced Manufacturing Hub Modifications 3 and 4 and the proposed Mirvac Industrial Development, which is located on land on the northern side of Elizabeth Drive opposite Martin Road.

The assessment concludes that a traffic signal warrant is met for the intersection's 2026 operation with the proposed CSR Modifications 3 and 4 development, as well as for the 2026 intersection's operation with the proposed Mirvac development.

REFERENCES

1. Traffic Assessment report for CSR's Badgerys Creek Advanced Manufacturing Hub Modification 3. 235 Martin Road Badgerys Creek. Transport and Urban Planning Pty Ltd.
2. Traffic Assessment Report for CSR's Advanced Manufacturing Hub Modification 4. 235 Martin Road Badgerys Creek. Transport and Urban Planning Pty Ltd.
3. Traffic advice from Ason Group regarding Mirvac Development dated 18 January 2019.
4. RMS Traffic Signal Design Guide – Section 2 Warrants.
5. Austroads Guide to Traffic Management Part 3 – Traffic Studies and Analysis.
6. Austroads Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings.
7. Western Sydney Aerotropolis Stage 1 Plan. Department of Planning and Environment. August 2018.



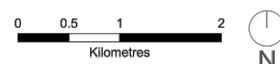
Please note that the precinct boundaries are for strategic planning purposes. The boundaries do not indicate future zone boundaries or commitments to the provision of infrastructure.



- Western Sydney Airport
- Precinct Boundary
- Cadastre Lot

- Agricultural
- Luddenham Village
- Flexible Employment
- Urban Land

- Non Urban Land
- Mixed Flexible Employment & Urban Land



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APPENDIX 1

TRAFFIC SIGNAL WARRANT FOR ELIZABETH DR/MARTIN RD INTERSECTION AT BADGERYS CREEK **WESTERN SYDNEY AEROTROPOLIS STAGE 1 STRUCTURE PLAN**

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