

# MR 644 PROSPECT HIGHWAY UPGRADE

## Traffic and Transport Assessment

Rev No.	Date	Prepared by	Reviewed by
01	15/02/2013	N Vukic	M Stephens
02	20/02/2013	N Vukic	M Stephens
03	1/05/2013	N Vukic / M Stephens	B Hamilton
04	19/06/2013	N Vukic	N Nassar / M Stephens
05	15/07/2013	N Vukic	N Nassar

Rev No.	Date	Issued to RMS
01	15/02/2013	E Davies
02	20/02/2013	E Davies
03	1/05/2013	A Lyle, E Davies, M Swallow
04	19/06/2013	A Lyle, E Davies, M Swallow
05	15/07/2013	A Lyle, E Davies, M Swallow

Contact for further information:

Nicole Vukic  
Traffic and Transport Planning Manager  
(02) 9900 7037  
[nicole.vukic@smec.com](mailto:nicole.vukic@smec.com)

© Snowy Mountains Engineering Corporation  
(SMEC Australia Pty Ltd)

The information within this document produced by SMEC Australia is solely for the use of the Client identified on the cover sheet for the purpose for which it has been prepared. SMEC Australia undertakes no duty to or accepts any responsibility to any third party who may rely upon this document. All rights reserved. No section or element of this document may be removed from this document, reproduced, electronically stored or transmitted in any form without the written permission of SMEC Australia.

## TABLE OF CONTENTS

1	INTRODUCTION .....	3
2	EXISTING TRANSPORT NETWORK.....	5
3	DESCRIPTION OF PROPOSAL.....	11
4	MODELLING METHODOLOGY .....	17
5	IMPACT ASSESSMENT .....	22
6	DESIGN RECOMMENDATIONS.....	29
7	CONCLUSION .....	32

APPENDIX A:	Modelled Design, Drawing Number DS2012/000491, 10 December 2012
APPENDIX B:	Intersection phasing and AIMSUN and PARAMICS signal data
APPENDIX C:	Revised Design, Drawing Number DS2012/000491, 3 June 2013

# 1 INTRODUCTION

## Background

NSW Roads and Maritime Services (RMS) commissioned SMEC Australia Pty Ltd (SMEC) to:

- + Conduct traffic modelling of the preferred Prospect Highway (MR644) Upgrade (referred to herein as “the Proposal”) design using existing data provided by RMS and assist RMS in selecting a preferred local access strategy to inform the Major Project Review Committee (MPRC)
- + Undertake a comparative assessment of the two access strategy options for Tudor Avenue, Vesuvius Street and Roger Place and recommend an access arrangement
- + Provide design recommendations for the Prospect Highway Upgrade, between Reservoir Road and St Martins Crescent
- + Conduct a qualitative assessment of the proposed new two-way link road between the Great Western Highway and the Prospect Highway proposed by RMS.

## Project overview

The road network within the study area is approaching capacity and experiences significant delays during the AM and PM peak periods. Traffic volumes are forecast to increase with the development of Greystanes Southern Employment Lands Estate and the Wet ‘n Wild water park, south of the study area.

In 2011, RMS commissioned micro-simulation (PARAMICS) traffic modelling of potential upgrades to the Prospect Highway between Reservoir Road and Lancelot Street.

Traffic models were prepared under 2016, 2021 and 2031 forecast traffic volumes, based on a combination of RMS’s strategic EMME model outputs and first principle calculations.

RMS developed a preferred corridor layout based on the outcomes of a post options workshop held in August 2012. The preferred corridor upgrade comprises:

- + Dual carriageway with two general traffic lanes in each direction and bus only lanes in each direction between Tudor Avenue and Lancelot Street
- + Two-way link road between the Great Western Highway and the Prospect Highway with signalised

control at its intersection with the Great Western Highway allowing for all movements at this location

- + Signalisation of the Great Western Highway eastbound exit ramp and the Prospect Highway intersection
- + Signalisation of the M4 Western Motorway eastbound exit ramp, M4 Western Motorway eastbound entry ramp and the Prospect Highway intersection
- + Signalisation of the Prospect Highway / Stoddart Road intersection.

The following two access strategy options were considered for the intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway:

- + **Option 1:** Provision of left-in / left-out only access to the minor approach.
- + **Option 2:** Provision of left-in / right-in and left-out only access to the minor approach

## Site location

The Proposal is located north of the M4 Western Motorway, within the Blacktown City local government area (LGA) approximately 28 kilometres west of Sydney CBD. Figure 1.1 illustrates the study area.

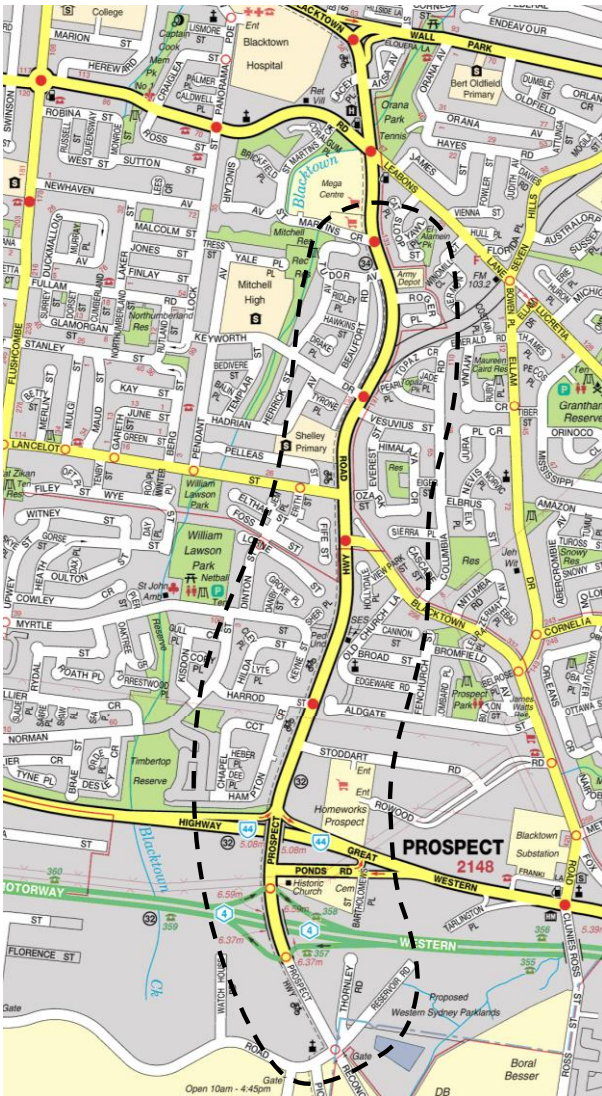


Figure 1.1: Prospect Highway Upgrade, study area

## Report scope

The scope of this report is to:

- + Detail the existing transport network, current road performance, public transport provisions and pedestrian and cyclist facilities (Section 2)
- + Provide an overview of the proposed Prospect Highway Upgrade and the two access strategy options under consideration (Section 3)
- + Document the AIMSUN traffic modelling methodology adopted in developing the models used to assess the access strategy options using the data available from previous modelling conducted by RMS (Section 4)
- + Provide a comparative performance assessment the two access strategy options and their impacts on the Prospect Highway operations and local resident access to inform the MPRC (Section 5)
- + Recommend modifications to improve the operation for the proposed design and a preferred access strategy (Section 6).

## 2 EXISTING TRANSPORT NETWORK

### Road network

#### Administrative road hierarchy

RMS has an administrative classification for the funding and management of the state's road network. This classification comprises:

- + State Classified Roads (main roads, highways and motorways), which are under the care, control and management of RMS
- + Regional Roads, which are partly funded by RMS but under the care and control of relevant local councils
- + Other Roads, which are under the care and management of relevant local councils.

Within the study area, the arterial roads are managed by RMS. The remaining collector and local streets are under the care and control of Blacktown City Council.

The following sub sections provide detailed descriptions of the key roads within the study area.

#### Functional road hierarchy

In addition to the administrative classification, RMS has defined four road classes in its functional road hierarchy system. These are summarised in **Table 2.1**.

The road network in the study area can be categorised as follows:

- + Arterial Roads
- + Sub-arterial Roads
- + Collector Roads
- + Local Streets.

**Table 2.2** summarises the administrative and functional road classifications for the key roads within the study area and provides a brief description of the existing road and intersection configurations.

Table 2.1: Functional road hierarchy

Road Class	Description	Through Traffic	Speed Limit (km/h)
Arterial Roads	Regional road in urban areas, forming the principal corridors for transport movements. Typical traffic volumes greater than 15,000 vehicles per day (vpd).	Yes	70-100
Sub-arterial Roads	Provide links from arterial roads to areas of development or carry traffic from one part of a subregion to all parts of the region. May relieve traffic on arterial roads in some circumstances. Typical traffic volumes between 5,000 and 20,000 vpd.	Some	60-80
Collector Roads	Provide links to sub-arterial or arterial roads, to the local road system in developed areas. Typical traffic volumes between 2,000 and 10,000 vpd.	Little	50-60
Local Roads	Provide direct vehicular access to the development or development precinct and connect to the collector, sub-arterial or arterial road network. Low volumes, usually less than 2,000 vpd.	No	50

Source: RMS Network Planning Practice Notes and Austroads

Table 2.2: Key road descriptions

Road	Road Hierarchy	Description
Prospect Highway	Administrative: State classified Functional: Sub-arterial	Provides a north-south connection with the M4 Western Motorway and Great Western Highway. Two-lane, two-way configuration with one lane in each direction. Localised widening at intersections for turning and acceleration lane provisions. Roundabout-controlled intersections with: + Reconciliation Road / Reservoir Road + M4 Western Motorway entry and exit ramps. Give-way controlled intersections with: + Great Western Highway eastbound exit ramp + Vesuvius Street + Roger Place + Tudor Avenue. Signalised controlled intersections with: + Harrod Street + Blacktown Road + Lancelot Street + Keyworth Drive + St Martins Crescent. Seagull controlled intersection with: + Ponds Road. Partial seagull controlled intersections with: + Stoddart Road. Posted speed limit of 60 km/h.
Great Western Highway	Administrative: State classified Functional: Arterial	Dual carriageway with three lanes in each direction. Eastbound exit ramp to the Prospect Highway is single lane, with northbound access to the Prospect Highway under give-way control. Eastbound entry ramp from the Prospect Highway is single lane with no merge on the Great Western Highway. Posted speed limit is 80 km/h. Ramp exit posted speed limit is 60 km/h.
M4 Western Motorway	Administrative: State classified Functional: Arterial	Dual carriageway with three lanes in each direction. Eastbound exit ramp commences as one lane and splits into two lanes on approach to the roundabout controlled intersection with the Prospect Highway and M4 Western Motorway eastbound entry ramp. Eastbound entry ramp is two lanes from the roundabout, merging into one lane on approach to the M4 Western Motorway. Westbound exit ramp commences as one lane and splits into two lanes on approach to the roundabout controlled intersection with the Prospect Highway and M4 Western Motorway westbound entry ramp. Westbound entry ramp is two lanes from the roundabout, merging into one lane on approach to the M4 Western Motorway. Posted speed limit is 100 km/h. Ramp exit posted speed limit is 60 km/h.
Reservoir Road (South of M4)	Administrative: Other Functional: Local	Two-lane, two-way configuration. Posted speed limit of 60 km/h.
Ponds Road	Administrative: State Road Functional: Arterial	Forms the westbound exit ramp and entry ramp for the Great Western Highway for the Prospect Highway traffic. Seagull intersection with the Prospect Highway, with all movements permitted into and out of Ponds Road. Posted speed limit of 60 km/h.

Road	Road Hierarchy	Description
Stoddart Road	Administrative: Other Functional: Local	Two-lane, two-way configuration. Partial seagull intersection with the Prospect Highway, with left and right-in and left out movements permitted into and out of Stoddart Road.
Harrod Street	Administrative: Other Functional: Local	Two-lane, two-way configuration. Posted speed limit of 50 km/h.
Blacktown Road	Administrative: Regional Functional: Collector	Two-lane, two-way configuration. Signalised intersection with the Prospect Highway, with bus priority provided on the Blacktown Road approach to this intersection. Posted speed limit of 60 km/h.
Lancelot Street	Administrative: Other Functional: Collector	Two-lane, two-way configuration. Signalised intersection with the Prospect Highway, with bus priority provided on both the Prospect Highway approaches and the northbound departure of the intersection. Posted speed limit of 50 km/h.
Vesuvius Street	Administrative: Other Functional: Local	Two-lane, two-way configuration. Posted speed limit of 50 km/h.
Keyworth Drive	Administrative: Other Functional: Local	Two-lane, two-way configuration. Posted speed limit of 50 km/h.
Roger Place	Administrative: Other Functional: Local	“No Through Road” with two-lane, two-way configuration. Posted speed limit of 50 km/h.
Tudor Avenue	Administrative: Other Functional: Local	Two-lane, two-way configuration. Posted speed limit of 50 km/h.



### Existing road performance

RMS conducted traffic modelling to determine the operation of the existing network under 2010 AM and PM peak traffic volumes (PB, June 2011). The existing road network performance presented in this section is extracted from these modelling results.

Table 2.3 summarises the Level of Service criteria adopted for this assessment. It is based on the RMS delay method.

Tables 2.4 and 2.5 summarise the AM and PM peak intersection analysis results under 2010 traffic volumes.

The key findings of the modelling conducted by RMS for the AM peak period include:

- + The majority of the intersections operate at Level of Service C or better during the AM peak period, with the exception of the Prospect Highway / Lancelot Street intersection, which operates at Level of Service D in the period between 8am and 9am
- + The bridge over the Great Western Highway is restricted to one lane in each direction which causes congestion
- + There is resultant platooning of traffic in both directions on the Prospect Highway between the northern roundabout at the M4 Western Motorway interchange and Harrod Street due to congestion on the bridge over Great Western Highway.

The key findings from the modelling conducted by RMS for the PM peak period include:

- + The intersections at the Great Western Highway and M4 Western Motorway interchanges (including Ponds Road) operate at Level of Service of D and F indicating that they are operating at or near capacity
- + The southern M4 Western Motorway interchange roundabout experiences significant delays on the southern approach. This is caused by the high volume of traffic turning right from southbound Prospect Highway towards the M4 Western Motorway westbound providing limited gaps for traffic from the southern approach

- + The bridge over the Great Western Highway is restricted to one lane in each direction, which causes congestion. In the PM peak, this causes delays to traffic approaching from Ponds Road
- + The eastbound exit ramp to the northern M4 Western Motorway interchange roundabout is delayed by congestion on the Prospect Highway in the northbound direction.

Table 2.3: Intersection Level of Service (LOS) criteria (RMS method of delay)

LOS	Average delay per vehicle (secs)	Traffic signals, roundabout	Give Way and Stop signs
A	<14.5	Good operation	Good operation
B	14.5 to 28.5	Good operation with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28.5 to 42.5	Satisfactory	Satisfactory, however a crash study is recommended
D	42.5 to 56.5	Operating near capacity	Operating near capacity and a crash study is required
E	56.5 to 70.5	At capacity and is likely to cause excessive delays at signals. Consider implementing alternative control method to roundabouts.	At capacity and requires alternative control method
F	70.5<	At capacity and small increases in traffic volumes are likely to cause disproportionately greater increases in delay.	At capacity and small increases in traffic volumes are likely to cause disproportionately greater increases in delay



Table 2.4: 2010 AM peak intersection analysis results

Intersection	Time	LOS	Average Delay (s)
Prospect Highway / Lancelot Street	7:00-8:00	C	30
	8:00-9:00	D	43
Prospect Highway / Blacktown Road	7:00-8:00	B	28
	8:00-9:00	B	24
Prospect Highway / Harrod Street	7:00-8:00	B	15
	8:00-9:00	B	15
Prospect Highway /Stoddart Road <sup>1</sup>	7:00-8:00	A	13
	8:00-9:00	A	13
Prospect Highway / GWH <sup>1</sup>	7:00-8:00	A	11
	8:00-9:00	B	24
Prospect Highway / Ponds Road <sup>1</sup>	7:00-8:00	B	20
	8:00-9:00	B	20
Prospect Highway/ M4 Ramp (north) <sup>1</sup>	7:00-8:00	A	12
	8:00-9:00	A	10
Prospect Highway /M4 Ramp (south) <sup>1</sup>	7:00-8:00	C	29
	8:00-9:00	B	26
Prospect Highway /Reservoir Road <sup>1</sup>	7:00-8:00	A	11
	8:00-9:00	A	9

Source: PB, June 2011

Note:

1. Level of Service based on the worst movement for roundabout and priority controlled intersections.

Table 2.5: 2010 PM peak intersection analysis results

Intersection	Time	LOS	Average Delay (s)
Prospect Highway / Lancelot Street	16:00-17:00	C	30
	17:00-18:00	C	34
Prospect Highway / Blacktown Road	16:00-17:00	C	39
	17:00-18:00	D	43
Prospect Highway / Harrod Street	16:00-17:00	B	17
	17:00-18:00	B	19
Prospect Highway /Stoddart Road <sup>1</sup>	16:00-17:00	B	28
	17:00-18:00	B	27
Prospect Highway / GWH <sup>1</sup>	16:00-17:00	F	73
	17:00-18:00	F	78
Prospect Highway / Ponds Road <sup>1</sup>	16:00-17:00	F	155
	17:00-18:00	D	43
Prospect Highway/ M4 Ramp (north) <sup>1</sup>	16:00-17:00	F	73
	17:00-18:00	D	50
Prospect Highway /M4 Ramp (south) <sup>1</sup>	16:00-17:00	F	104
	17:00-18:00	F	90
Prospect Highway /Reservoir Road <sup>1</sup>	16:00-17:00	A	4
	17:00-18:00	A	6

Source: PB, June 2011

Note:

1. Level of Service based on the worst movement for roundabout and priority controlled intersections.

### Existing land uses

The study area generally comprises the following land uses and community facilities:

- + Fully developed low to medium density residential land uses on both sides of the Prospect Highway, north of the Great Western Highway
- + Bulky goods retail and light industrial area in the precinct between the Great Western Highway, the Prospect Highway and Blacktown Road
- + Homebase Prospect located between the Great Western Highway and the Prospect Highway, accessed via Stoddart Road
- + Industrial area south of the M4 Western Motorway
- + Shelley Public School adjacent to the Prospect Highway, between Lancelot Street and Keyworth Drive
- + Blacktown Mega Centre retail centre, north of St Martins Crescent, west of the Prospect Highway
- + Blacktown Road Children’s Centre childcare facility, on the Prospect Highway, between Lancelot Street and Vesuvius Street.

### Public transport

There are a number of bus stops along the Prospect Highway corridor in the following locations adjacent to:

- + Stoddart Road (in both directions)
- + Lancelot Street (in both directions)
- + Keyworth Drive (in both directions)
- + Roger Place (southbound direction only)
- + Tudor Avenue (northbound direction only)
- + Blacktown Mega Centre (in both directions).

### Pedestrian and cyclist facilities

There is an existing shared user path located on the western side of the Prospect Highway between Harrod Street and St Martins Crescent. The shared user path has a width of approximately three metres for its length. There is a narrow concrete footpath located on the eastern side of the Prospect Highway between Lancelot Street and Keyworth Drive and Roger Place cul-de-sac and Leabons Lane.

Figure 2.1 illustrates the existing bus stops and the pedestrian and cyclist network within the study area.

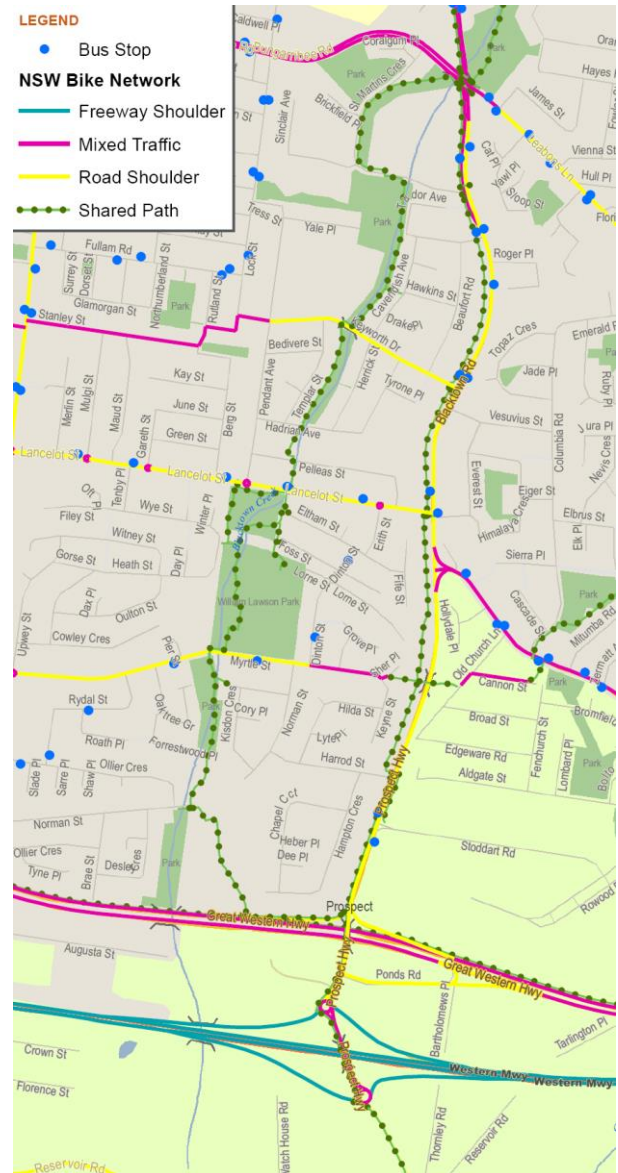


Figure 2.1: Bus stops and the pedestrian and cyclist network in the study area

### 3 DESCRIPTION OF PROPOSAL

#### Overview of proposal

The Prospect Highway Upgrade involves:

- + Signalisation of the roundabout at Reservoir Road and Reconciliation Road (refer Figure 3.1)
- + Signalisation of the M4 Western Motorway entry and exit ramp connections with the Prospect Highway (refer Figures 3.2, 3.3 and 3.4)
- + Provision of a two-way link road (entry / exit ramp) between the Great Western Highway and the Prospect Highway (refer Figure 3.2) with signalised control at its intersections with the Great Western Highway and the Prospect Highway (refer Figures 3.5 and 3.6)
- + Duplication of the Prospect Highway bridges over the M4 Western Motorway and the Great Western Highway (refer Figure 3.1)
- + Dual carriageway with two general traffic lanes in each direction and bus only lanes in each direction between Tudor Avenue and Lancelot Street (refer Figure 3.7)
- + Signalisation of the existing partial seagull intersection at Stoddart Road (refer Figure 3.8)
- + Modifications to the access arrangements for Vesuvius Street, Roger Place, Tudor Avenue and Ponds Road.

A copy of the Prospect Highway Upgrade design assumed for the purpose of the modelling is presented in Appendix A<sup>1</sup>.



Figure 3.1: Signalisation of Reservoir Road and Reconciliation Road



Figure 3.2: Upgraded interchange with the M4 Western Motorway and the Great Western Highway

<sup>1</sup> Drawing No.DS2012/000491, Sheet SK14, 10/12/2012



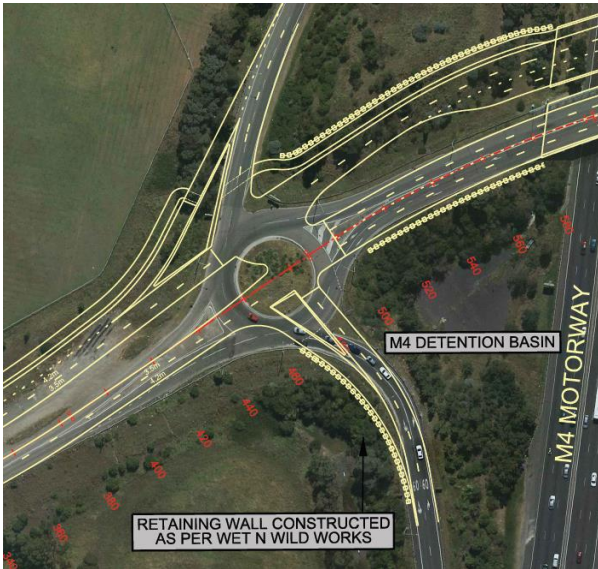


Figure 3.3: Signalisation of the M4 Western Motorway westbound entry / exit ramp connection to the Prospect Highway

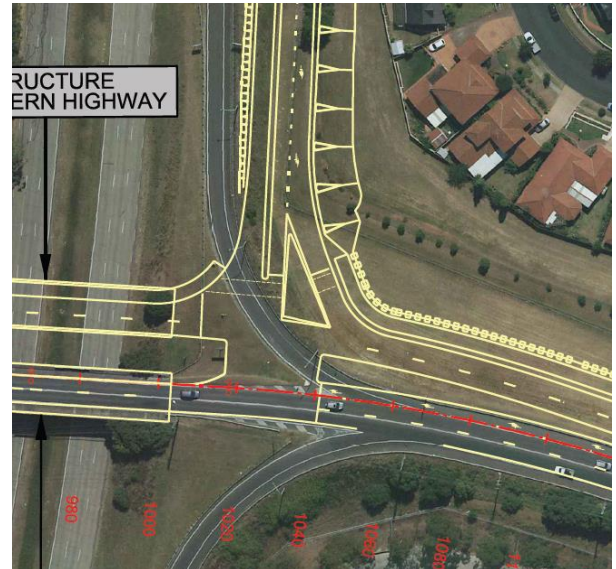


Figure 3.5: Signalisation of the new connection with the Prospect Highway

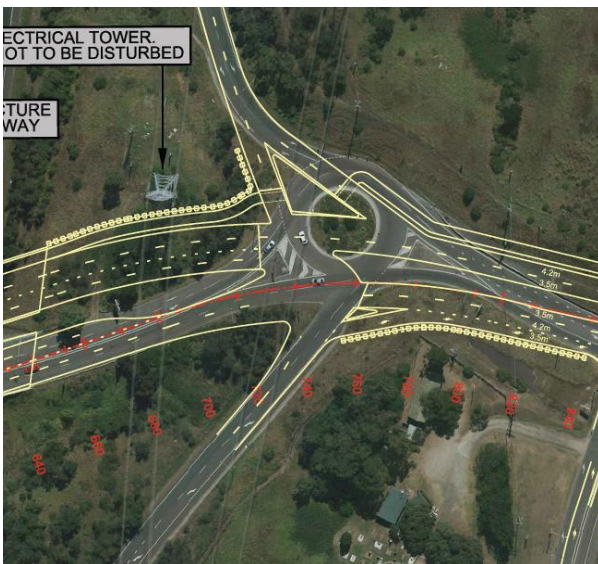


Figure 3.4: Signalisation of the M4 Western Motorway eastbound entry / exit ramp connection to the Prospect Highway



Figure 3.6: Signalisation of the new ramp connection with the Great Western Highway





Figure 3.7: Provision of bus lanes on the approaches to Vesuvius Street and Keyworth Drive



Figure 3.8: Signalisation of Stoddart Road and Prospect Highway

### Access strategy options

Two access strategy options were developed for the intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway. The access strategy options are:

- + Option 1: Provision of left-in / left-out only access to the minor approach
- + Option 2: Provision of left-in / right-in and left-out only access to the minor approach.

The intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway currently allow all movements into and out of the minor approaches.

### Option 1: left-in / left-out access

For this option, left-in / left-out only access is provided at the intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway. The following subsections summarise the alternative routes required for vehicles currently turning right into and out of the minor approaches.

#### Vesuvius Street

The shortest alternative route for vehicles currently turning right out of Vesuvius Street and travelling towards the north of the Prospect Highway would be:

- + Travel northbound on Columbia Road
- + Continue along Emerald Road
- + Turn left into Ellam Drive / Bowen Place
- + Turn left into Leabons Lane

The shortest alternative route for vehicles approaching from the south currently turning right from the Prospect Highway into Vesuvius Street would be:

- + Turn right at the signalised intersection at Blacktown Road
- + Turn left into Columbia Road
- + Turn left into Vesuvius Street

Figure 3.7 illustrates the Vesuvius Street diversion for Option 1.

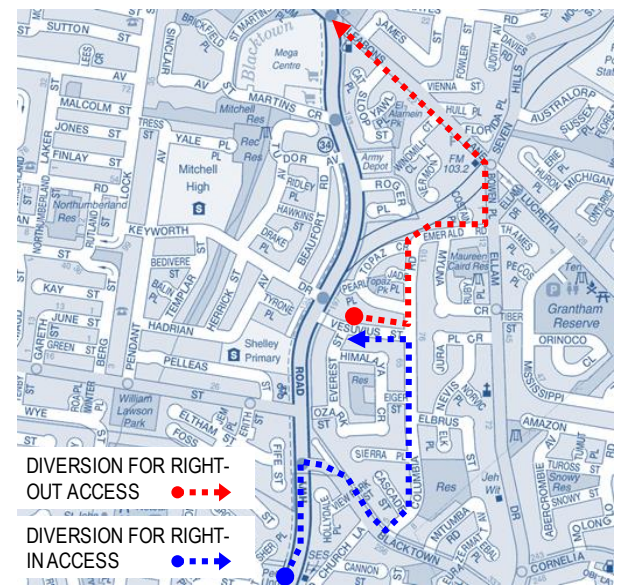


Figure 3.7: Vesuvius Street diversion, Option 1

### Roger Place

The shortest alternative route for vehicles currently turning right out of Roger Place and travelling towards the north of the Prospect Highway would be:

- + Turn left out of Roger Place
- + Turn right at the signalised intersection at Keyworth Drive
- + Turn right into Beaufort Road
- + Turn right into Tudor Avenue
- + Turn left into the Prospect Highway.

For Option 1, there is no viable diversion for the banned right turn into Roger Place, with vehicles required to perform a U-turn in St Martins Crescent, which is not considered acceptable without an appropriate U-turn facility. It is noted that the existing Mega Centre would be used by drivers to perform the U-turn.

Figure 3.8 illustrates the Roger Place diversion for Option 1.

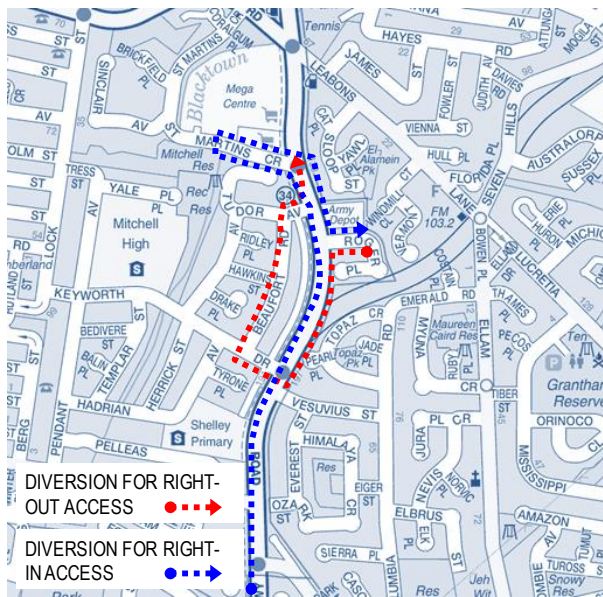


Figure 3.8: Roger Place diversion, Option 1

### Tudor Avenue

The shortest alternative route for vehicles currently turning right out of Tudor Avenue and travelling towards the south of the Prospect Highway would be:

- + Travel southbound along Cavendish Avenue or Beaufort Avenue
- + Turn left into Keyworth Drive
- + Turn right into the Prospect Highway.

The shortest alternative route for vehicles approaching from the north currently turning right from the Prospect Highway into Tudor Avenue would be:

- + Turn right at the signalised intersection at Keyworth Drive
- + Turn right into Cavendish Avenue or Beaufort Avenue

Figure 3.9 illustrates the Tudor Avenue diversion for Option 1.

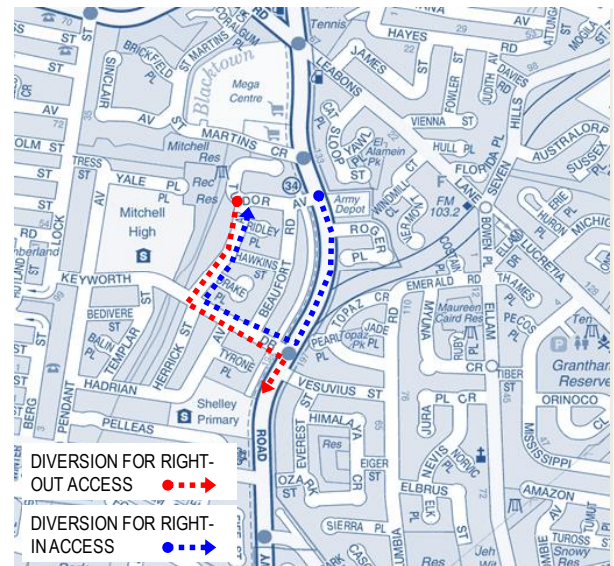


Figure 3.9: Tudor Avenue diversion, Option 1

### Option 2: left-in / right-in and left-out only access

For this option, left-in / right-in and left-out only access is provided at the intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway. The following subsections summarise the alternative routes required for vehicles currently turning right out of the minor approaches.

#### Vesuvius Street

The shortest alternative route for vehicles currently turning right out of Vesuvius Street and travelling towards the north of the Prospect Highway would be:

- + Travel northbound on Columbia Road
- + Continue along Emerald Road
- + Turn left onto Ellam Drive / Bowen Place
- + Turn left onto Leabons Lane

Figure 3.10 illustrates the Vesuvius Street diversion for Option 2.



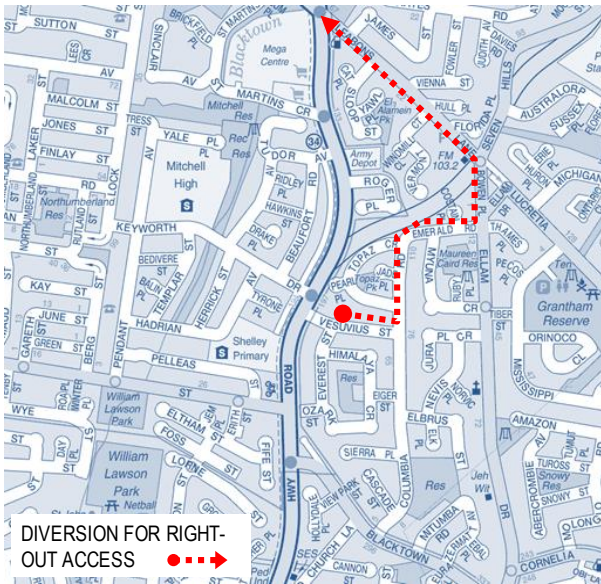


Figure 3.10: Vesuvius Street diversion, Option 2

**Roger Place**

The shortest alternative route for vehicles currently turning right out of Roger Place and travelling towards the north of the Prospect Highway would be:

- + Turn left out of Roger Place
- + Turn right at the signalised intersection at Keyworth Drive
- + Turn right into Beaufort Road
- + Turn right into Tudor Avenue
- + Turn left into the Prospect Highway.

Figure 3.11 illustrates the Roger Place diversion for Option 2.

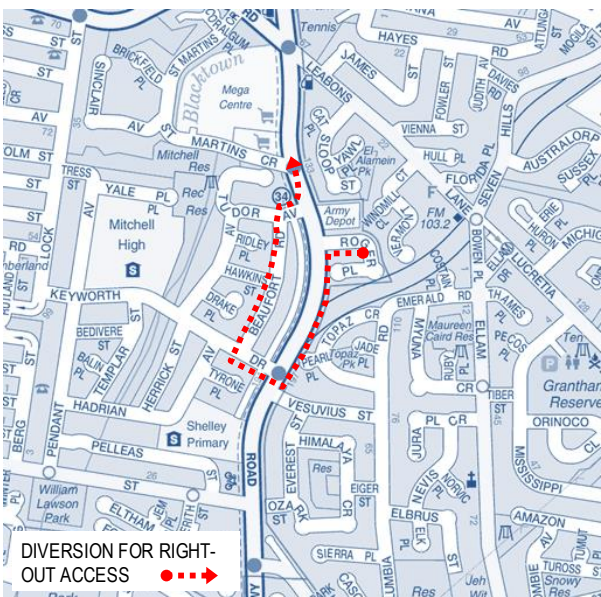


Figure 3.11: Roger Place diversion, Option 2

**Tudor Avenue**

The shortest alternative route for vehicles currently turning right out of Tudor Avenue and travelling towards the south of the Prospect Highway would be:

- + Travel southbound along Cavendish Avenue or Beaufort Avenue
- + Turn left into Keyworth Drive
- + Turn right into the Prospect Highway.

Figure 5.6 illustrates the Tudor Avenue diversion for Option 2.

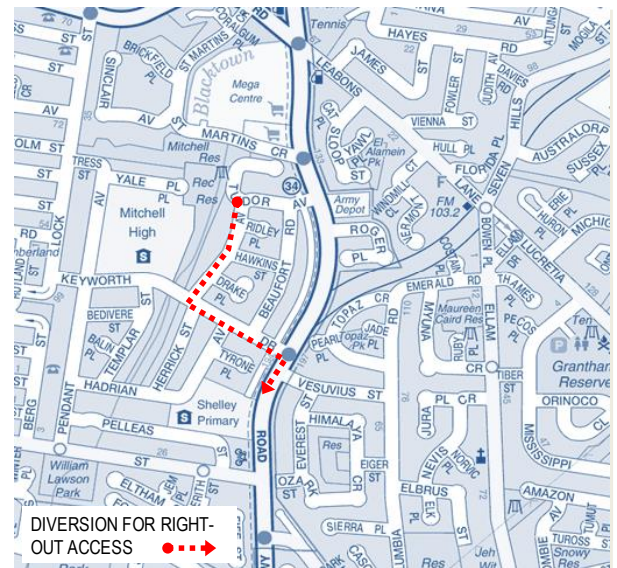


Figure 5.6: Tudor Avenue diversion, Option 2

**Access for properties**

Properties fronting the eastern side of the Prospect Highway are able to perform all turn movements into and out of their driveways. Following the Prospect Highway Upgrade, properties fronting the Prospect Highway will be left-in / left-out only in both access strategy options (Option 1 and Option 2).

For properties fronting the eastern side of Prospect Highway between Vesuvius Street and Lancelot Street, the alternative route for drivers wishing to head north would be:

- + Turn left out of the driveway
- + Turn right into Lancelot Street
- + Perform a U-turn at the roundabout at Lancelot Street / Edith Street
- + Turn left into Prospect Highway.

Alternatively, drivers wishing to head north from properties between Vesuvius Street and Lancelot Street could also take the following route:



- + Turn left out of the driveway
- + Turn left into Blacktown Road
- + Turn left into Columbia Road
- + Continue along Emerald Road
- + Turn left into Ellam Drive / Bowen Place
- + Turn left into Leabons Lane.

The alternative route for vehicles approaching from the south currently turning right from the Prospect Highway into properties between Vesuvius Street and Lancelot Street would be:

- + Turn right at the signalised intersection at Blacktown Road
- + Turn left into Columbia Road
- + Turn left into Vesuvius Street
- + Turn left into the Prospect Highway
- + Turn left into the driveway.

For the Army Reserve Depot located on the eastern side of the Prospect Highway, north of Tudor Avenue, divers wishing to travel north would perform the following alternative route:

- + Turn left out of the driveway
- + Turn right at the signalised intersection at Keyworth Drive
- + Turn right into Beaufort Road
- + Turn right into Tudor Avenue
- + Turn left into the Prospect Highway.

The alternative route for vehicles approaching from the south currently turning right from the Prospect Highway into the Army Reserve Depot would be:

- + Turn right at the signalised intersection at Blacktown Road
- + Turn left into Columbia Road
- + Continue along Emerald Road
- + Turn left into Ellam Drive / Bowen Place
- + Turn left into Leabons Lane
- + Turn left into the Prospect Highway
- + Turn left into the driveway.

## 4 MODELLING METHODOLOGY

### Base case model development

RMS commissioned the development and calibration of 2008 AM and PM peak base case PARAMICS micro-simulation model of the study area. The development and calibration of this model is documented in a separate report<sup>2</sup>. A key outcome of this work was the development of a calibrated and validated set of base model trip matrices. These were a crucial foundation for the forecasting trip matrices developed by SMEC for this traffic assessment.

SMEC was engaged by RMS to prepare the following updates to the micro-simulation models for the study area:

- + Convert the PARAMICS models over to AIMSUN to make them compatible with the models being developed for the M4 Managed Motorway and WestConnex projects
- + Extend the AIMSUN models north to St Martins Crescent to encompass the increased project scope
- + Expand the adjacent road network to include Beaufort Road so that the access strategy detours for residents could be modelled
- + Update the signal phasing data in accordance with the phasing arrangements and green-splits provided by RMS
- + Update the forecast trip matrices based on the data provided by RMS to reflect the new delivery timeframes, modelling 2018, 2028 and 2038 forecast years.

The existing network was coded up using the following:

- + Spatially accurate aerial photographs
- + Traffic signal coding data provided by RMS<sup>3</sup>.

The original calibrated 2008 trip matrices were expanded to include the residential catchments north of Keyworth Drive. In the absence of any observed data, the trips generated from these catchments were

estimated based on the number of households, using the RMS standard peak hour trip generation rates for residential development<sup>4</sup>. The trips were then assigned to the network based on the trip patterns observed in adjacent catchments within the models. It is important to note that the flow patterns south of Keyworth Drive remained constant and were not changed by the expansion of the trip tables at the northern end of the study area.

The trip matrices provided by RMS did not include pedestrians and are therefore, not included in the modelling conducted by SMEC.

The trip matrices provided by RMS did not include buses. In order to code the existing bus services and model the bus priority at key intersections, SMEC extracted bus frequencies from existing published bus timetable information and included this data in the revised matrices.

### Future land use assumptions

The future year trip matrices used in the modelling assessments are based on 2021 and 2031 trip matrices supplied by RMS. These matrices were based on forecasts extracted from the RMS Sydney strategic transport model and subsequently adjusted to reflect the following local development impacts:

- + **Reconciliation Road link with Widemere Road:** The RMS strategic model indicated that this link will significantly increase traffic south of the M4 Western Motorway and generate a redistribution of trips. The magnitude of the increase on Reconciliation Road is presented in **Table 4.1**. In addition, traffic movements from the M4 Western Motorway to the Prospect Highway (northbound), will reduce compared to existing traffic volumes
- + **Greystanes Southern Employment Lands Estate:** The additional trips associated with this development were incorporated in the future year trip matrices. **Table 4.2** provides a summary of the forecast hourly trips from / to Greystanes Southern Employment Lands Estate and the study area
- + **Wet 'n' Wild water park development:** The forecast trip generation of the development is presented in **Table 4.3**.

<sup>2</sup> MR 644 Prospect Highway Upgrade from Lancelot Street to Reservoir Road, Traffic Study, Paramics Modelling/Option Assessment Report, Parson Brinkerhoff, June 2011

<sup>3</sup> SCATS phasing sequence information sent by N Leitch, email dated 15 May 2013; existing phase timing sent by N Leitch, email dated 5 June 2013; green time offsets sent by N Leitch, email dated 17 June 2013

<sup>4</sup> Guide to Traffic generating Development, RTA October, 2002

Table 4.1: Reconciliation Road two-way traffic flow estimates south of Reservoir Road

	AM peak (7am-9am)	PM peak (4pm-6pm)
2011	1,048	836
2012 With Connection	3,850	3,140

Source: RMS

Table 4.2: Greystanes Southern Employment Lands Estate hourly future trips towards the M4 Western Motorway

Year	Peak	Trips per hour	
		To	From
2016	AM	601	97
	PM	129	555
2021	AM	674	104
	PM	140	610
2031	AM	820	115
	PM	161	722

Source: RMS

Table 4.3: Wet 'n' Wild peak traffic generation

	AM peak	PM peak
Arrivals	65	65
Departures	16	262
TOTAL	81	327

Source: ARUP<sup>5</sup>

The development of these trip matrices is documented in an earlier modelling report prepared for RMS<sup>2</sup>.

These trip matrices were based on the following growth assumptions:

- + A growth rate of 0.75 per cent per annum between 2008 and 2021
- + A growth rate of 0.5 per cent per annum between 2021 and 2031.

SMEC used these growth assumptions to factor up the supplied forecast trip matrices to reflect the following new project delivery time frames:

- + 2013 base
- + 2018 opening year
- + 2028 10-years after opening
- + 2038 20-years after opening.

### Access strategy impacts

The impact assessment of the two access strategy options was undertaken using both manual and AIMSUN modelling methods.

Due to the limited scope of the trip matrices available for the project, it was not possible to explicitly code all the detours generated by the two access strategy options. It was initially agreed with RMS that the impacts of the detours, for local residents, would be assessed manually.

The manual method involved:

- + Identifying a series of residential catchments feeding the three roads affected by the access strategy (the number of households in each catchment was estimated from aerial photography)
- + The shortest alternative route required for each residential catchment was determined using aerial photography
- + Two reference points were identified on the Prospect Highway to the north and south
- + The length of existing routes and proposed detour routes were measured from the residential catchments to the two reference points
- + The difference in length and travel times was then compared for the access strategy options.

An average travel speed of 40 km/h was assumed for the analysis based on discussions with RMS. This lower speed took account of some intersection delay on local roads which could not be explicitly estimated.

The results of the manual assessment are presented in Section 5.

Reliance on the manual method alone presented some problems when it came to comparative assessments of the two access strategy options using the AIMSUN models. In the absence of a wider modelled network, the restricted movements were forced to undertake alternative detours within the model itself. This resulted in unrepresentative and overly complex U-turn manoeuvres that impacted unfairly on the overall

<sup>5</sup> Transport and Accessibility Impacts report by ARUP for Prospect Aquatic Investments Pty Ltd

performance of the Prospect Highway. Eliminating the detours was also deemed unacceptable, as the models would then fail to recognise the relative impacts of the access strategy options.

The compromise solutions to the problem were as follows:

- + **Right-turn out of Vesuvius Street** – expansion of the trip matrices and connection to a new dummy zone in Vesuvius Street, which represents the detour movements to the north via Columbia Road, Ellam Drive and Leabons Lane. A travel time penalty was then applied to detoured traffic entering the new zone, to reflect the additional travel time involved. This travel time penalty was based on the manual travel time calculations discussed earlier
- + **Right-turn into Roger Place** – expansion of the trip matrices and connection to a new dummy zone at the northern end of the AIMSUN model. Trips from the south with a destination in Roger Place would be redirected to the dummy zone. An equivalent number of trips would exit the zone and travel south along the Prospect Highway and turn left into Roger Place. A turn penalty was placed on the link entering the dummy zone to reflect delays performing a U-turn in St Martins Crescent (the most convenient likely location).

All other detours were explicitly modelled.

## Future model development

The future models were coded up using:

- + Drawing number DS2012/000491, dated 12 December 2012. This is included in **Appendix A** of this report
- + Signal coding data provided by RMS<sup>6</sup>.

## Signal optimisation

The initial coding of signalised intersections in the models was based on the existing phasing data supplied by RMS. However, during optimisation of the future models, some changes were made to green-splits and offsets. This section documents the main adjustments to the signal coding to optimise future network performance.

The signalised intersections in the model are operating at fixed cycle times of 130 seconds during the AM and PM peaks.

The bus phases at the intersections of Prospect Highway with Lancelot Street and Blacktown Road are actuated and the bus jump phase is triggered only when a bus approaches the bus lane detector.

The existing and optimised signal offsets adopted for the models are presented in **Table 4.4**.

Leabons Lane is the leading intersection for the existing critical sub system, which includes:

- + Keyworth Drive
- + Lancelot Street
- + Blacktown Road
- + Harrod Street.

For the future road network, the new signalised intersection at Stoddart Road would also be included in this sub system.

A second sub system was established in the model to capture the future signalised intersections south of Stoddart Road. The intersections included in this new sub system include:

- + Great Western Highway link road
- + M4 Western Motorway eastbound entry / exit ramp
- + M4 Western Motorway westbound entry / exit ramp (leading intersection).

The optimisation of the future signalised intersections for both sub systems was conducted based on observed model operation.

The intersection of Reconciliation Road / Reservoir Road will be included in a separate sub system in the future road network and has not been included in the signal offsets in **Table 4.4**.

The following sections summarise the signal phasing sequence provided by RMS. The phasing diagrams and green-splits for each signal site are presented in **Appendix B**.

### Reservoir Road and Reconciliation Road

This intersection operates under a double diamond phasing sequence.

### M4 Western Motorway westbound entry / exit ramp

This intersection operates under a standard four-phase T-intersection phasing sequence.

### M4 Western Motorway eastbound entry / exit ramp

This intersection operates under a standard four-phase T-intersection phasing sequence.

<sup>6</sup> SCATS phasing sequence information sent by N Leitch, email dated 15 May 2013; existing phase timing sent by N Leitch, email dated 5 June 2013; green time offsets sent by N Leitch, email dated 17 June 2013

#### Prospect Highway and Great Western Highway link

This intersection operates under a standard four-phase T-intersection phasing sequence.

#### Great Western Highway and Prospect Highway link

This intersection operates under a standard four-phase T-intersection phasing sequence.

#### Stoddart Road

This intersection operates under a standard four-phase T-intersection phasing sequence.

#### Harrod Street

This intersection operates under a standard four-phase T-intersection phasing sequence.

#### Blacktown Road

This intersection operates under a standard five-phase T-intersection phasing sequence. This intersection has been coded with a detector actuated bus phase, which triggers an early start for the right-turn bus movements from Blacktown Road.

#### Lancelot Street

This intersection operates under a standard four-phase T-intersection phasing sequence. This intersection has been coded with a detector actuated bus phase, which triggers an early start for the northbound bus movements.

Table 4.4: Existing and optimised signal offsets

Intersecting road	Modelled sub system	Existing signal offsets (secs)		Optimised signal offsets (secs)	
		AM	PM	AM	PM
Leabons Lane	1	0	0	0	0
Keyworth Drive	1	-61	+61	-61	+61
Lancelot Street	1	-79	+96	-58	+82
Blacktown Road	1	-91	+91	-43	+70
Harrod Street	1	+16	+89	+65	+77
Stoddart Road	1			+35	+87
Great Western Highway	2			-25	+15
M4 Western Motorway eastbound entry / exit ramp	2			-5	-25
M4 Western Motorway westbound entry / exit ramp	2			0	0

## 5 IMPACT ASSESSMENT

### Global network performance impacts

The network performance statistics for the three access strategy options compared with the 2018 do nothing (base) option have been extracted from the AIMSUN models and are presented in **Tables 5.1** and **5.2**.

The performance criteria are:

- + Average vehicle delay (sec/km)
- + Average vehicle speed (km/h).

Options 1 and 2 are the two access strategy options nominated by RMS for consideration.

Option 3 is a hybrid option prepared by SMEC. It has the same restrictions as Option 1, except at Roger Place, where the right-turn into the residential catchment would be retained.

The global network performance statistics reveal the following:

- + All three access strategy options provide a significant performance improvement over the 2018 do nothing (base) case
- + The relative difference in network performance amongst the three access strategy options is negligible (under 2038 forecast flows the difference in vehicle delay between strategies is less than three seconds in both peak periods)
- + Option 1 is generally generating the best network performance statistics
- + Given the low numbers of vehicles being impacted under the three different access strategy options, any impacts caused by the detours are having a negligible effect on overall network performance statistics.

Table 5.1: Comparison of AM peak global network performance for each access strategy option

Year	Criteria	2018 AM base	Access strategy		
			Option 1	Option 2	Option 3
2018 AM	Delay (sec/km)	131.6	21.9	22.3	22.4
	Speed (km/h)	59	70	70	70
2028 AM	Delay (sec/km)		32.1	35.9	36.3
	Speed (km/h)		66	66	66
2038 AM	Delay (sec/km)		47.5	50.0	49.7
	Speed (km/h)		65	64	64

Table 5.2: Comparison of PM peak global network performance for each access strategy option

Year	Criteria	2018 PM base	Access strategy		
			Option 1	Option 2	Option 3
2018 PM	Delay (sec/km)	175.4	23.6	23.6	23.2
	Speed (km/h)	64	68	68	68
2028 PM	Delay (sec/km)		28.5	28.4	28.3
	Speed (km/h)		65	65	65
2038 PM	Delay (sec/km)		34.0	34.6	34.8
	Speed (km/h)		62	62	62



## Prospect Highway performance impacts

The performance of the Prospect Highway under the three access strategy options is presented in Tables 5.3 to 5.6.

This assessment focuses on the average travel times and delay experienced by users travelling in both directions along the Prospect Highway only.

The performance criteria are:

- + Average vehicle delay (sec/km)
- + Average vehicle speed (km/h)

The Prospect Highway performance statistics reveal the following:

- + Delay along the Prospect Highway, in both directions, is significantly reduced under all three access strategy options when compared to the 2018 do nothing (base) case
- + Travel speeds along the Prospect Highway will improve by 9 to 13 km/h under all the access strategy options compared with the 2018 do nothing (base) case
- + The relative difference in travel speed and vehicle delay performance amongst the three access strategy options is negligible.

**Table 5.3: Comparative performance of northbound movements along the Prospect Highway in AM peak under each access strategy option**

Year	Criteria	2018 AM base	Access strategy		
			Option 1	Option 2	Option 3
2018 AM	Delay (sec/km)	35.1	9.4	9.4	9.4
	Speed (km/h)	34	46	46	46
2028 AM	Delay (sec/km)		10.7	11.1	11.1
	Speed (km/h)		45	44	44
2038 AM	Delay (sec/km)		12.7	12.8	12.9
	Speed (km/h)		43	43	43

**Table 5.4: Comparative performance of southbound movements along the Prospect Highway in AM peak under each access strategy option**

Year	Criteria	2018 AM base	Access strategy		
			Option 1	Option 2	Option 3
2018 AM	Delay (sec/km)	33.6	8.9	8.9	8.9
	Speed (km/h)	34	47	47	47
2028 AM	Delay (sec/km)		10.2	10.6	10.7
	Speed (km/h)		45	45	45
2038 AM	Delay (sec/km)		12.1	12.3	12.5
	Speed (km/h)		44	44	43

**Table 5.5: Comparative performance of northbound movements along the Prospect Highway in PM peak under each access strategy option**

Year	Criteria	2018 PM base	Access strategy		
			Option 1	Option 2	Option 3
2018 PM	Delay (sec/km)	57.3	10.4	10.3	10.1
	Speed (km/h)	35	45	45	45
2028 PM	Delay (sec/km)		11.2	11.4	11.3
	Speed (km/h)		43	43	43
2038 PM	Delay (sec/km)		13.1	13.3	13.3
	Speed (km/h)		42	42	42

Table 5.6: Comparative performance of southbound movements along the Prospect Highway in PM peak under each access strategy option

Year	Criteria	2018 PM base	Access strategy		
			Option 1	Option 2	Option 3
2018 PM	Delay (sec/km)	51.9	9.8	9.7	9.6
	Speed (km/h)	36	46	46	45
2028 PM	Delay (sec/km)		10.8	10.9	10.8
	Speed (km/h)		44	44	44
2038 PM	Delay (sec/km)		12.7	12.7	12.8
	Speed (km/h)		43	43	43

## Great Western Highway to Prospect Highway two-way link road qualitative assessment

The modelling conducted includes the Great Western Highway two-way link road design presented in **Appendix A**. This proposed arrangement operates appropriately under forecast traffic volumes, subject to the design recommendations provided in **Section 6**.

The proposal to provide a two-way link road between the Great Western Highway and the Prospect Highway the following movements will have the following benefits:

- + There is no existing southbound access on the Prospect Highway for traffic approaching from the eastbound carriageway of the Great Western Highway. The proposed arrangement will provide southbound access on the Prospect Highway for eastbound traffic on the Great Western Highway, via a signal-controlled intersection.
- + The proposed arrangement provides a more direct route for northbound traffic on the Prospect Highway requiring access to the eastbound Great Western Highway carriageway, via the two-way link road and signal-controlled intersection.
- + Northbound traffic on the Prospect Highway currently turns right onto Ponds Road to enter the Great Western Highway westbound carriageway. This movement requires uncontrolled right-turns across southbound traffic on the Prospect Highway. Under the proposed arrangement, northbound traffic accesses the westbound Great Western Highway carriageway at the signal-controlled intersection via the two-way link road, eliminating the potential conflict associated with uncontrolled right-turn movements.
- + Westbound traffic on the Great Western Highway requiring northbound travel on the Prospect Highway is required to perform an uncontrolled right-turn at the Ponds Road / Prospect Highway intersection. Under the proposed arrangement, the potential conflict associated with this uncontrolled right-turn is eliminated by providing a signalised controlled right-turn for westbound Great Western Highway traffic travelling northbound on the Prospect Highway.
- + Northbound traffic on the Prospect Highway is provided with more direct access to the eastbound Great Western Highway carriageway via the two-way link road and signal-controlled intersection.

### Access strategy impacts (manual assessment)

Figure 5.7 illustrates the increase in travel distance experienced for each option, by the number of dwellings. Figure 5.8 illustrates the average increase in travel times for each option, by the number of dwellings.

The manual assessment of the Option 1 access strategy revealed the following:

- + Approximately 116 of the dwellings are likely to have an overall increase in travel distance of between one and two kilometres for their return trips (to and from home)
- + Approximately 130 of the dwellings are likely to have an overall increase in travel distance of between 500 metres and one kilometre for their return trips (to and from home)
- + Approximately 228 of the dwellings are likely to have an overall increase in travel distance of between 200 and 500 metres for their return trips (to and from home)
- + Approximately 60 of the dwellings are likely to have an overall increase in travel distance of up to 200 metres for their return trips (to and from home).

The manual assessment of Option 2 access strategy revealed the following:

- + Approximately 36 of the dwellings in the catchment are likely to have an overall increase in travel distance of between one and two kilometres for their return trips (to and from home)
- + Approximately 90 of the dwellings are likely to have an overall increase in travel distance of between 500 metres and one kilometre for their return trips (to and from home)
- + Approximately 61 of the dwellings are likely to have an overall increase in travel distance of between 200 and 500 metres for their return trips (to and from home)
- + Approximately 81 of the dwellings are likely to have an overall increase in travel distance of up to 200 metres for their return trips (to and from home).

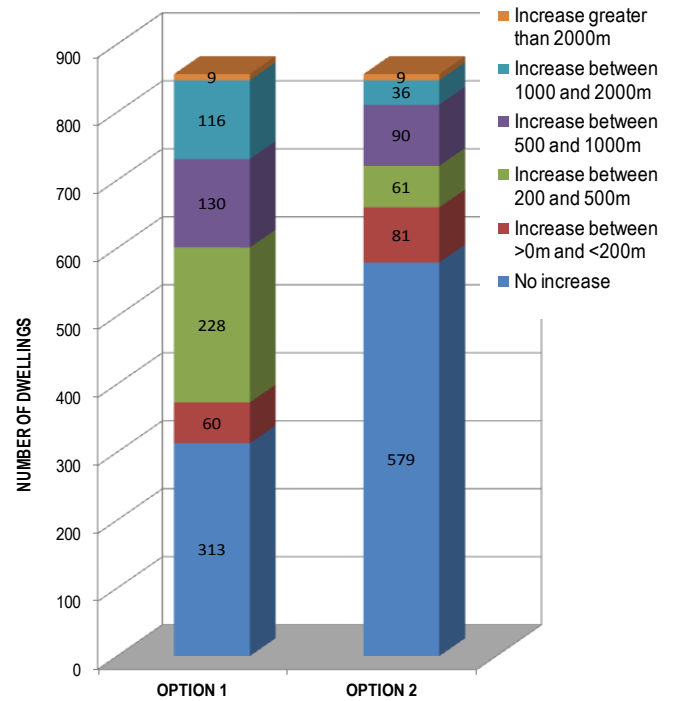


Figure 5.7: Average increase in travel distance by number of dwellings

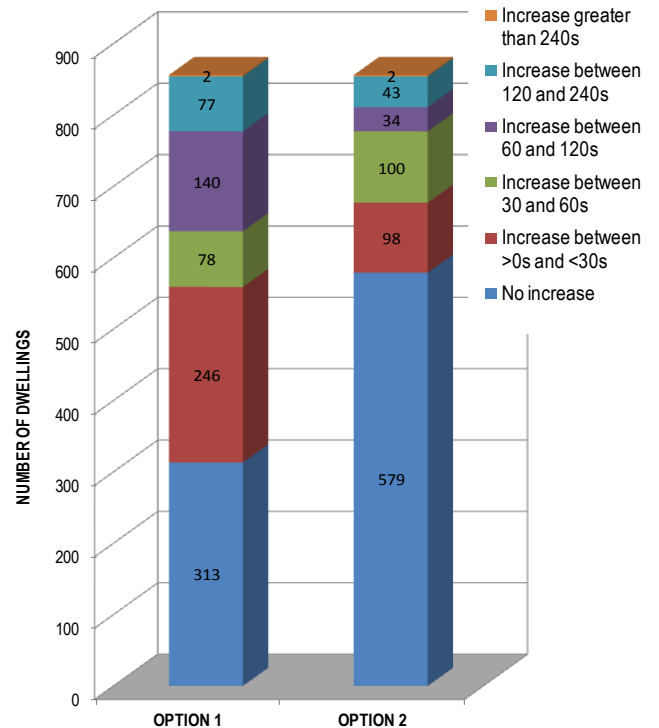


Figure 5.8: Average increase in travel time (in seconds) by number of dwellings

For both Options 1 and 2, approximately nine dwellings are likely to have an overall increase in travel distance of more than two kilometres for their return trips (to and from home).

Option 1 clearly has the most significant potential impact on residential travel times. Overall, Option 1 impacts 63 per cent of the households in the Vesuvius Street, Roger Place and Tudor Avenue catchments. Conversely, Option 2 only impacts 32 per cent of households in the same catchment.

However, the manual assessment is only considering the overall increase in travel distances. This method fails to consider the overall improvements to travel times residents will benefit from as a result of the Prospect Highway Upgrade.

The next section assesses the impacts of the access strategy options using the AIMSUN micro-simulation models. This analysis should identify how much the improvements to the Prospect Highway will offset the impacts of detours resulting from the different access strategy options.

### Access strategy impacts (modelling assessment)

The AIMSUN models were used to assess the average travel times for key movements at Vesuvius Street, Roger Place and Tudor Avenue that are impacted by the three access strategy options under consideration.

The travel times, under each access strategy are compared against the 2018 do nothing option. The results are presented in **Tables 5.7** and **5.8**.

The analysis reveals that the additional travel time generated by the turn ban detours is being offset by the improved travel times along the Prospect Highway. In some cases, the improvements on the Prospect Highway will reduce current travel times despite the access restrictions.

Table 5.7: Modelled AM peak travel times along impacted access routes under access strategy options (minutes:seconds)

Year	Residential access route	2018	Access strategy		
		Do nothing	Option 1	Option 2	Option 3
2018AM	Tudor Avenue -> Blacktown Road intersection	10:32	02:43	02:34	02:24
	Tudor Avenue -> St Martin Crescent	03:19	00:25	00:25	00:25
	St Martin Crescent -> Tudor Avenue	03:57	01:37	00:27	01:35
	Roger Place -> Blacktown Road intersection	12:24	01:42	01:44	01:53
	Roger Place -> St Martin Crescent	09:00	02:00	01:59	01:59
	Blacktown Road intersection -> Roger Place	06:13	02:58	01:44	01:44
	Vesuvius Street -> Blacktown Road intersection	07:44	01:13	01:12	01:13
	Vesuvius Street -> Leabons Lane	07:04	03:49	03:46	03:47
2028AM	Blacktown Road intersection -> Vesuvius Street	04:39	03:13	01:05	03:14
	Tudor Avenue -> Blacktown Road intersection	10:32	02:41	02:44	02:26
	Tudor Avenue -> St Martin Crescent	03:19	00:28	00:29	00:27
	St Martin Crescent -> Tudor Avenue	03:57	01:45	00:28	01:44
	Roger Place -> Blacktown Road intersection	12:24	01:50	01:47	01:57
	Roger Place -> St Martin Crescent	09:00	02:03	02:05	02:00
	Blacktown Road intersection -> Roger Place	06:13	03:09	01:59	01:52
	Vesuvius Street -> Blacktown Road intersection	07:44	01:18	01:16	01:17
2038AM	Vesuvius Street -> Leabons Lane	07:04	03:48	03:47	03:47
	Blacktown Road intersection -> Vesuvius Street	04:39	03:26	01:08	03:15
	Tudor Avenue -> Blacktown Road intersection	10:32	02:47	02:44	02:34
	Tudor Avenue -> St Martin Crescent	03:19	00:29	00:30	00:29
	St Martin Crescent -> Tudor Avenue	03:57	01:46	00:32	01:51
	Roger Place -> Blacktown Road intersection	12:24	01:47	01:48	01:57
	Roger Place -> St Martin Crescent	09:00	02:09	02:08	02:05
	Blacktown Road intersection -> Roger Place	06:13	03:04	01:47	01:58
2038AM	Vesuvius Street -> Blacktown Road intersection	07:44	01:18	01:19	01:20
	Vesuvius Street -> Leabons Lane	07:04	03:48	03:49	03:50
	Blacktown Road intersection -> Vesuvius Street	04:39	03:26	01:14	03:28

Table 5.8: Modelled PM peak travel times along impacted access routes under access strategy options (minutes:seconds)

Year	Residential access route	2018	Access strategy		
		Do nothing	Option 1	Option 2	Option 3
2018PM	Tudor Avenue -> Blacktown Road intersection	19:48	02:06	02:04	02:41
	Tudor Avenue -> St Martin Crescent	07:18	00:23	00:23	00:24
	St Martin Crescent -> Tudor Avenue	14:32	01:44	00:26	01:51
	Roger Place -> Blacktown Road intersection	04:40	02:16	02:11	02:20
	Roger Place -> St Martin Crescent	03:00	01:57	02:08	02:29
	Blacktown Road intersection -> Roger Place	07:02	03:09	02:02	01:54
	Vesuvius Street -> Blacktown Road intersection	01:26	01:22	01:24	01:35
	Vesuvius Street -> Leabons Lane	02:37	03:44	03:46	03:46
Blacktown Road intersection -> Vesuvius Street	03:52	03:11	01:12	02:52	
2028PM	Tudor Avenue -> Blacktown Road intersection	19:48	02:29	02:23	02:44
	Tudor Avenue -> St Martin Crescent	07:18	00:25	00:23	00:26
	St Martin Crescent -> Tudor Avenue	14:32	01:52	00:27	01:57
	Roger Place -> Blacktown Road intersection	04:40	02:22	02:26	02:18
	Roger Place -> St Martin Crescent	03:00	02:05	02:28	02:28
	Blacktown Road intersection -> Roger Place	07:02	03:12	02:05	02:06
	Vesuvius Street -> Blacktown Road intersection	01:26	01:31	01:29	01:45
	Vesuvius Street -> Leabons Lane	02:37	03:46	03:46	03:46
Blacktown Road intersection -> Vesuvius Street	03:52	03:16	01:16	03:01	
2038PM	Tudor Avenue -> Blacktown Road intersection	19:48	02:19	02:21	03:03
	Tudor Avenue -> St Martin Crescent	07:18	00:28	00:26	00:24
	St Martin Crescent -> Tudor Avenue	14:32	01:53	00:28	01:58
	Roger Place -> Blacktown Road intersection	04:40	02:27	02:18	02:36
	Roger Place -> St Martin Crescent	03:00	02:21	02:17	02:25
	Blacktown Road intersection -> Roger Place	07:02	03:16	02:14	02:11
	Vesuvius Street -> Blacktown Road intersection	01:26	01:33	01:36	01:52
	Vesuvius Street -> Leabons Lane	02:37	03:42	03:46	03:46
Blacktown Road intersection -> Vesuvius Street	03:52	03:20	01:22	03:08	



## 6 DESIGN RECOMMENDATIONS

### Prospect Highway design

Following the modelling process, SMEC has identified a number of design improvements that could be undertaken to further optimise the performance of the Prospect Highway Upgrade design. These improvements complement all the access strategy options currently under consideration.

The suggested design improvements are as follows:

- + The M4 Western Motorway exit ramp currently splits from two to four lanes at the left turn slip lane (refer **Figure 6.1**). This may lead to the slip lane being blocked by queuing traffic waiting to enter the Prospect Highway. The two lanes on the left turn slip will be starved of traffic. Consideration should be given to providing a section of left turn auxiliary lane feeding into the two left-turn slip lanes
- + The Prospect Highway southbound left turn slip lane, to the Great Western Highway ramp, diverges very close to traffic signals (refer **Figure 6.2**). It is likely that queuing traffic could extend back and block this slip lane. Whilst this was observed to occur rarely in the modelling, it represents a potential risk under increased traffic demand. Consideration should be given to providing a short section of left turn auxiliary lane
- + The new signalised intersection on the Great Western Highway has a single lane approach for the link from the Prospect Highway (refer **Figure 6.3**). A single lane on the approach will operate inefficiently as left turn movements operating during the B and C-phases could be blocked in B-phase by traffic waiting to turn right onto the Great Western Highway. Consideration should be given to providing a short left turn auxiliary lane approaching the signals.
- + The proposed lane configuration on the Keyworth Drive approach is not shown on the design drawings. It is recommended that the design adopt a shared left/right and a dedicated right lane (refer **Figure 6.4**).

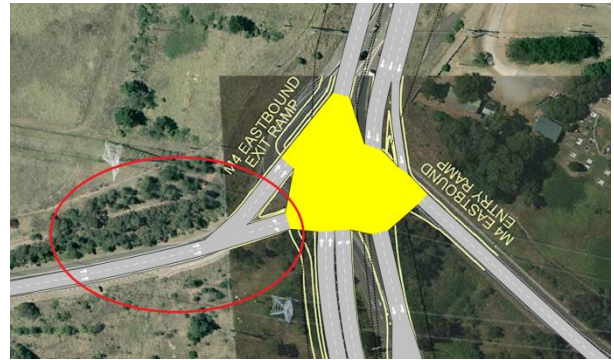


Figure 6.1: M4 Western Motorway eastbound exit ramp



Figure 6.2: Prospect Highway southbound exit ramp to the Great Western Highway

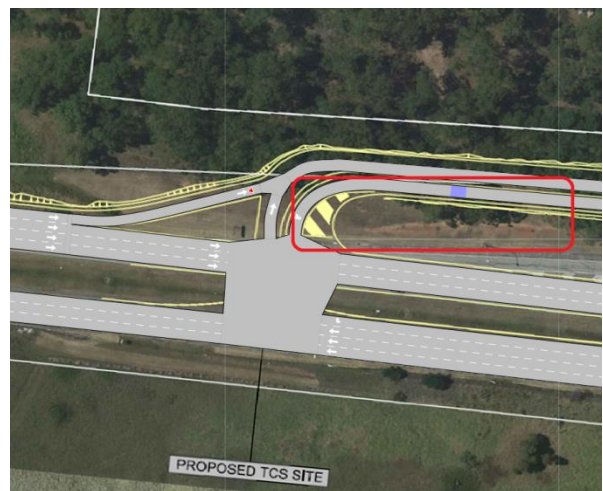


Figure 6.3: Great Western Highway intersection with link road to the Prospect Highway





Figure 6.4: Keyworth Drive approach lane configuration

Following the preceding issue of this report, RMS has updated the design to include these design recommendations. The revised design is provided in Appendix C.

### M4 Managed Motorway project

RMS is currently developing a design for ramp metering systems on the M4 Western Motorway entry / exit ramps to the Prospect Highway as part of a wider managed motorway scheme. An AIMSUN model is also in development to assist with the planning of the scheme.

The details of ramp storage requirements and signal timings were unavailable at the time of this report's issue and have not been included in the Prospect Highway AIMSUN models.

Our review of model operations suggests that:

- + A ramp metering system on the westbound and eastbound entry ramps could generate queues that impact on the Prospect Highway Upgrade signal operations. These ramps are operating close to capacity under 2038 flows and are impacting on M4 Western Motorway operations. The inclusion of additional storage lanes on the ramps is likely
- + The exit ramps appear to be functioning well under 2038 forecast flows. There is little or no queuing on the ramps that may warrant SCATS intervention by a managed motorway system to clear traffic. Accordingly, it is unlikely that the managed motorway scheme will impact the operation of the Prospect Highway Upgrade.

### Access strategy

Under the Option 1 access strategy, access in and out of Vesuvius Street, Roger Place and Tudor Avenue is restricted to left-in-left out movements at the Prospect Highway. The Option 2 access strategy comprises left-in / right-in and left out only access at the intersections of Vesuvius Street, Roger Place and Tudor Avenue.

The relative operational impacts of the two options on the Prospect Highway and local residents have been compared in Section 5. When it comes to global performance measures, Option 1 optimises the performance of the Prospect Highway Upgrade. However, the improvement over Option 2 is minor.

Operational performance aside, a key issue with the Option 1 strategy, is the lack of a viable detour option for the right turn into Roger Place.

For the purpose of the assessment, it has been assumed that a U-turn would be performed in St Martins Crescent, as illustrated in Figure 6.6. However, no formal U-turn facility exists in St Martins Crescent at present and the Mega Centre is likely to be used to perform U-turns.

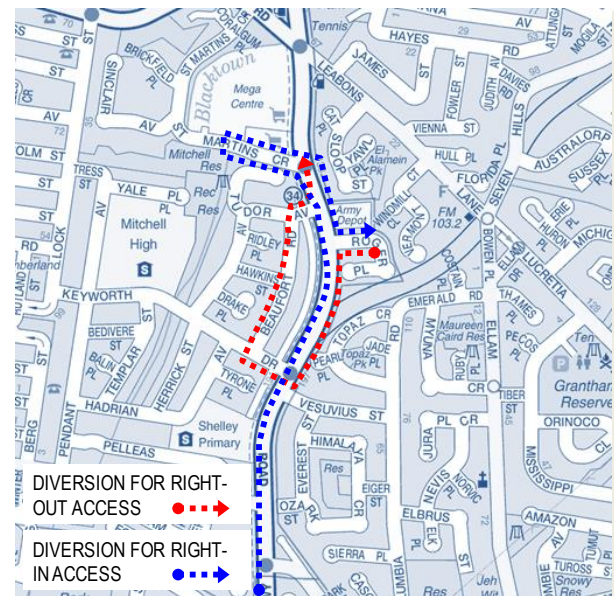


Figure 6.6: Roger Place diversions under the Option 1 access strategy

If RMS was to proceed with the Option 1 access strategy, the design would need to be amended to include such a facility.

Alternatively, SMEC recommends a hybrid access strategy based on Option 1. The same restrictions would

apply, except at Roger Place, where the right-turn into the catchment would be retained.

The impacts of this hybrid strategy, described in our modelling scenarios as Option 3, are presented in **Tables 5.7 and 5.8**.

The analysis suggests that Option 3 would reduce the Option 1 travel times between Blacktown Road and Roger Place by more than a minute.

## 7 CONCLUSION

### Background

SMEC was commissioned by RMS to conduct traffic modelling of the preferred Prospect Highway Upgrade design and to assist RMS in selecting a preferred access strategy option.

PARAMICS modelling of potential Prospect Highway Upgrades was conducted by RMS between Reservoir Road and Lancelot Street. RMS developed a preferred corridor layout based on the outcomes of a post options workshop held in August 2012.

SMEC updated the PARAMICS models for the preferred corridor layout using AIMSUN software, which coincides with the modelling software currently being used for the M4 Managed Motorway and WestConnex projects. The modelled network was extended north to St Martins Crescent to encompass the project scope required to assess the access strategy options. The trip matrices used in PARAMICS were also updated to reflect the revised project delivery timeframes, modelling 2018, 2028 and 2038 forecast years.

Two access strategy options were developed for the intersections of Vesuvius Street, Roger Place and Tudor Avenue with the Prospect Highway. The two access strategy options assessed are:

- + **Option 1:** Provision of left-in / left-out only access to the minor approach
- + **Option 2:** Provision of left-in / right-in and left-out only access to the minor approach.

The access strategy options were assessed using two methods:

- + AIMSUN modelling
- + Manual modelling.

### Modelling results

The AIMSUN modelling results indicate that the proposed Prospect Highway Upgrade would effectively reduce the congestion issues currently experienced by the existing alignment. The global operation of the modelled network shows negligible differences between the two access strategy options.

The primary impacts of the two access strategy options are experienced by the local residents who are required to perform detours resulting from changes to the current access arrangements at the intersections of the Prospect Highway with:

- + Vesuvius Street
- + Roger Place
- + Tudor Avenue.

The AIMSUN modelling demonstrates that Option 1 generates the best network performance for global statistics. However, Option 1 does not present a viable diversion for the banned right-turn into Roger Place, with vehicles required to perform a U-turn in St Martins Crescent, which is not considered acceptable without an appropriate U-turn facility. To address the shortcoming of Option 1, SMEC developed a third access strategy option (Option 3), which has the same turn restrictions at Vesuvius Street and Tudor Avenue as Option 1, but allows a right-turn into Roger Place.

Table 7.1 summarises the advantages and disadvantages of the three access options.

**Table 7.1: Comparison assessment of access strategy options**

Option	Advantages	Disadvantages
Option 1	<ul style="list-style-type: none"> <li>+ Significantly improves operation of the Prospect Highway</li> <li>+ Provides the best network performance statistics</li> </ul>	<ul style="list-style-type: none"> <li>+ Biggest impact on residential accessibility</li> <li>+ Does not provide a viable diversion for the banned right-turn movements into Roger Place</li> </ul>
Option 2	<ul style="list-style-type: none"> <li>+ Significantly improves operation of the Prospect Highway</li> <li>+ Smallest impact on residential accessibility</li> </ul>	<ul style="list-style-type: none"> <li>+ Provides marginally lower network performance statistics than Option 1</li> </ul>
Option 3	<ul style="list-style-type: none"> <li>+ Significantly improves operation of the Prospect Highway</li> <li>+ Provides Roger Lane local residents with viable access arrangements</li> <li>+ Represents a compromise strategy</li> </ul>	<ul style="list-style-type: none"> <li>+ Provides marginally lower network performance statistics than Option 1</li> </ul>

A number of design improvements to the preferred Prospect Highway Upgrade corridor layout were identified for consideration to improve the overall performance of the network. These improvements include:

- + Providing a left-turn auxiliary lane feeding into the two slip lanes on approach to the M4 Western Motorway exit ramp
- + Providing a left-turn auxiliary lane on approach to the southbound Prospect Highway left turn slip lane, to the Great Western Highway entry ramp
- + Providing a left turn auxiliary lane approaching the signals for the link from the Prospect Highway to the Great Western Highway
- + The proposed lane configuration on the Keyworth Drive approach is not shown on the design drawings. It is recommended that the design adopt a shared left/right and a dedicated right lane.

## Conclusion

The AIMSUN modelling of the three access strategy options indicates that there is negligible difference in the network global performance under each access strategy. The main impacts will be on the access for local residents resulting from the changed access arrangements at Vesuvius Street, Tudor Avenue and Roger Place. However, in many cases the AIMSUN modelling has revealed that the additional travel time generated by the turn ban detours is often being offset by the improved travel times along the upgraded Prospect Highway.

## Recommendation

Based on the manual and AIMSUN modelling conducted to assess the access strategy options, it is recommended that Option 3 access strategy is adopted.

Option 3 provides the second best network performance statistics, whilst providing Roger Place with viable access arrangements.

# APPENDIX A

Modelled Design, Drawing Number DS2012/000491, 10  
December 2012

## APPENDIX B

Intersection phasing  
and AIMSUN and PARAMICS signal data



Reservoir Road and Reconciliation Road

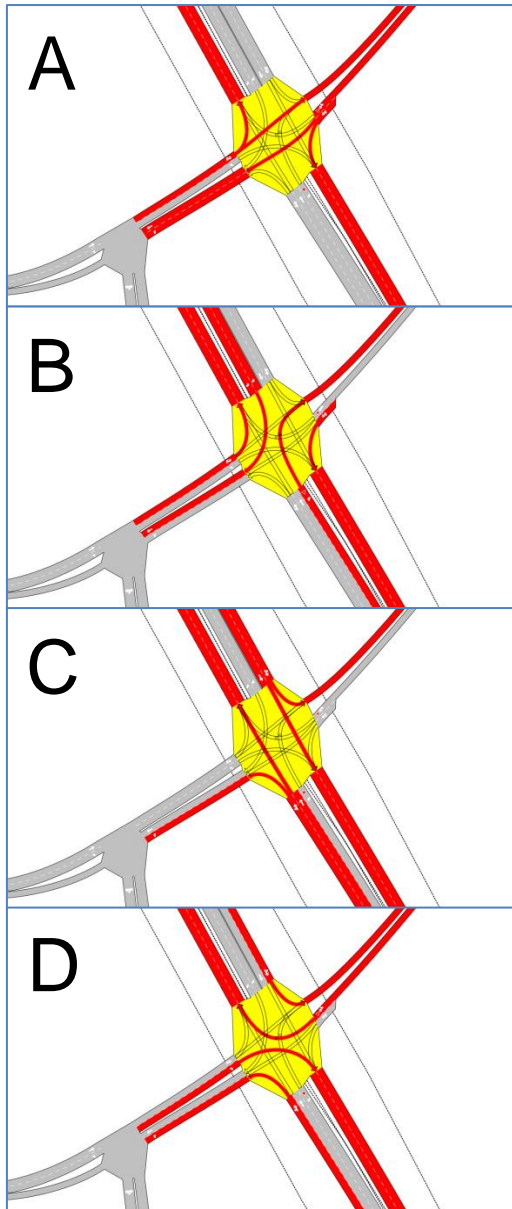


Table B1: Optimised green-splits, Reservoir Road and Reconciliation Road

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	12	19	66	33
	2028	12	19	66	33
	2038	12	19	66	33
PM	2018	19	12	76	23
	2028	19	12	76	23
	2038	19	12	76	23

M4 Western Motorway westbound entry / exit ramps

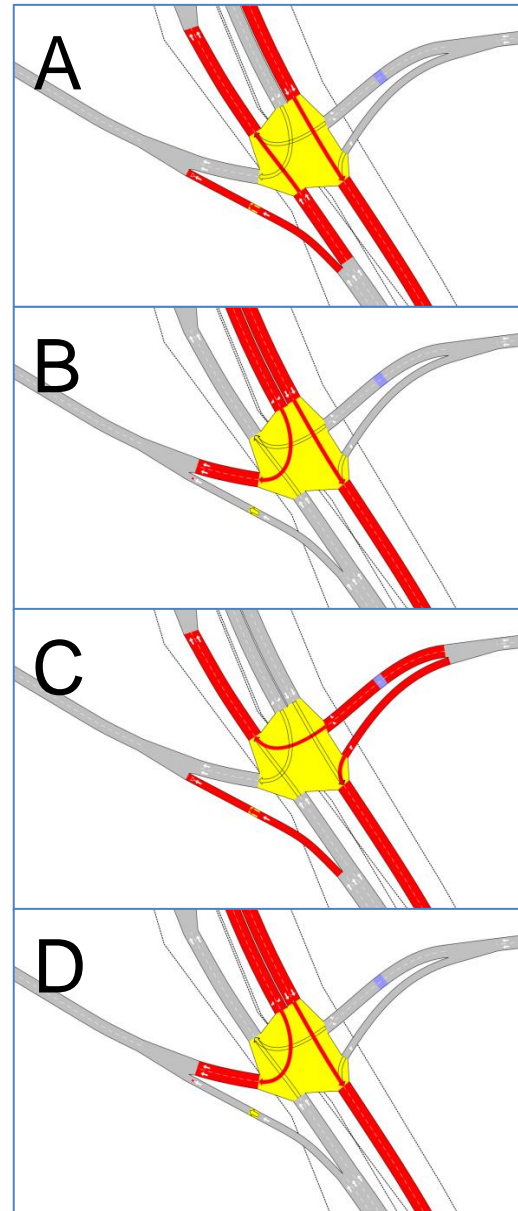
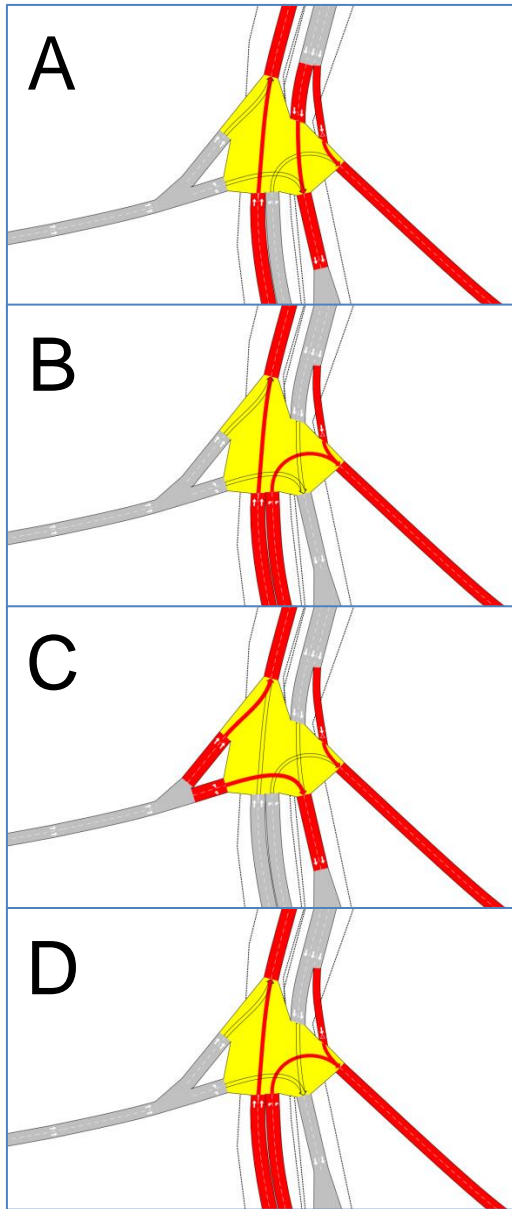


Table B2: Optimised green-splits, M4 Western Motorway westbound entry / exit ramps

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	46	17	50	17
	2028	46	17	50	17
	2038	46	17	50	17
PM	2018	59	35	36	0
	2028	59	35	36	0
	2038	59	35	36	0



M4 Western Motorway eastbound entry / exit ramps



Prospect Highway and Great Western Highway link

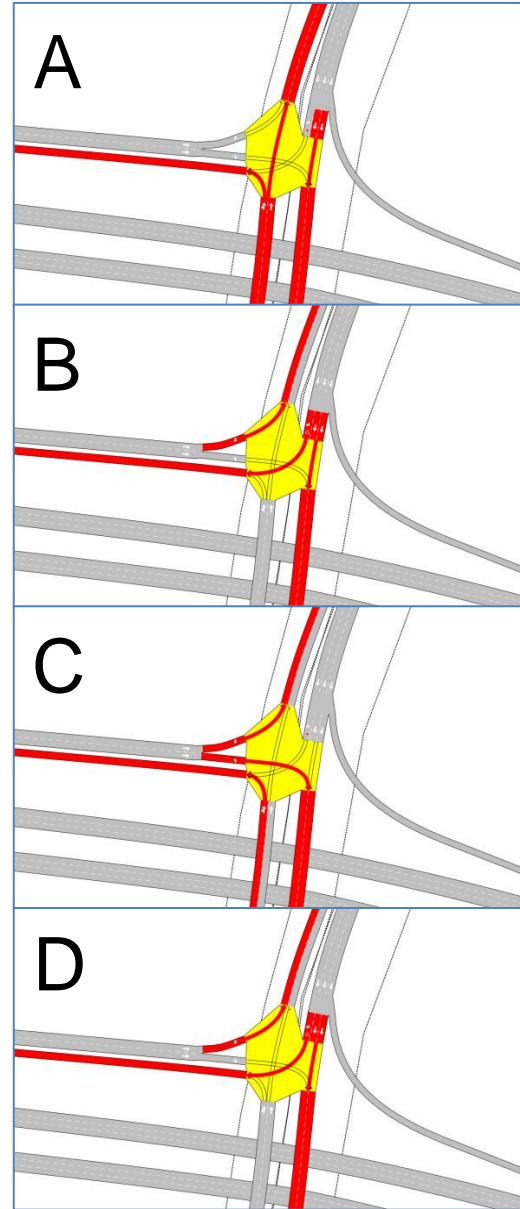


Table B3: Optimised green-splits, M4 Western Motorway eastbound entry / exit ramps

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	75	14	41	0
	2028	75	14	41	0
	2038	75	14	41	0
PM	2018	78	20	32	0
	2028	78	20	32	0
	2038	78	20	32	0

Table B4: Optimised green-splits, Prospect Highway and Great Western Highway link

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	86	14	16	14
	2028	86	14	16	14
	2038	86	14	16	14
PM	2018	86	14	16	14
	2028	86	14	16	14
	2038	86	14	16	14

### Great Western Highway and Prospect Highway link

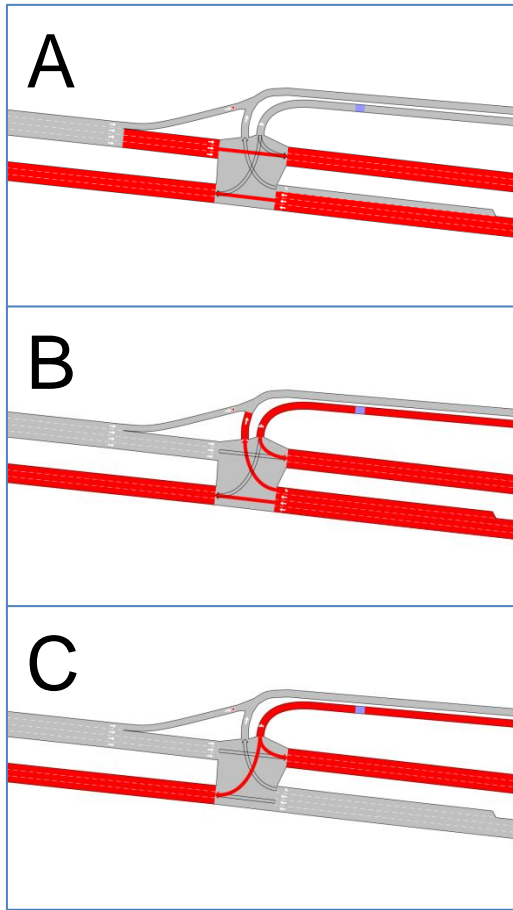


Table B5: Optimised green-splits, Great Western Highway and Prospect Highway link

Peak	Year	Phase green-splits (secs)		
		A	B	C
AM	2018	87	14	29
	2028	87	14	29
	2038	87	14	29
PM	2018	88	16	26
	2028	88	16	26
	2038	88	16	26

### Stoddart Road

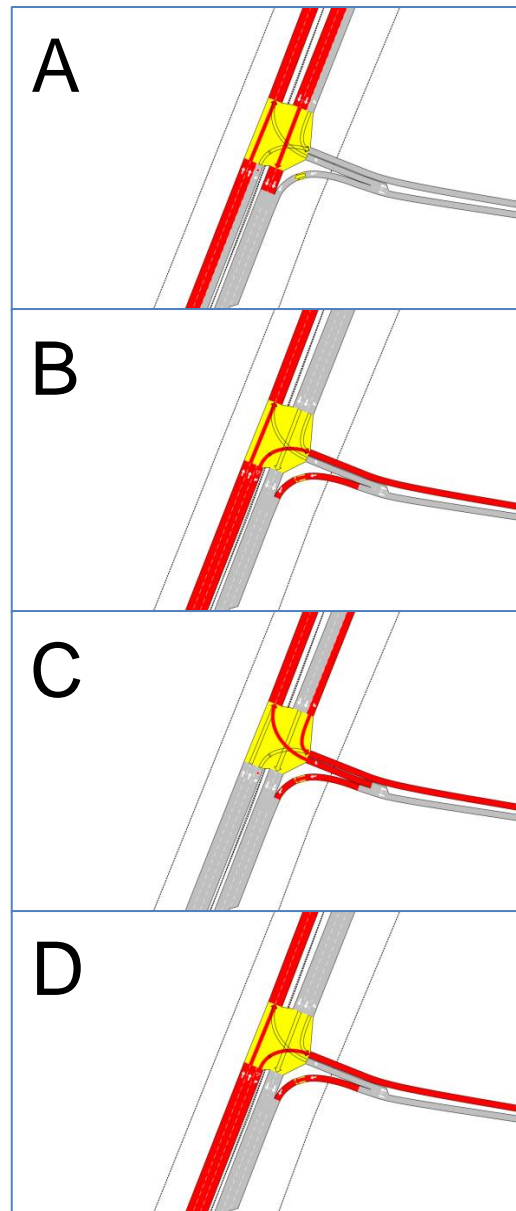


Table B6: Optimised green-splits, Stoddart Road

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	80	18	14	18
	2028	80	18	14	18
	2038	80	18	14	18
PM	2018	84	16	14	16
	2028	84	16	14	16
	2038	84	16	14	16

Harrod Street

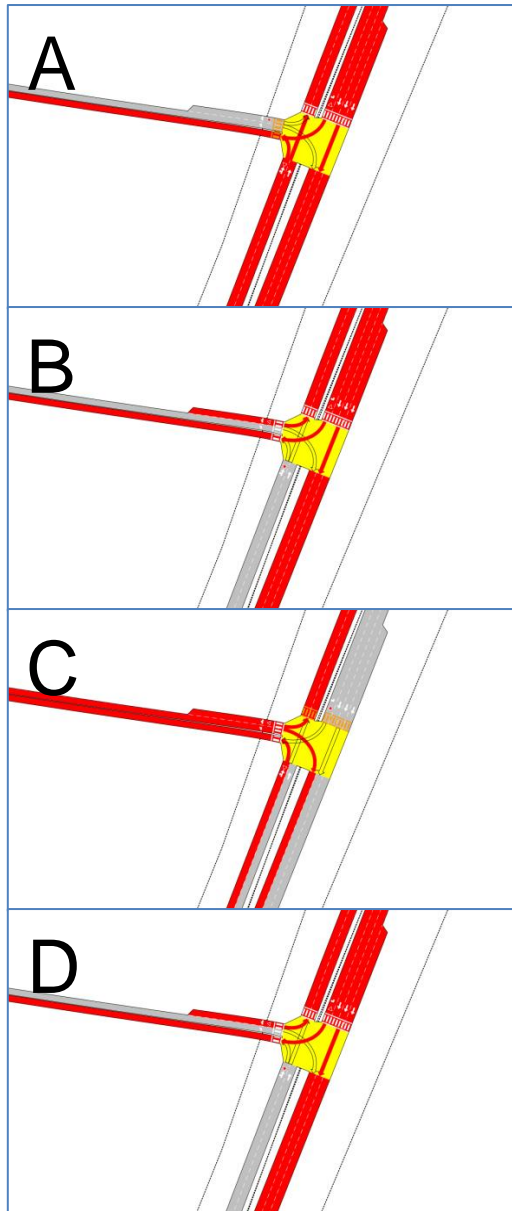


Table B7: Optimised green-splits, Harrod Street

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	78	14	24	14
	2028	78	14	24	14
	2038	78	14	24	14
PM	2018	84	14	18	14
	2028	84	14	18	14
	2038	84	14	18	14

Blacktown Road

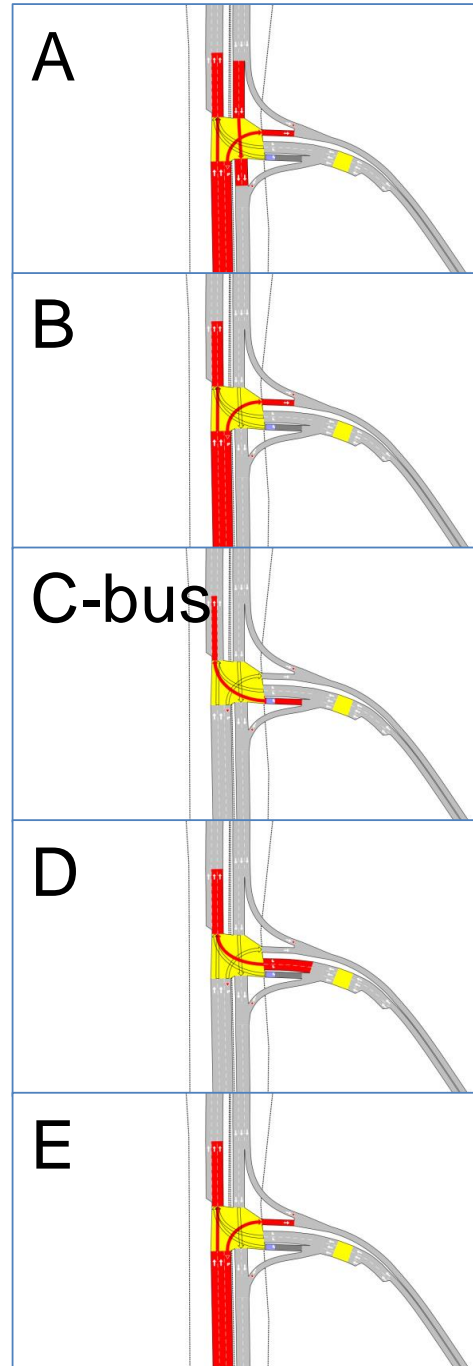
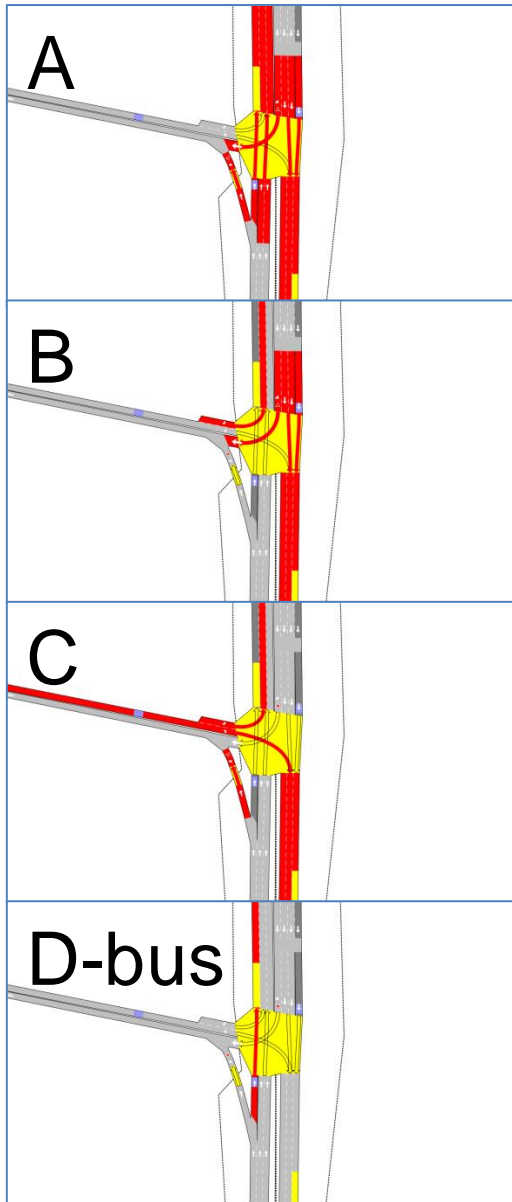


Table B8: Optimised green-splits, Blacktown Road

Peak	Year	Phase green-splits (secs)				
		A	B	C	D	E
AM	2018	78	14	6	24	14
	2028	78	14	6	24	14
	2038	78	14	6	24	14
PM	2018	73	22	6	35	0
	2028	73	22	6	35	0
	2038	73	22	6	35	0

Lancelot Street



Keyworth Drive

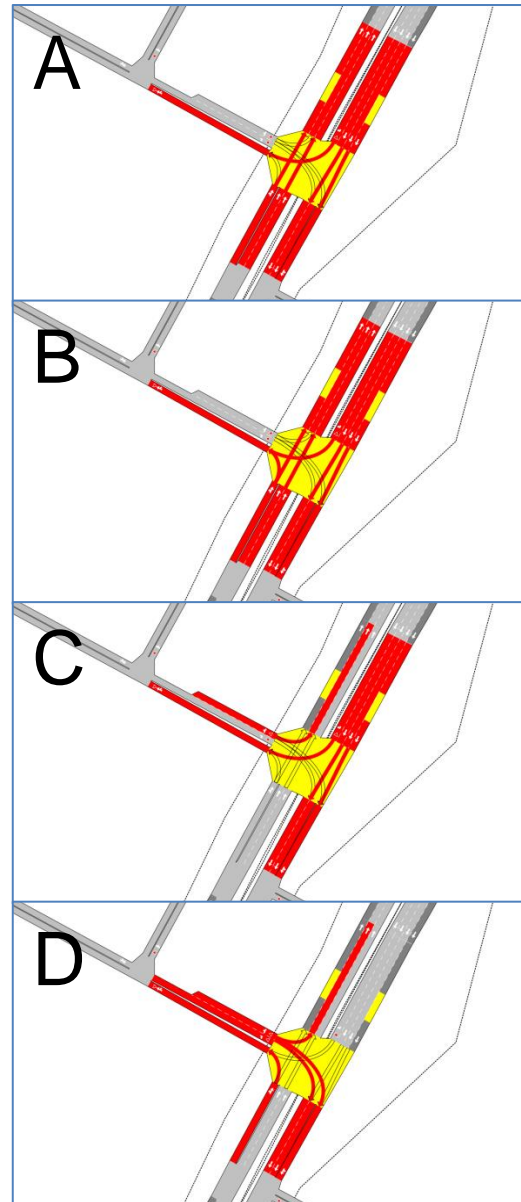


Table B9: Optimised green-splits, Lancelot Street

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	88	14	28	6
	2028	88	14	28	6
	2038	88	14	28	6
PM	2018	88	14	28	6
	2028	88	14	28	6
	2038	88	14	28	6

Table B10: Optimised green-splits, Keyworth Drive

Peak	Year	Phase green-splits (secs)			
		A	B	C	D
AM	2018	31	43	15	31
	2028	31	43	15	31
	2038	31	43	15	31
PM	2018	39	37	15	39
	2028	39	37	15	39
	2038	39	37	15	39



## APPENDIX C

Revised Design, Drawing Number DS2012/000491, 3  
June 2013