Prospect Highway Upgrade

Reservoir Road to St Martins Crescent

Traffic and Transport Assessment

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EXECUTIVE SUMMARY

NSW Roads and Maritime Services (Roads and Maritime) is planning for the future upgrade of the Prospect Highway between Reservoir Road at Prospect and 200 metres north of St Martins Crescent at Blacktown for a length of 3.6 kilometres, referred to herein as "the proposal". The primary objective of the proposal is to provide increased capacity and improved performance for forecast traffic growth to 2031 along the corridor.

Prospect Highway forms the main road corridor connecting the City of Blacktown with the M4 Western Motorway. It is proposed to upgrade the corridor to meet future traffic demand, reduce travel times and improve road safety. The proposal would involve improvements to the existing route of the Prospect Highway.

The proposal primarily involves the upgrade of the Prospect Highway from an undivided two-lane road to a divided four-lane road between Reservoir Road at Prospect and 200 metres north of St Martins Crescent at Blacktown.

The key features of the Prospect Highway proposal include:

- Two lanes in each direction with a central median between the Reservoir Road and Blacktown Road.
- Three lanes in each direction with a central median between Blacktown Road and 200 metres north of St Martins Crescent with dedicated kerbside bus lanes in both directions. The proposal ties into the existing configuration north of St Martins Crescent.
- Construction of two new bridge structures over the M4 Western Motorway and the Great Western Highway on the western side of the existing bridge structures.
- Construction of a new two way link road between the Great Western Highway and the Prospect Highway (replacing the Great Western Highway eastbound exit ramp).
- Upgrading four existing signalised intersections with Prospect Highway, including:
  - M4 Western Motorway westbound entry and exit ramp.
  - Harrod Street.
  - Blacktown Road.
  - Keyworth Drive.
- Construction of five new signalised intersections at:
  - Reservoir Road / Reconciliation Road / Prospect Highway.
  - M4 Western Motorway eastbound exit and entry ramps / Prospect Highway.
  - Two way link road at its intersection with the Great Western Highway.
  - Two way link road at its intersection with the Prospect Highway.
  - Stoddart Road / Prospect Highway.

- Conversion of three priority controlled intersections to left in and left out movements only at the following locations:
  - Ponds Road / Prospect Highway.
  - Vesuvius Street / Prospect Highway.
  - Tudor Avenue / Prospect Highway.
- Conversion of the existing priority controlled intersection of Roger Place / Prospect Highway to left in, right in and left out movements only.
- Relocation of five bus stops at the following locations:
  - Northbound bus stops north of Keyworth Drive and north of Tudor Avenue from the existing informal service road to behind the kerb of the new alignment.
  - Northbound bus stop north of Stoddart Road to north of Harrod Street.
  - Northbound and southbound bus stops north of St Martins Crescent towards the south.
- Installation of two new bus stops (northbound and southbound adjacent to the intersection of the Prospect Highway / Reservoir Road / Reconciliation Road).
- Upgrade of the pedestrian underpass beneath the Prospect Highway linking Old Church Lane and Keyne Street.
- Upgrade of the temporary shared path between the M4 Western Motorway westbound exit ramp and Harrod Street.
- Realigning the existing footpath between Harrod Street and Blacktown Road.
- Provision of a footpath on the eastern side of the Prospect Highway between Keyworth Drive and Roger Place.

This Traffic and Transport Assessment Report was prepared to support the Review of Environmental Factors and includes:

- Examination and assessment of traffic and transport patterns (including pedestrians, cyclists, public transport and parking) and conditions for the existing corridor and connections.
- Review of the previous traffic and transport studies and investigations commissioned by Roads and Maritime Services in relation to the proposal.
- Review of historic traffic volume and crash data for the proposal corridor.
- Development, calibration and validation of a base year traffic model for the existing road configuration.
- Modelling to assess the current and future years' (2018, 2028 and 2038) road network performance for the existing road configuration ('do nothing') and the proposed upgrade.
- Assessment of the bus service performance for the current and future years' road network performance for the current road configuration ('do nothing') and Roads and Maritimes' preferred option.

- Determination of the impacts of the proposal during the construction and operation phases for all road users, including property and local access, public transport, pedestrians, cyclists and vehicular traffic.
- Development of mitigation and management measures to minimise the impacts identified.

Operational assessment

The key findings from the operational assessment include:

- The mid-block capacity on the Prospect Highway is over capacity in almost all do nothing future years and peak hours. The corridor experiences an operational condition where vehicles are travelling at very low speeds caused by intersection congestion and delay. With the proposal, the capacity is improved substantially, with an operational conditions that are relatively unimpeded and improved manoeuvrability compared with do nothing.
- In the AM peak, the travel times along the corridor are likely to improve by two to four minutes in the northbound direction and a substantial 29 to 39 minutes in the southbound direction in all future years compared with do nothing. In the PM peak the travel times along the corridor are likely to improve by one to four minutes in both directions compared with do nothing.
- The analysis of the intersection performance with the proposed upgrade shows that all of the intersections operate at an acceptable level of service of D or better during the AM and PM peak periods for all the forecast years, compared to the do nothing scenario, which indicates multiple intersections are likely to operate at levels of service of E or F.
- The impacts of the changed access arrangements for local residents revealed that residents would be required to travel further to reach their destination. This corresponds to a delay of less than one minute in the PM peak (determined by modelling), however, since the do nothing scenarios have severe congestion, a substantial reduction in travel time is likely to be realised for the residents impacted by the revised access arrangements due to the improvement in travel times on the Prospect Highway corridor.
- In the AM peak, bus travel speeds and travel times improve in all forecast years with the proposal compared with the do nothing scenario. In the PM peak, the bus travel speeds increase by a minimum of one kilometre per hour (the average being an increase of four kilometres per hour) and bus travel times improve by a minimum of one minute (the average being a reduction of seven minutes) for the bus routes along the proposal corridor. Bus route 812 is the exception, which has travel times increase by up to one minute and the average travel speed reduce in both directions in 2018 and in the southbound direction in 2028 and 2038. The proposed road upgrade includes additional bus stops and changes to the road corridor which impact bus travel patterns. The majority of the additional travel time is caused at the southern extent of the proposal with the new bus stops requiring additional dwell times compared to the do nothing scenario, which does not factor the additional dwell time.
- The proposal is likely to improve the safety on the corridor in the following ways:
  + The introduction of the signalised intersection at the Prospect Highway and the new two way link road creates gaps for traffic turning left out of Ponds Road, which could potentially reduce the number of crashes recorded at this intersection.

+ The divided carriageway and the removal of the right turn out of Ponds Road is likely to reduce the number of crashes associated with vehicles turning across the Prospect Highway traffic at this location.
+ Head-on collisions would be reduced with the introduction of the divided carriageway.
+ The introduction of signals at Stoddart Road would control right turn movements from the Prospect Highway.
+ The pedestrian underpass of the Prospect Highway between Old Church Lane and Keyne Street would be upgraded to incorporate Crime Prevention through Environmental Design principles as far as practicable to improve user safety.
+ Additional signalised pedestrian crossings are proposed along the Prospect Highway corridor.
+ The revised access arrangements at the intersections of the Prospect Highway with Vesuvius Street, Roger Place and Tudor Avenue remove vehicles turning right from the minor approaches across the Prospect Highway traffic.

Preliminary construction traffic impacts

Truck movements during the construction phase are likely to increase by an average of 40 and up to 80 truck movements per day during peak construction periods. The additional peak heavy vehicle movements associated with construction are not expected to have a substantial impact on existing heavy vehicle volumes.

Under the construction staging strategy developed by Roads and Maritime, access to existing properties along the Prospect Highway corridor would be maintained during all stages of construction.

Local road access is likely to be impacted during construction as follows for various stages of construction:

- The radii for turning manoeuvres into and out of Keyworth Drive are likely to be reduced.
- Traffic accessing Tudor Avenue is likely to be detoured to Keyworth Drive.
- Traffic accessing Vesuvius Street is likely to be detoured via Blacktown Road, Columbia Road, Ellam Drive, Emerald Road and Leabons Lane.

A number of bus stops are likely to be relocated or removed during the construction of the proposal. The bus stops that are proposed to be temporarily removed or relocated are within appropriate walking distance of 400 metres or less to alternative bus stops or from the existing bus stop locations. During construction buses would continue to use the Prospect Highway corridor.

Pedestrian and cyclist access would be maintained or alternative routes provided throughout the construction phase. Provisions for pedestrian and cyclist access to Shelley Public School, Blacktown Children's Centre and bus stops would be maintained for all stages of construction.

Mitigation and management measures

The proposed mitigation and management measures are presented in the following table.

Summary of mitigation and management measures

Mitigation and management measure	Detail design	Pre-construction	Construction	Operation
Develop a detailed Traffic Management Plan		✓		
Consult with properties impacted by access arrangement alterations	✓			✓
Temporarily relocate maintenance access at Shelley Public School			✓	
Consultation with bus operators for relocated or removed bus stops	✓			✓
Pedestrian and cyclist access (including crossing facilities) to be maintained and separated from works areas at all times			✓	
Relocate all pick-up and set-down arrangements at Shelley Public School to Hadrian Avenue and Pelleas Street			✓	✓
Monitor bus travel speeds along the Prospect Highway corridor and consider implementing bus jump start phasing at key signalised intersections.				✓

In summary, the proposal would achieve the primary objective of providing increased capacity and improved performance for forecast traffic growth to 2031 along the corridor. As a result of the proposed upgrade, travel times along the corridor would decrease. Additionally, the proposal would improve safety along the corridor, by introducing a divided carriageway, providing controlled turning movements at intersections, which are currently uncontrolled and constructing additional pedestrian facilities, including paths and signalised crossings.

1. INTRODUCTION

1.1 Project background

NSW Roads and Maritime Services (Roads and Maritime) is planning for the future upgrade of the Prospect Highway between Reservoir Road at Prospect and 200 metres north of St Martins Crescent at Blacktown. Preliminary investigations for the Prospect Highway upgrade have included development of a strategic concept design and access strategy.

The Prospect Highway is an 8.1 kilometre long arterial road, linking Reservoir Road at Prospect in the south and the M2 Motorway at Seven Hills via Abbott Road in the northeast. The corridor is contained within the Blacktown Local Government Area (LGA) and located within the Roads and Maritime Sydney Region. The north-south route links major urban, commercial and industrial areas to the M4 Western Motorway, M7 Motorway and M2 Motorway and is a main connector road through the suburbs of Prospect, Blacktown and Seven Hills and also services nearby Pemulwuy. The proposal involves upgrading the southern 3.6 kilometre section of Prospect Highway between Reservoir Road, Prospect and St Martins Crescent, Blacktown. The Prospect Highway corridor is a key link for the local community, providing pedestrian and cycle access between low density residential neighbourhoods. The Prospect Highway also directly services commercial and industrial centres, educational institutions including a primary school and an early learning childcare centre, the State Emergency Services Blacktown Unit Facility, Army Reserve Depot, St Mark's Coptic Catholic Church and the historic St Bartholomew's Anglican Church and cemetery. Additionally, a new water theme park known as Wet 'n' Wild Sydney is located at the southern end of the proposal and opened in late 2013. Prospect Reservoir is located south west of the proposal area.

It is proposed to upgrade the corridor to meet increased future volume traffic demand to 2031 and improve travel times and road safety. The proposal would involve improvements to the existing Prospect Highway corridor between Reservoir Road and St Martins Crescent.

The proposal does not include a Prospect Highway extension through to Seven Hills. This project may be investigated in the future.

The proposal

The key features of the proposed Prospect Highway upgrade (referred to herein as 'the proposal') are:

- Two lanes in each direction with a central median between the Reservoir Road and Prospect Highway intersection and the M4 Western Motorway westbound entry and exit ramps. This section includes:
  - Dual right turn lanes for southbound traffic on the Prospect Highway into Reservoir Road.
  - A left turn auxiliary lane for northbound traffic on the Prospect Highway into the M4 Western Motorway westbound entry ramp.

- Two lanes in each direction between the M4 Western Motorway westbound entry and exit ramps and Ponds Road. This section includes:
  - A central median between the M4 Western Motorway exit ramp and Ponds Road.
  - Dual right turn lanes for southbound traffic on the Prospect Highway into the M4 Western Motorway westbound entry ramp.
  - Dual right turn lanes for northbound traffic on the Prospect Highway into the M4 Western Motorway eastbound entry ramp.
  - Auxiliary left turn priority controlled slip lanes for southbound traffic on the Prospect Highway into the M4 Western Motorway eastbound entry ramp and into Ponds Road.
- Two lanes in each direction between Ponds Road and the two way link road divided by two separate bridge structures.
- Construction of two new bridge structures over the M4 Western Motorway and the Great Western Highway on the western side of the existing bridge structures. The existing bridges would function as the new southbound carriageway and the new bridges would function as the new northbound carriageway. The new bridges include provision of a shared pedestrian and cyclist path on the western side of the structures.
- Construction of a new two way link road between the Great Western Highway and the Prospect Highway (replacing the Great Western Highway eastbound exit ramp). The two way link road comprises two lanes in each direction with dedicated left and right turn lanes at its intersections with the Great Western Highway and the Prospect Highway.
- Two lanes in each direction with a central median between the two way link road and Stoddart Road. This section includes a northbound right turn lane into Stoddart Road and a left turn priority controlled slip lane from Stoddart Road into the Prospect Highway.
- Two lanes in each direction with a central median between Stoddart Road and Harrod Street. This section also includes a left turn auxiliary lane into Stoddart Road for southbound traffic on the Prospect Highway.
- Two lanes in each direction with a central median between Harrod Street and Blacktown Road. This section includes:
  - A right turn lane into Blacktown Road for northbound traffic on the Prospect Highway.
  - A right turn lane into Harrod Street for southbound on the Prospect Highway.
- Retention of the existing four lanes plus left turn auxiliary lanes into Blacktown Road and Lancelot Street between Blacktown Road and Lancelot Street.

- Three lanes in each direction with a central median between Lancelot Street and Roger Place. The kerbside lane in each direction is a dedicated bus lane. This section includes:
  - A right turn lane into Lancelot Street for southbound traffic on the Prospect Highway.
  - A right turn lane into Keyworth Drive for southbound traffic on the Prospect Highway.
  - A right turn lane into Roger Place for northbound traffic on the Prospect Highway.
- Three lanes in each direction with a central median between Roger Place and Tudor Avenue. The kerbside lane in each direction would be a dedicated bus lane.
- Three lanes in both directions with a central median between Tudor Avenue and around 200 metres north of St Martins Crescent. The kerbside lane in each direction would be a dedicated bus lane. The proposed upgrade ties into the existing configuration north of St Martins Crescent. This section includes a right turn lane into St Martins Crescent for southbound traffic on the Prospect Highway.
- Upgrading four existing signalised intersections with Prospect Highway, including:
  - M4 Western Motorway westbound entry and exit ramp, upgrade to include two dedicated right turn lanes for southbound traffic on the Prospect Highway to travel west on the M4 Western Motorway and two dedicated through lanes for northbound and southbound traffic on the Prospect Highway.
  - Harrod Street, upgrading of the existing intersection to provide two lanes in each direction on the Prospect Highway with a dedicated right turn bay into Harrod Street for southbound traffic on the Prospect Highway.
  - Blacktown Road, upgrading of the existing intersection to provide a signalised pedestrian crossing on the southern approach of the intersection.
  - Keyworth Drive, upgrading of existing intersection to provide two lanes and a dedicated bus lane in each direction on the Prospect Highway. The proposal also includes a dedicated right turn bay into Keyworth Drive for southbound traffic on the Prospect Highway.
- Construction of five new signalised intersections by:
  - Conversion of the existing Reservoir Road/ Reconciliation Road and Prospect Highway roundabout intersection to a signalised intersection.
  - Conversion of the existing M4 Western Motorway eastbound exit and entry ramps roundabout to a signalised intersection.
  - Installing a new signalised intersection at the two way link road at its intersection with the Great Western Highway.
  - Installing a new signalised intersection at the two way link road at its intersection with the Prospect Highway.

  - Conversion of the existing priority controlled intersection at Stoddart Road to a signalised intersection.

- Conversion of three priority controlled intersections to left in and left out movements only at the following locations:
  - Ponds Road / Prospect Highway.
  - Vesuvius Street / Prospect Highway.
  - Tudor Avenue / Prospect Highway.
- Conversion of the existing priority controlled intersection of the Roger Place / Prospect Highway intersection to left-in, right-in and left-out movements only.
- Relocation of five bus stops:
  - Northbound bus stops north of Keyworth Drive and north of Tudor Avenue would be relocated from the existing informal service road to behind the kerb of the new alignment.
  - Northbound bus stop north of Stoddart Road wold be relocated to north of Harrod Street.
  - Northbound and southbound bus stops north of St Martins Crescent would be relocated towards the south, closer to the intersection of Prospect Highway and St Martins Crescent.
- Installation of two new bus stops (northbound and southbound adjacent to the intersection of the Prospect Highway / Reservoir Road / Reconciliation Road).
- Upgrade of the pedestrian underpass beneath the Prospect Highway linking Old Church Lane and Keyne Street.
- Upgrade of the temporary shared path between the M4 Western Motorway westbound exit ramp and Harrod Street.
- Realigning the existing footpath between Harrod Street and Blacktown Road to accommodate the proposed alignment of the Prospect Highway and provide connectivity to the proposed signalised pedestrian crossing on the southern side of the Prospect Highway and Blacktown Road intersection.
- Provision of a footpath on the eastern side of the Prospect Highway between Keyworth Drive and Roger Place.
- Provision of three retaining walls ranging from about two metres to about seven metres in height at the following locations:
  - St Bartholomew's Cemetery for a length of about 80 metres.
  - Proposed Great Western Highway / Prospect Highway link road for a length of about 270 metres.

  - Great Western Highway / Prospect Highway intersection and along the northbound carriageway of the Prospect Highway for a length of about 200 metres.

- Establishment of temporary site compounds and stockpiles during construction.
- Upgrade of the existing pavement and cross drainage systems including the construction and extension of pavement drainage lines.
- Utilities relocation where required.
- Upgrade of street lighting along the proposal length.
- Landscaping of the corridor.

Project objectives

The primary objective of the proposal is to provide increased capacity in order to cater for forecast transport growth to 2031 on the Prospect Highway between Reservoir Road at Prospect and St Martins Crescent at Blacktown.

Other objectives of the proposal include:

- Improve safety and access for both through and local traffic.
- Improve safety for cyclists and pedestrians by providing an off-road shared path.
- Improve travel times and reduce congestion along the Prospect Highway between Blacktown and the M4 Western Motorway.

1.2 Study objectives

Roads and Maritime is undertaking an assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the proposal. Part 5, Section 111 of the EP&A Act requires the environmental impact assessment to be documented in a review of environmental factors (REF) for the proposal.

SMEC Australia Pty Ltd (SMEC) was commissioned by Roads and Maritime to prepare a Traffic and Transport Assessment report to support the REF for the proposal and meet Roads and Maritime's obligations under the EP&A Act. The objectives of the Traffic and Transport Assessment report are to:

- Examine and assess the traffic and transport patterns (including pedestrians, cyclists, public transport and parking) and conditions for the existing corridor and connections.
- Review the previous traffic and transport studies and investigations commissioned by Roads and Maritime in relation to the proposal.
- Review historic traffic volume and crash data for the proposal corridor.
- Develop, calibrate and validate a base year traffic model for the existing road configuration.

- Conduct modelling to assess the current and future years' road network performance for the existing road configuration ('do nothing') and Roads and Maritime's preferred option.
- Assess the bus service performance for the current and future years' road network performance for the current road configuration ('do nothing') and Roads and Maritime's preferred option.
- Determine the impacts of the proposal during the construction and operation phases for all road users, including property and local access, public transport, pedestrians, cyclists and vehicular traffic.
- Develop mitigation and management measures to minimise the impacts identified.

1.3 Report structure

The remainder of this report is structured as follows:

- **Section 2 Existing transport conditions:** Describes the existing corridor, its surrounding land uses, current modes of travel along the corridor, traffic volumes and patterns, operational assessment and historical crash analysis.
- **Section 3 Traffic modelling:** Presents the previous modelling results, specifies the modelling purpose and scenarios, describes the modelling approach and assumptions, details the network modelled and provides the results of the future base case assessment.
- **Section 4 The proposal:** Provides an overview of the proposal, specifies the design criteria and summarises the staging of works associated with the proposal.
- **Section 5 Transport appraisal:** Assesses the impacts of the proposal on public transport, walking and cycling, freight transport and road safety.
- **Section 6 Traffic assessment:** Presents the results of the traffic modelling and impact assessment, including the consequence of the 'do nothing' scenario, preliminary construction impacts identified and impacts during operation of the proposal.
- **Section 7 Mitigation and management measures:** Provides a package of mitigation and management measures developed to minimise the impacts identified with consideration of all road users during the construction and operation phases.
- **Section 8 Summary and recommendations:** Summarises the findings from the Traffic and Transport Assessment and provides the recommendations for minimising the impacts of the proposal.
- **Appendix A Pedestrian and cyclist facility photographic inventory**: Includes a photographic inventory of some of the existing pedestrian and cyclist facilities along the proposal corridor.
- **Appendix B Model calibration and validation:** Includes the calibration and validation report for the development of the base year model for the existing road configuration.

- **Appendix C Concept design:** Provides Roads and Maritime's concept design for the proposal.
- **Appendix D Traffic volume data:** Provides the traffic volume data used to inform this Traffic and Transport Assessment.
- **Appendix E Traffic signal data:** Includes the traffic signal data obtained from Roads and Maritime to inform the development of the traffic modelling and the phase timings for the future road network with the proposal.
- **Appendix F Previous modelling results**: Includes the report for the previous modelling conducted by SMEC for the proposal.

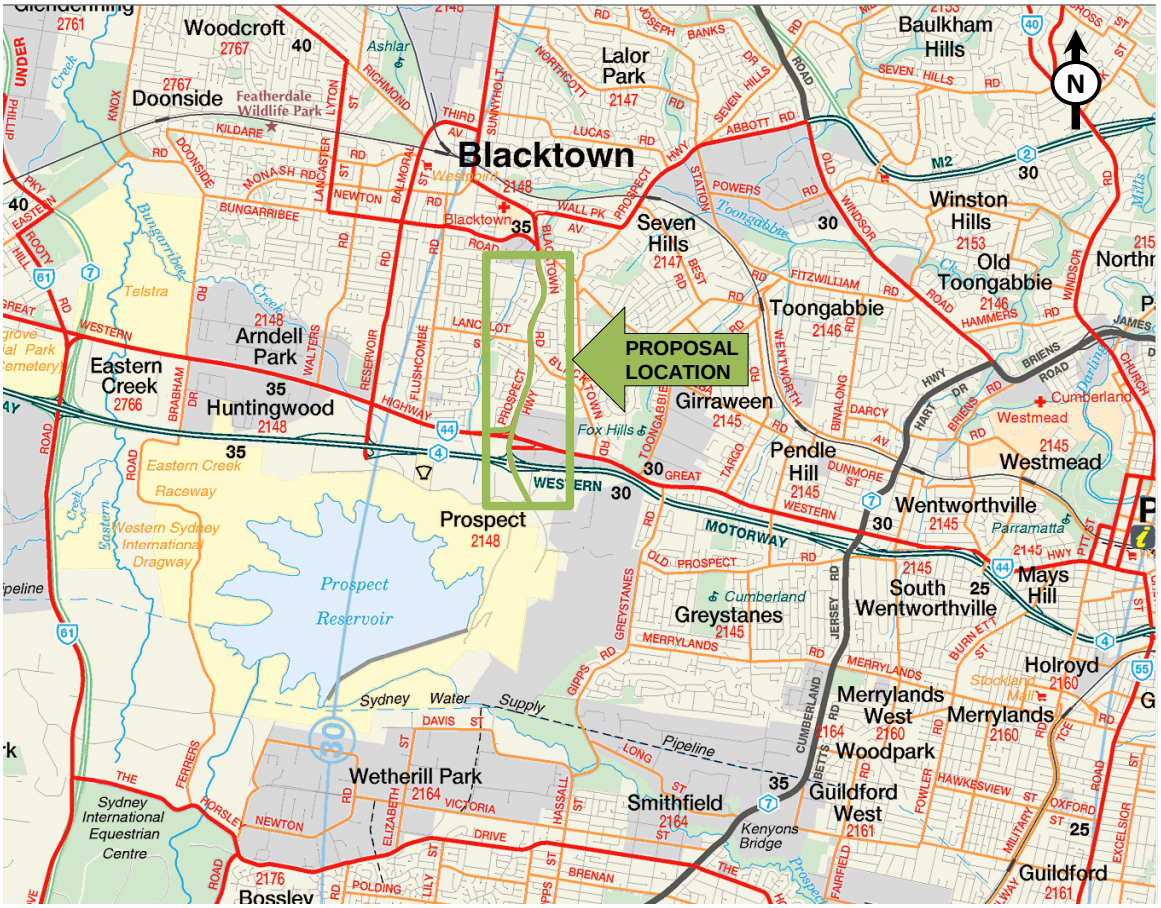
2. EXISTING TRANSPORT CONDITIONS

2.1 Corridor description

2.1.1 Route environment

The Prospect Highway is a north-south corridor between the suburbs of Prospect, Seven Hills and Blacktown, which forms part of the eight kilometre corridor linking the M4 Western and Westlink M2 Motorways through the City of Blacktown LGA. The proposal comprises a 3.6 kilometre route from Reservoir Road at Prospect in the south to about 200 metres north of St Martins Crescent at Blacktown in the north. Figure 2.1 illustrates the proposal location.

The Prospect Highway is generally an undivided two-lane road. There are localised widenings at key intersections for turning and acceleration lane provisions. An informal service road runs along the western side of the Prospect Highway, between about 70 metres south of Vesuvius Street and 60 metres south of St Martins Crescent.



Source: UBD Australian City Streets, version 3.0.

Figure 2.1: Prospect Highway proposal location

2.1.2 Major intersections along the corridor

Table 2.1 summarises the existing intersections along the Prospect Highway corridor.

Table 2.1: Major intersections along the Prospect Highway

Intersection	Approach	Speed limit	Control method
Reservoir Road / Reconciliation Road	Prospect Highway (north)	60 km/h	Roundabout
	Reservoir Road (east)	60 km/h	
	Reconciliation Road (south)	60 km/h	
	Reservoir Road (west)	60 km/h	
M4 Western Motorway, westbound exit and entry ramps	Prospect Highway (north)	60 km/h	Signalised
	M4 Western Motorway westbound exit ramp (east)	60 km/h	
	Prospect Highway (south)	60 km/h	
	M4 Western Motorway westbound entry ramp (west)	100 km/h	
M4 Western Motorway, eastbound exit and entry ramps	Prospect Highway (north)	60 km/h	Roundabout
	M4 Western Motorway eastbound entry ramp (east)	100 km/h	
	Prospect Highway (south)	60 km/h	
	M4 Western Motorway eastbound exit ramp (west)	100 km/h	
Ponds Road	Prospect Highway (north)	60 km/h	Seagull
	Ponds Road (east)	60 km/h	
	Prospect Highway (south)	60 km/h	
Great Western Highway, eastbound exit and entry ramps	Prospect Highway (north)	60 km/h	Give-way, left-out only from Great Western Highway eastbound exit ramp
	Great Western Highway eastbound entry ramp (east)	80 km/h	
	Prospect Highway (south)	60 km/h	

Intersection	Approach	Speed limit	Control method
	Great Western Highway eastbound exit ramp (west)	60 km/h	
Stoddart Road	Prospect Highway (north)	60 km/h	Partial seagull, left and right-in and left out only
	Stoddart Road (east)	50 km/h	
	Prospect Highway (south)	60 km/h	
Harrod Street	Prospect Highway (north)	60 km/h	Signalised
	Prospect Highway (south)	60 km/h	
	Harrod Street (west)	50 km/h	
Blacktown Road	Blacktown Road (north)	60 km/h	Signalised, with left turn slip lanes into and out of Blacktown Road (east)
	Blacktown Road (east)	50 km/h	
	Prospect Highway (south)	60 km/h	
Lancelot Street	Blacktown Road (north)	60 km/h	Signalised, left turn slip lane into Lancelot Street
	Blacktown Road (south)	60 km/h	
	Lancelot Street (west)	50 km/h	
Vesuvius Street	Blacktown Road (north)	60 km/h	Give-way, right turn into Vesuvius Street banned 7am to 10am and 3pm to 7pm
	Vesuvius Street (east)	50 km/h	
	Blacktown Road (south)	60 km/h	
Keyworth Drive	Blacktown Road (north)	60 km/h	Signalised
	Blacktown Road (south)	60 km/h	
	Keyworth Drive (west)	50 km/h	
Roger Place	Blacktown Road (north)	60 km/h	Give-way
	Roger Place (east)	50 km/h	
	Blacktown Road (south)	60 km/h	

Intersection	Approach	Speed limit	Control method
Tudor Avenue	Blacktown Road (north)	60 km/h	Give-way
	Blacktown Road (south)	60 km/h	
	Tudor Avenue (west)	50 km/h	
St Martins Crescent	Blacktown Road (north)	60 km/h	Signalised
	Blacktown Road (south)	60 km/h	
	St Martins Crescent (west)	50 km/h	

Figure 2.2 illustrates the location and controls of key intersections along the proposal corridor.

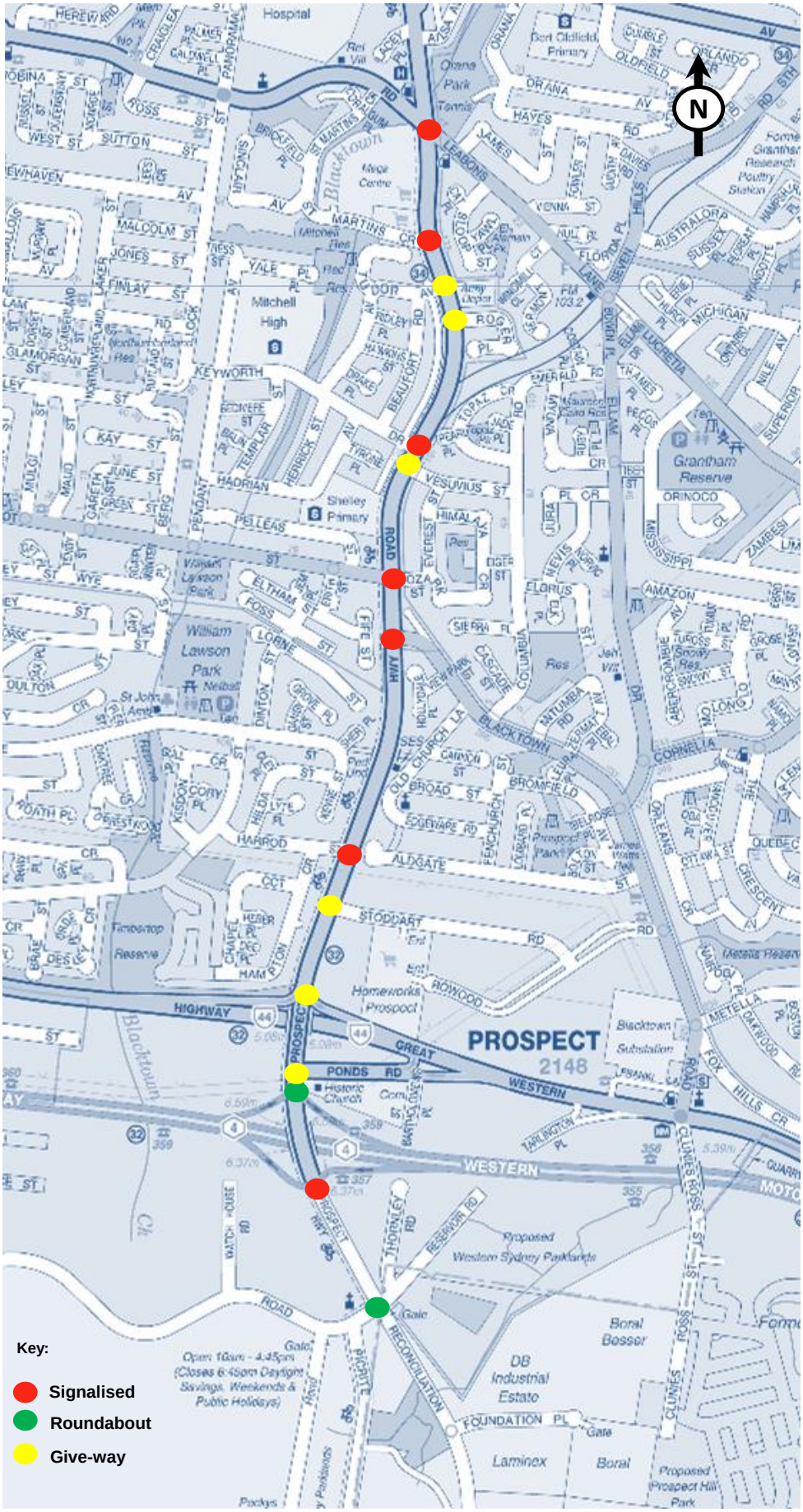


Figure 2.2: Key intersection controls along the proposal corridor

2.1.3 Existing key features of the corridor

The key features of the existing Prospect Highway corridor include:

- Bridge over the M4 Western Motorway comprising four lanes.
- A 132 kV Endeavour Energy electrical stanchion is located on the western side of the Prospect Highway about 50 metres south of the M4 Western Motorway eastbound exit ramp. The power line corridor runs in an east-west direction across the Prospect Highway.
- Bridge over the Great Western Highway comprising two lanes.
- A 132 kV Endeavour Energy electrical stanchion is located on the western side of the Prospect Highway about 50 metres south of Harrod Street. The power line corridor runs in an east-west direction across the Prospect Highway.
- Pedestrian underpass between Old Church Lane and Keyne Street.
- The Prospect Highway is a controlled access road south of the Blacktown Road intersection with no direct property access, with the exception of one property at 501 Prospect Highway.
- Northbound bus only lane on the approach from and departure to the Lancelot Street intersection and a southbound bus only lane on the southbound approach to the Lancelot Street intersection.
- An informal service along the western side of the Prospect Highway, between about 70 metres south of Vesuvius Street and 60 metres south of St Martins Crescent.

There are a number of accesses located on both sides of the Prospect Highway corridor, which were identified during the detailed site investigations. These accesses include:

- Blacktown Road Children's Centre access on the eastern side, north of Blacktown Road. The access includes a left turn bay into the site access with a length of about 40 metres. The site has about 20 off-street parking spaces.
- Shelley Public School maintenance access on the western side, north of Lancelot Street. A pedestrian access to the school is also located on the western side of the Prospect Highway corridor.
- Medlife Medical Centre access located on the western side, about 70 metres south of Tudor Avenue.
- Army cadet base (Safe Base Bravo) located on the eastern side, south of St Martins Crescent.
- Residential property accesses on western side of the Prospect Highway corridor:
  - Five driveway accesses between Lancelot Street and Shelley Public School.
  - Six driveway accesses between Shelley Public School and Keyworth Drive.
  - 24 driveway accesses between Keyworth Drive and Tudor Avenue, from the informal service road.

  - Three driveway accesses between Tudor Avenue and St Martins Crescent.
- Residential property accesses on the eastern side of the Prospect Highway corridor:
  - 17 driveway accesses between Blacktown Road and Vesuvius Street.
  - Three driveway accesses between Vesuvius Street and Keyworth Drive.
  - Nine driveway accesses between the army cadet base and St Martins Crescent.

Section 2.3.2 Public transport, including networks and services and Section 2.3.3 Walking, cycling, including networks and facilities detail the existing bus stops, pedestrian and cyclist facilities along the proposal corridor.

2.1.4 Speed environment

Figure 2.3 illustrates the posted speed limits on the proposal corridor and key roads connecting to the corridor.

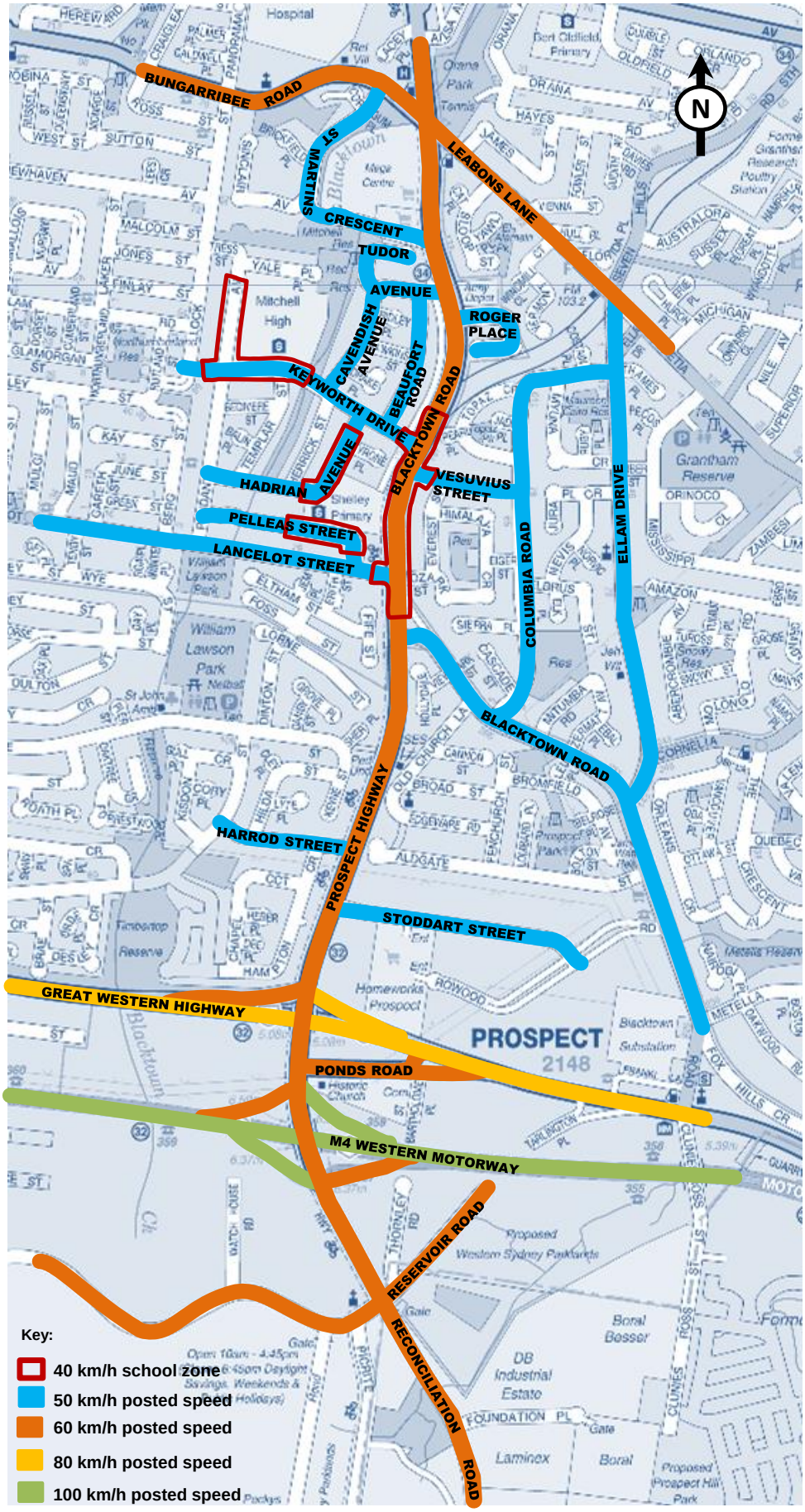


Figure 2.3: Posted speed limits on key roads

Surveys conducted for one week commencing 8 October 2013 recorded the speed at key locations. Table 2.2 summarises the 85th percentile speed from the surveys. Figure 2.4 illustrates the location of the traffic count surveys.

Table 2.2: Existing 85th percentile speed survey, seven day average

Location	Northbound	Southbound
Reconciliation Road, south of Reservoir Road	55 km/h	62 km/h
Prospect Highway, 200 m north of Great Western Highway	66 km/h	65 km/h
Blacktown Road, east of Mitumba Road	66 km/h (eastbound)	64 km/h (westbound)
Columbia Road, north of Sierra Place	63 km/h	62 km/h
Columbia Road, north of Jade Place	61 km/h	58 km/h
Blacktown Road, south of Roger Place	60 km/h	59 km/h
Cavendish Avenue, north of Ridley Place	35 km/h	35 km/h
Ellam Drive, north of Myuna Crescent	53 km/h	52 km/h

The 85th percentile speed survey results indicate that vehicles are generally travelling below the sign posted speed limit at the following locations:

- Northbound on Reconciliation Road, south of Reservoir Road.
- Southbound on Columbia Road, north of Jade Place.
- Blacktown Road, south of Roger Place (both directions).
- Cavendish Avenue, north of Ridley Place (both directions).

The 85th percentile speed survey results indicate that vehicles are generally travelling slightly above the sign posted speed limit at the following locations:

- Southbound on Reconciliation Road, south of Reservoir Road.
- Columbia Road, north of Sierra Place (both directions).
- Northbound on Columbia Road, north of Jade Place.
- Ellam Drive, north of Myuna Crescent (both directions).

These results indicate that traffic is generally travelling within or close to the signposted speed limits within the study area under existing conditions.

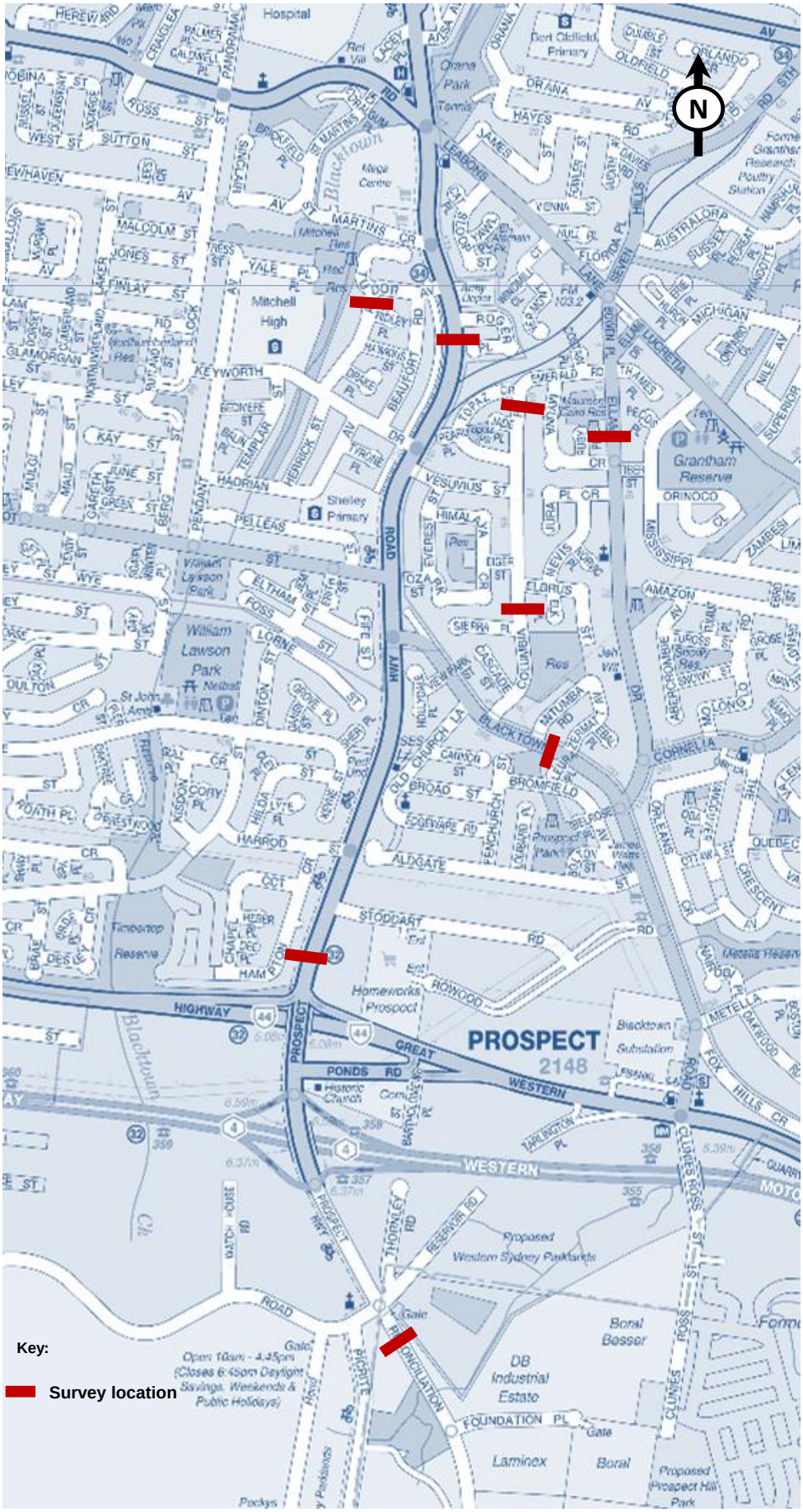


Figure 2.4: Traffic survey locations

2.1.5 Freight and access routes

The Prospect Highway and Blacktown Road are dedicated B-double routes for vehicles up to 26 metres in length. The proposal corridor is also a 4.6-metre high vehicle route. The following B-double routes connect with the proposal corridor:

- Reservoir Road.
- M4 Western Motorway.
- Great Western Highway.
- Stoddart Road.
- Bungarribee Road.

There is a higher mass limit on the bridge over the Great Western Highway (restriction code BN 321).

The *Metropolitan Road Freight Hierarchy on State Road Network Practice Note* (Transport for NSW, June 2011) identifies the Prospect Highway corridor as a secondary freight route. Secondary freight routes have the function of connecting significant clusters of major business and freight origins and destinations within a region. Secondary freight routes carry 1,000 to 5,000 heavy vehicles per day and should comprise four or more lanes.

Figure 2.5 illustrates the B-double and high vehicle routes connecting the proposal corridor.

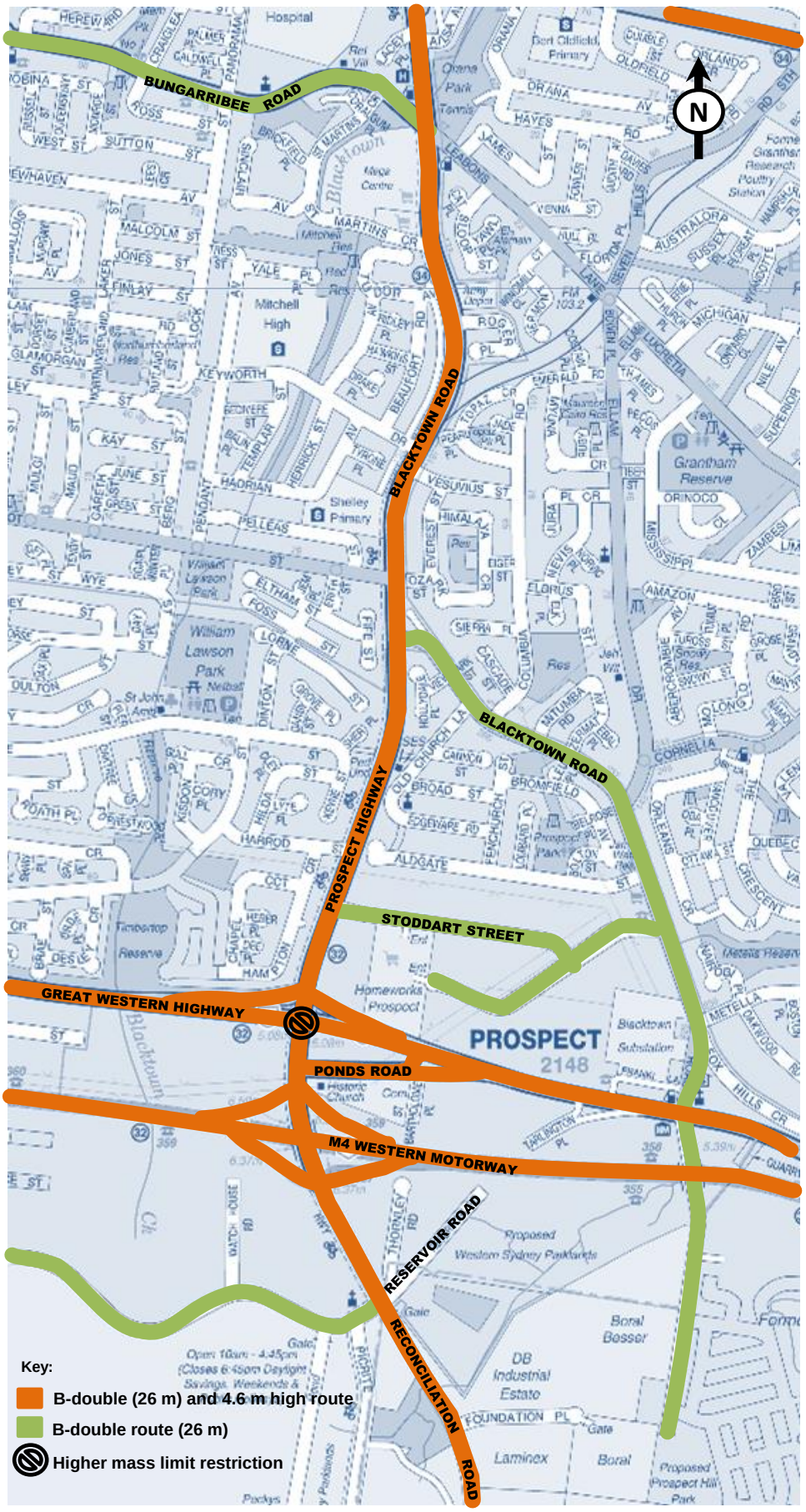


Figure 2.5: B-double and high vehicle routes

2.2 Surrounding land uses

2.2.1 Land uses

The land uses in the proposal area comprise:

- Commercial and distribution land uses along Reconciliation Road.
- Wet 'n' Wild Sydney and an outdoor cinema along Reservoir Road.
- St Mark Coptic Catholic Church on Reservoir Road.
- Transport corridor and rural land uses along the M4 Western Motorway.
- St Bartholomew's church and cemetery located on Ponds Road.
- Transport corridor and rural land uses along the Great Western Highway.
- A mix of low to medium density residential land uses on the western side of the Prospect Highway, north of the Great Western Highway.
- Bulky goods retail and light industrial area in the precinct on the eastern side of the Prospect Highway between the Great Western Highway, the Prospect Highway and Stoddart Road.
- A mix of low to medium density residential land uses on the eastern side of the Prospect Highway between Aldgate Street and north of the proposal area.
- Shelley Public School adjacent to the western side of the Prospect Highway, between Lancelot Street and Keyworth Drive.
- Blacktown Road Children's Centre childcare facility, on the eastern side of the Prospect Highway, between Lancelot Street and Vesuvius Street.
- Medical centre along the Prospect Highway between Tudor Avenue and St Martins Crescent.
- St Martins Village Shopping Centre along the Prospect Highway between St Martins Crescent and Leabons Lane.
- Blacktown Mega Centre retail centre, north of St Martins Crescent, west of the Prospect Highway.

Existing Shelley Public School access

SMEC commissioned surveys of the pick-up and set-down arrangements at Shelley Public School to determine how the students currently access the school. The survey looked at the Prospect Highway emergency access gate via the informal service road and the formal school entry points on Hadrian Avenue and Pelleas Street. Figure 2.6 illustrates the existing accesses to the Shelley Public School surveyed to inform this analysis.

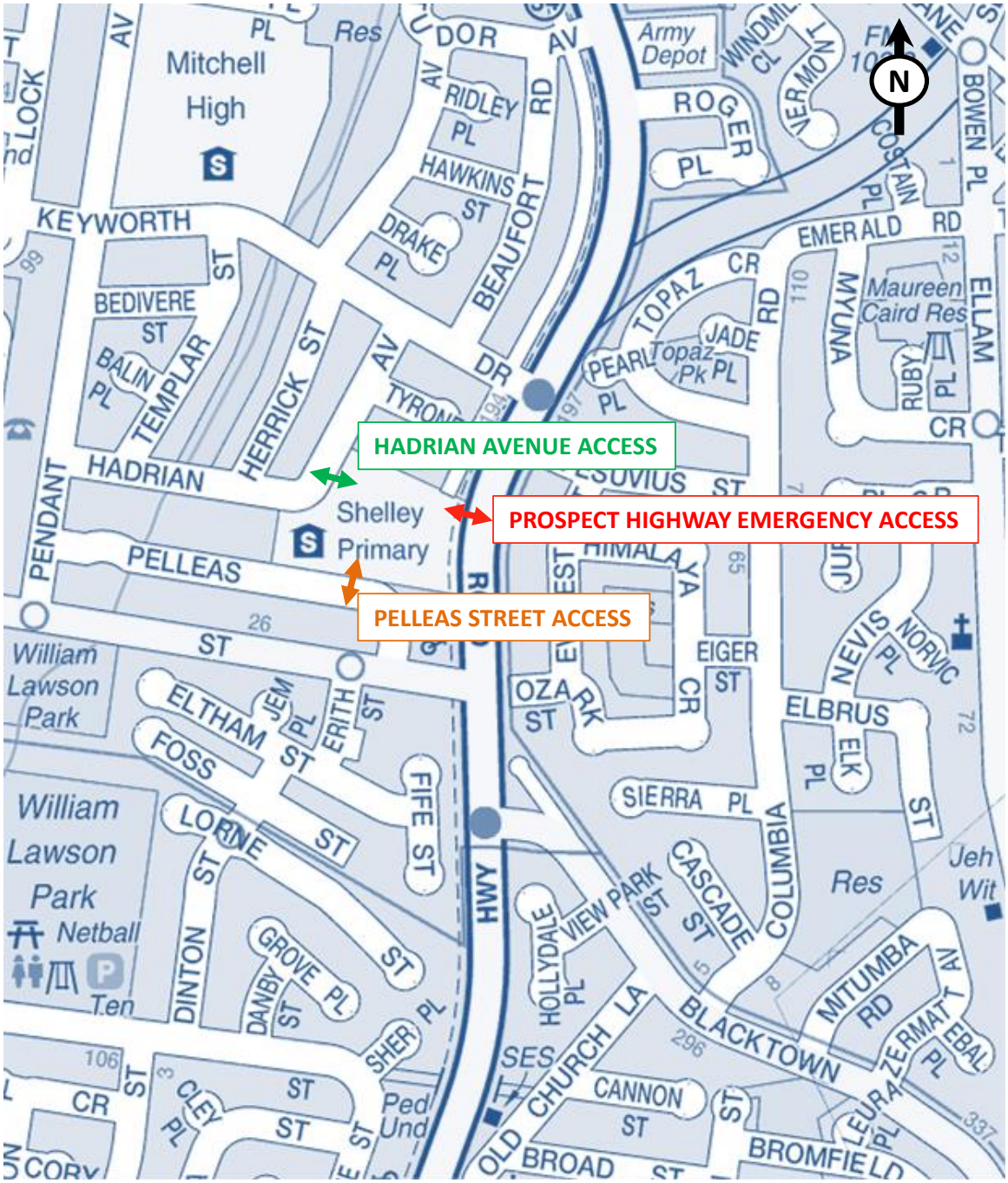


Figure 2.6: Location of existing accesses to Shelley Public School

No parking restrictions are located on the kerbs adjacent to the school access on Hadrian Avenue during school drop-off and pick-up periods. There is a no stopping restriction for a length of about 50 metres on the curve of Pelleas Street on the kerb opposite the school access, between 8:30 and 9:30am and 3 and 4pm on school days. No stopping restrictions are in place on the approaches to the marked pedestrian crossings located on Hadrian Avenue and Pelleas Street. The remainder of Hadrian Avenue and Pelleas Street adjacent to the school accesses have unrestricted parking.

Surveys were conducted at the Prospect Highway and Hadrian Avenue accesses between 21 November and 4 December 2013 from 6am to 8pm. Surveys were conducted at the Pelleas Street access on 28 November 2013 from 6am to 8pm. The surveys observed the following:

- Number of vehicles picking up and setting down students.
- Average length of stay for vehicles parked at the Hadrian Avenue and Prospect Highway accesses.
- Direction of approach for vehicles picking up and setting down students.
- Number of students arriving at school by walking, cycling and vehicle.
- Number of students arriving at the school with and without adult supervision.

Discussion was held on 3 December 2013 with Shelley Public School's administration to determine the events scheduled at the school during the two-week survey period. The following events were identified, which could potentially impact the outcome of the surveys:

- Parent and helper morning tea on 28 November 2013.
- Super Star morning tea on 3 December 2013.
- Carols event night on 4 December 2013 from 5:30pm.

On review of the survey results, the school AM peak drop-off period on 3 December 2013 were substantially impacted by the event on this day. Therefore, the results from this survey day have been excluded from the analysis.

Table 2.3 summarises the average number of students arriving at school by walking, cycling and car. Figures 2.7 and 2.8 illustrate the number of parked vehicles by time of day on Hadrian Avenue and the Prospect Highway informal service road adjacent to the school accesses, respectively.

Table 2.3: Average number students arriving at school by mode

Access location	Walking	Cycling	Car
Prospect Highway	42 (66%)	2 (2%)	20 (31%)
Hadrian Avenue	118 (58%)	0 (0%)	84 (42%)
Pelleas Street	99 (48%)	1 (<1%)	108 (52%)

The analysis of the travel mode of students accessing the school indicates:

- For the Prospect Highway and Hadrian Avenue accesses, the majority of students arrive at school by walking (58 to 66 per cent) with 48 per cent of students accessing the school via Pelleas Street walking to school.
- 31 per cent of students accessing the school via the Prospect Highway travel by car.
- 42 per cent of students accessing the school via Hadrian Avenue travel by car.
- 52 per cent of students accessing the school via Hadrian Avenue travel by car.

- A low proportion of students access the school by bicycle for all three school accesses (zero to two per cent).

Table 2.4 summarises the average length of stay of vehicles parking along Hadrian Avenue and the Prospect Highway corridor adjacent to the school accesses.

Table 2.4: Average length of stay of parked vehicles, school days

Average duration of stay	Hadrian Avenue	Prospect Highway (north of gate)	Prospect Highway (south of gate)
Less than 15 minutes	87 (66%)	21 (64%)	23 (69%)
15 to 30 minutes	23 (17%)	7 (21%)	6 (17%)
30 minutes to one hour	7 (5%)	2 (5%)	1 (4%)
One to two hours	3 (3%)	1 (4%)	1 (4%)
Two to four hours	8 (6%)	2 (5%)	1 (4%)
Four to six hours	3 (2%)	<1 (<1%)	0 (0%)
More than six hours	1 (1%)	<1 (<1%)	<1 (2%)

The analysis of the period of stay for vehicles parked along Hadrian Avenue and the Prospect Highway adjacent to the school accesses during school days indicates:

- The majority of vehicles stay parked for less than 15 minutes (64 to 69 per cent) at both accesses.
- About 17 to 21 per cent of parked vehicles stay for a period of 15 to 30 minutes at both accesses.
- The proportion of vehicles parked for longer than one hour at the Prospect Highway informal service road access is low.
- Vehicles parked adjacent to the Hadrian access comprise a small proportion that stay more than two hours and up to six hours (11 per cent).

The relatively short stay of vehicles adjacent to the Hadrian Avenue and Prospect Highway school accesses is consistent with patterns expected for school pick-up and set-down. The results imply that Hadrian Avenue and the informal service road along the Prospect Highway adjacent to the Shelley School access are unlikely to be used to access parking for local residential properties on school days.

Table 2.5: Average length of stay of parked vehicles, weekends

Average duration of stay	Hadrian Avenue	Prospect Highway (north of gate)	Prospect Highway (south of gate)
Less than 15 minutes	1	3	0
15 to 30 minutes	1	0	0
30 minutes to one hour	1	0	1
One to two hours	2	0	1
Two to four hours	1	1	1
Four to six hours	2	0	0
More than six hours	2	2	1

The results of the survey of vehicles parked on Hadrian Avenue and the Prospect Highway adjacent to the Shelley School access indicate that there is limited use of these corridors for parking outside school days. Therefore, only a small number of vehicles appear to be using the Hadrian Avenue and the Prospect Highway informal service road adjacent to the school accesses for residential property access / parking.

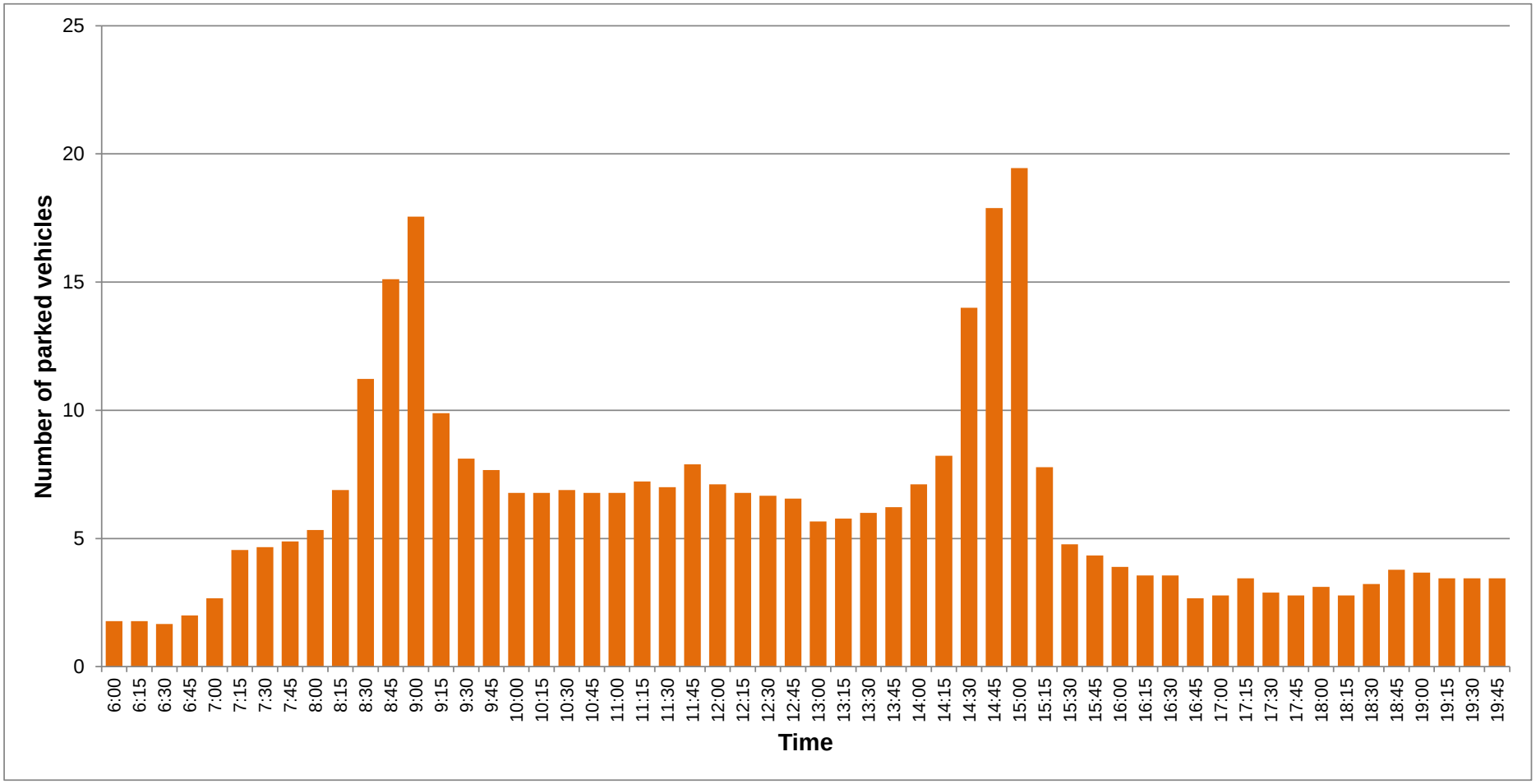


Figure 2.7: Average parking profile, Hadrian Avenue access, 21 November to 4 December 2013, school days

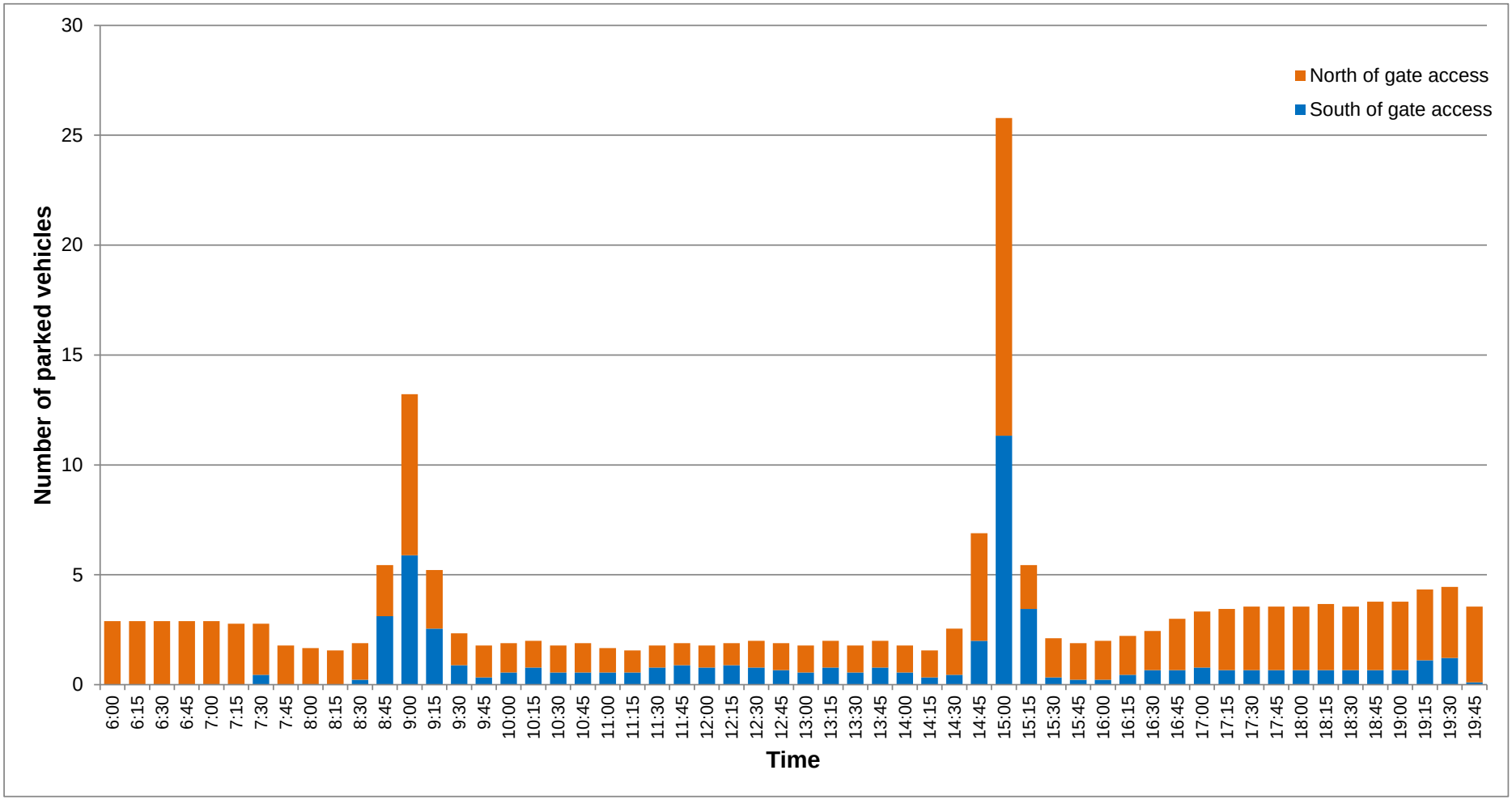


Figure 2.8: Average parking profile, Prospect Highway access, 21 November to 4 December 2013, school days

Analysis of Figures 2.7 and 2.8 indicates:

- Up to 18 vehicles are parked adjacent to the Hadrian Avenue school access during the AM peak school set-down period, peaking at 9am.
- Up to 19 vehicles are parked adjacent to the Hadrian Avenue school access during the PM peak school pick-up period, peaking at 3pm.
- Before and after school, fewer than five vehicles are parked within Hadrian Avenue, adjacent to the school access at any given time.
- During school hours (between peak pick-up and set-down times) six to eight vehicles were observed to park within Hadrian Avenue, adjacent to the school access.
- During the AM peak set-down period, up to 13 vehicles (six vehicles south of the gate and seven vehicles north of the gate) are parked adjacent to the Prospect Highway school access, peaking at 9am.
- Up to 26 vehicles (12 vehicles south of the gate and 14 vehicles north of the gate) are parked adjacent to the Prospect Highway school access, which occurs during the PM peak pick-up, peaking at 3pm.
- On school days, outside school set-down and pick-up periods (8:45 to 9:15am and 2:45 to 3:15pm, respectively), fewer than five vehicles are parked within the Prospect Highway informal service road adjacent to the school access (combined for north and south of the gate) at any given time.

Informal service road parking and existing Medlife Medical Centre access

SMEC commissioned a survey to be conducted along the informal service road and adjacent to the Medlife Medical Centre to determine the number of vehicles currently using the informal service road for residential parking and to access Medlife Medical Centre. The survey was conducted on Thursday 28 November 2013 from 6am to 8pm. Figure 2.9 illustrates the location of the survey cameras along the informal service road.

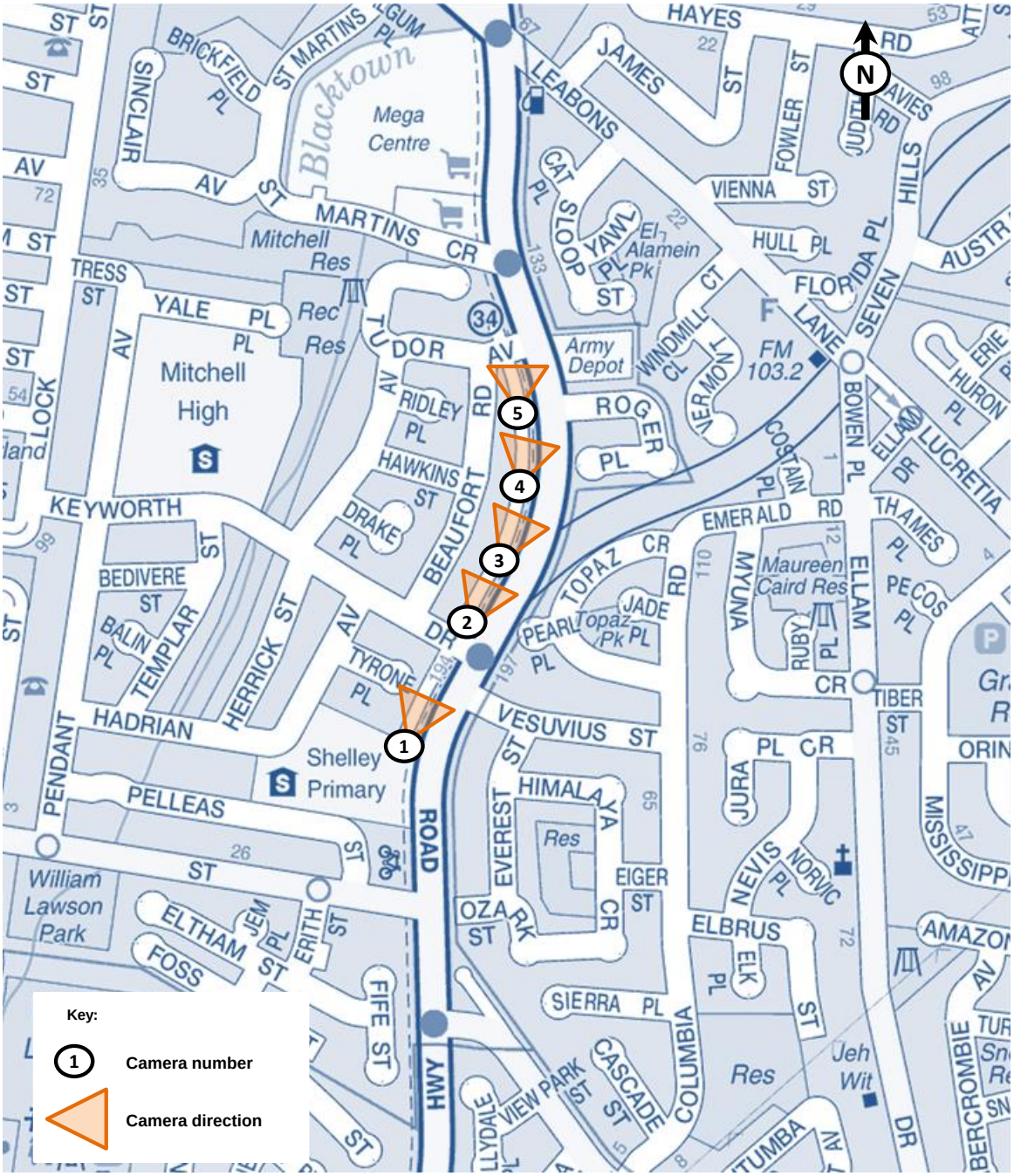


Figure 2.9: Informal service road parking survey camera locations

All vehicles captured by camera five were observed to serve people accessing the Medlife Medical Centre. During the same period of the survey, renovation works were being conducted on the Medlife Medical Centre. However, the survey observations revealed that none of the vehicles parked within the informal service road during the survey period could be attributed to trades people accessing the Medlife Medical Centre.

Camera one is the same as the camera capturing the Shelley Public School access north of the school gate.

Table 2.6 summarises the number of vehicles recorded at each parking location and their length of stay. Figure 2.10 illustrates the total number of vehicles parked within the informal service road by time of day.

Table 2.6: Average length of stay of parked vehicles

Average duration of stay	Camera number				
	1	2	3	4	5
Less than 15 minutes	29	3	0	2	7
15 to 30 minutes	10	1	1	0	3
30 minutes to one hour	1	1	0	1	7
One to two hours	1	0	2	1	6
Two to four hours	0	0	2	0	0
Four to six hours	0	1	0	0	1
More than six hours	0	0	1	0	0

The key findings from the parking survey of the informal service road are:

- The vehicles parked in camera location one were primarily associated with school pick-up and set-down of the Shelley Public School.
- A maximum of eight vehicles at a given time were observed to be parked for access to the Medlife Medical Centre, peaking at 9:30am.
- The predominant length of time vehicles parked within the informal service road to access the Medlife Medical Centre was less than 15 minutes (seven vehicles) and 30 minutes to one hour (seven vehicles). Six vehicles were observed to stay one to two hours to access the Medlife Medical Centre.
- The Medlife Medical Centre is generally accessed by vehicles parked within the informal service road between 7:30am and 6:30pm.
- Excluding the vehicles parked to access the school and the Medlife Medical Centre, a maximum of five vehicles were parked within the informal service road, peaking at around 7:45pm.

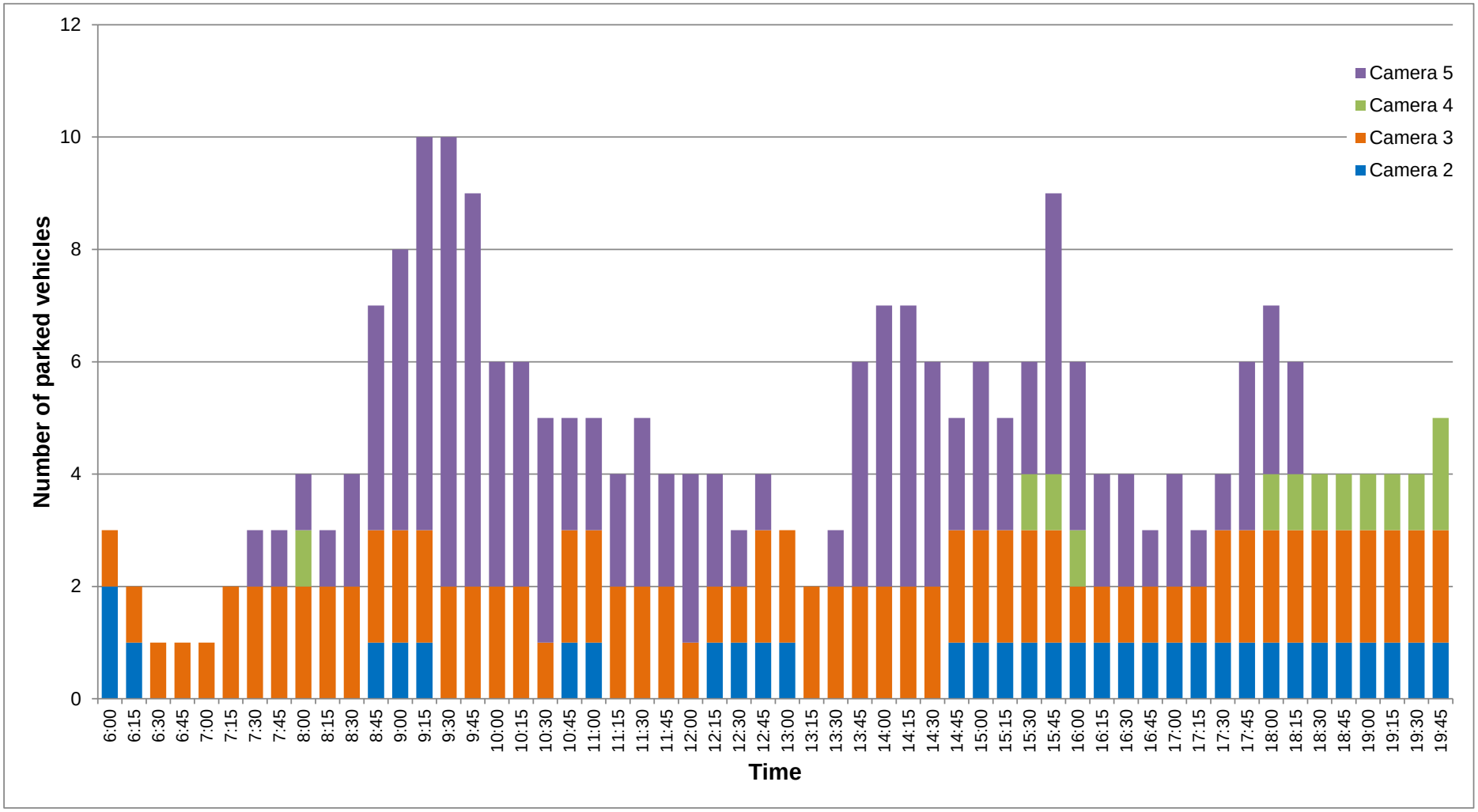


Figure 2.10: Number of vehicles parked within the informal service road by time of day (excluding school pick-up and drop-off vehicles)

2.2.2 Population and employment

Tables 2.7 and 2.8 summarise the expected population and employment growth, respectively for the LGAs surrounding the proposal corridor from 2011 to 2046. The population and employment growth in the region would increase the need for the Prospect Highway corridor upgrade, since it is likely to result in more people driving on the road network.

Table 2.7: Population growth forecast 2011 to 2046

LGA	2011	2016	2026	2036	2046
Blacktown	311,289	346,738	435,858	517,440	586,125
Fairfield	196,962	204,184	223,515	247,659	275,276
Holroyd	106,757	116,395	124,748	133,756	144,484
Penrith	186,590	202,797	223,468	246,040	271,909
Parramatta	171,733	181,880	195,843	211,153	229,440

Source: Bureau of Transport Statistics, Census, 2011.

Table 2.8: Employment growth forecast 2011 to 2046

LGA	2011	2016	2026	2036	2046
Blacktown	103,697	115,900	141,627	164,523	179,599
Fairfield	63,158	69,418	80,868	92,711	102,723
Holroyd	39,471	40,314	41,966	42,868	45,523
Penrith	69,457	75,712	89,600	100,863	110,540
Parramatta	118,542	128,396	145,012	158,997	172,138

Source: Bureau of Transport Statistics, Census, 2011.

2.3 Modes of travel

2.3.1 Private transport

Private vehicles are the dominant mode of transport within Sydney's western suburbs. Table 2.9 summarises the mode share during and average weekday of travel in the LGAs surrounding the proposal corridor and Sydney City. Figure 2.11 illustrates the mode share during and average weekday of travel in the LGAs surrounding the proposal corridor and Sydney City. This data was extracted from the 2011 Journey to Work data.

The mode share data indicates that:

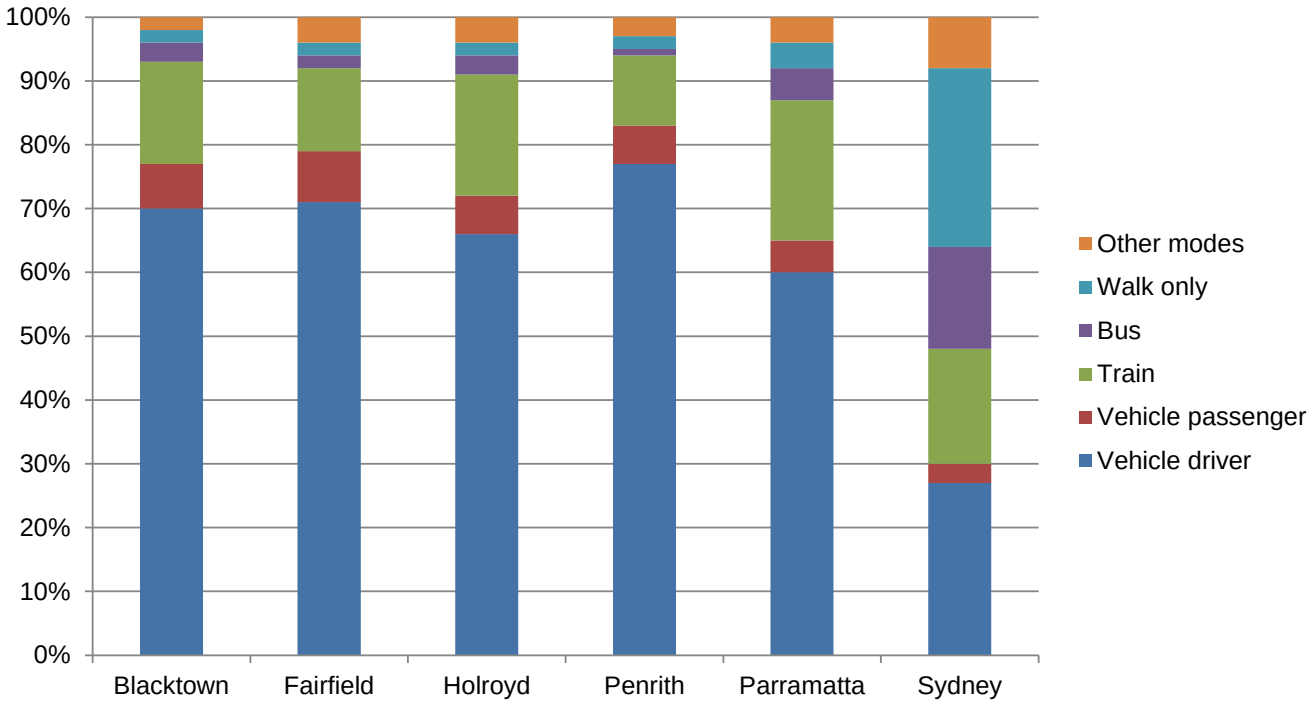
- Over 72 per cent of total trips on an average weekday in the Blacktown, Fairfield, Holroyd and Penrith LGAs is made by private vehicle.

- In Parramatta 65 per cent of total trips on an average weekday are made by private vehicle.
- The private vehicle usage in the LGAs surrounding the proposal corridor is substantially higher than Sydney City, which has a private vehicle mode share of 30 per cent. This is largely a result of less extensive public transport servicing the proposal study area compared with Sydney City's comprehensive public transport network.

Table 2.9: Travel to work mode share 2011

LGA	Vehicle driver	Vehicle passenger	Train	Bus	Walk only	Other modes
Blacktown	70%	7%	16%	3%	2%	2%
Fairfield	71%	8%	13%	2%	2%	4%
Holroyd	66%	6%	19%	3%	2%	4%
Penrith	77%	6%	11%	1%	2%	3%
Parramatta	60%	5%	22%	5%	4%	4%
Sydney	27%	3%	18%	16%	28%	8%

Source: Bureau of Transport Statistics, Census, 2011.



Source: Bureau of Transport Statistics, Census, 2011.

Figure 2.11: Travel to work mode share 2011

2.3.2 *Public transport, including networks and services*

Table 2.9 indicates that public transport accounts for 19 per cent in Blacktown LGA and ranges from 12 (Penrith) to 27 (Parramatta) per cent of the mode share in the LGAs surrounding the proposal corridor.

There are a number of bus routes servicing the Prospect Highway corridor. Table 2.10 summarises the bus services and frequencies along the proposal corridor. Figure 2.12 illustrates the bus routes.

Table 2.10: Existing bus services and frequencies

Route	Description	Frequency (minutes)			
		Peak hours	Off-peak	Saturday	Sunday
700	Blacktown to Parramatta, via Prospect	15-30	60	60	60
800	Fairfield to Blacktown, via Prospect	15	15-30	30	30
812	Blacktown to Fairfield, via Prospect	30	60	No services	No services

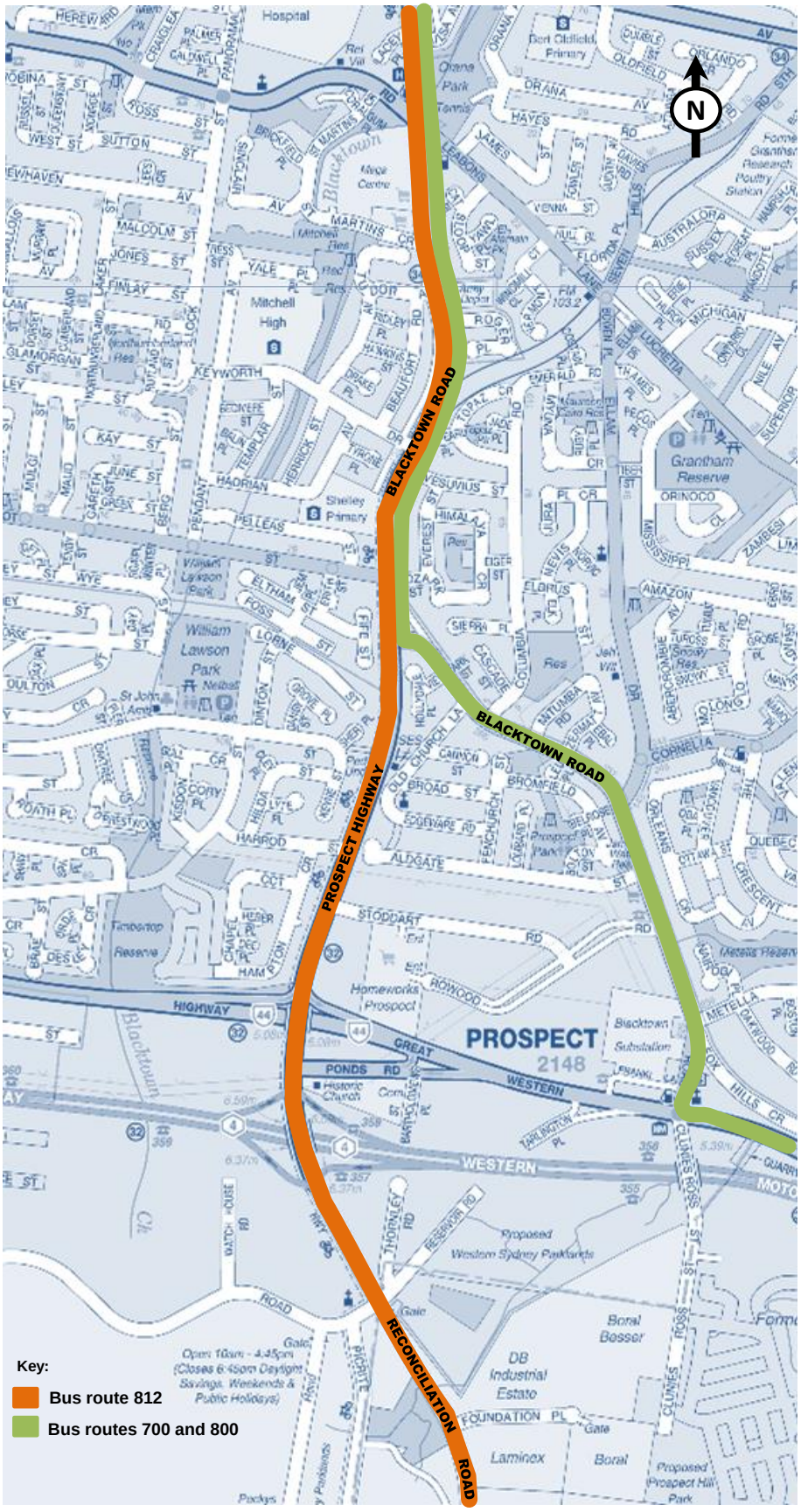
Source: Hills Bus, effective 17 June 2013 and Transport for NSW, effective 20 October 2013.

The existing bus stops along the proposal corridor are located adjacent to:

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

The following bus stops have bus shelters:

- Keyworth Drive (in both directions).
- Northbound bus stop, adjacent to Lancelot Street.
- Tudor Avenue (both directions).
- Northbound bus stop at Blacktown Mega Centre.



Source: Transport for NSW, 20 October 2013

Figure 2.12: Existing bus routes

2.3.3 *Walking, cycling, including networks and facilities*

A detailed site investigation was conducted and the following pedestrian and cyclist paths were identified:

- A three metre shared user path is located on the western side of the Prospect Highway corridor between north of St Martins Crescent and Reconciliation Road (refer to Photos A1 and A2 in Appendix A). South of St Martins Crescent there is localised narrowing of the shared user path to accommodate power poles and signal posts (refer to Photo A3 in Appendix A).
- A temporary shared path on the western side of the Prospect Highway between Harrod Street and Reservoir Road.
- 1.2 metre wide concrete footpath on both sides of Stoddart Road.
- 1.2 metre concrete footpath eastern side of the Prospect Highway between Stoddart Road and Harrod Street, with a fence and safety barrier located adjacent to the path (refer to Photo A4 in Appendix A).
- Pedestrian underpass (which also functions as an overflow culvert) located between Old Church Lane and Keyne Street, linking the residential areas on both sides of the Prospect Highway corridor, via the shared path network through the reserve on the western side of the Prospect Highway. The pedestrian underpass is poorly lit, has poor passive surveillance and has a substantial amount of graffiti (refer to photo A5 in Appendix A).
- 1.2 metre concrete path on the eastern side of the Prospect Highway corridor north of Blacktown Road to north of Keyworth Drive. The path links into a concrete footpath into Pearl Place. The path has a winding alignment adjacent to Blacktown Road Children's Centre to avoid trees and power poles (refer to photo A6 in Appendix A).
- 1.2 metre wide concrete footpath from the Prospect Highway corridor along both sides of Vesuvius Street.
- The existing shared user path on the western side of the Prospect Highway corridor aligns poorly with the signalised crossing at the intersection of Keyworth Drive (refer to photo A7 in Appendix A).
- 1.2 metre wide concrete footpath from the Prospect Highway corridor to Pearl Place.
- 1.2 metre wide concrete footpath from the Prospect Highway corridor to Tudor Avenue cul-de-sac. The path is in poor condition with a steep gradient on approach to Tudor Avenue cul-de-sac (refer to photo A8 in Appendix A). The 1.2 metre footpath continues along Tudor Avenue on both sides.
- 1.2 metre wide concrete path on both sides of Roger Place. A concrete footpath links the Prospect Highway corridor to the cul-de-sac of Roger Place.
- 1.2 metre wide concrete path on the western side of the Prospect Highway corridor between the Roger Place cul-de-sac to the proposal extent adjacent to Cat Place. A

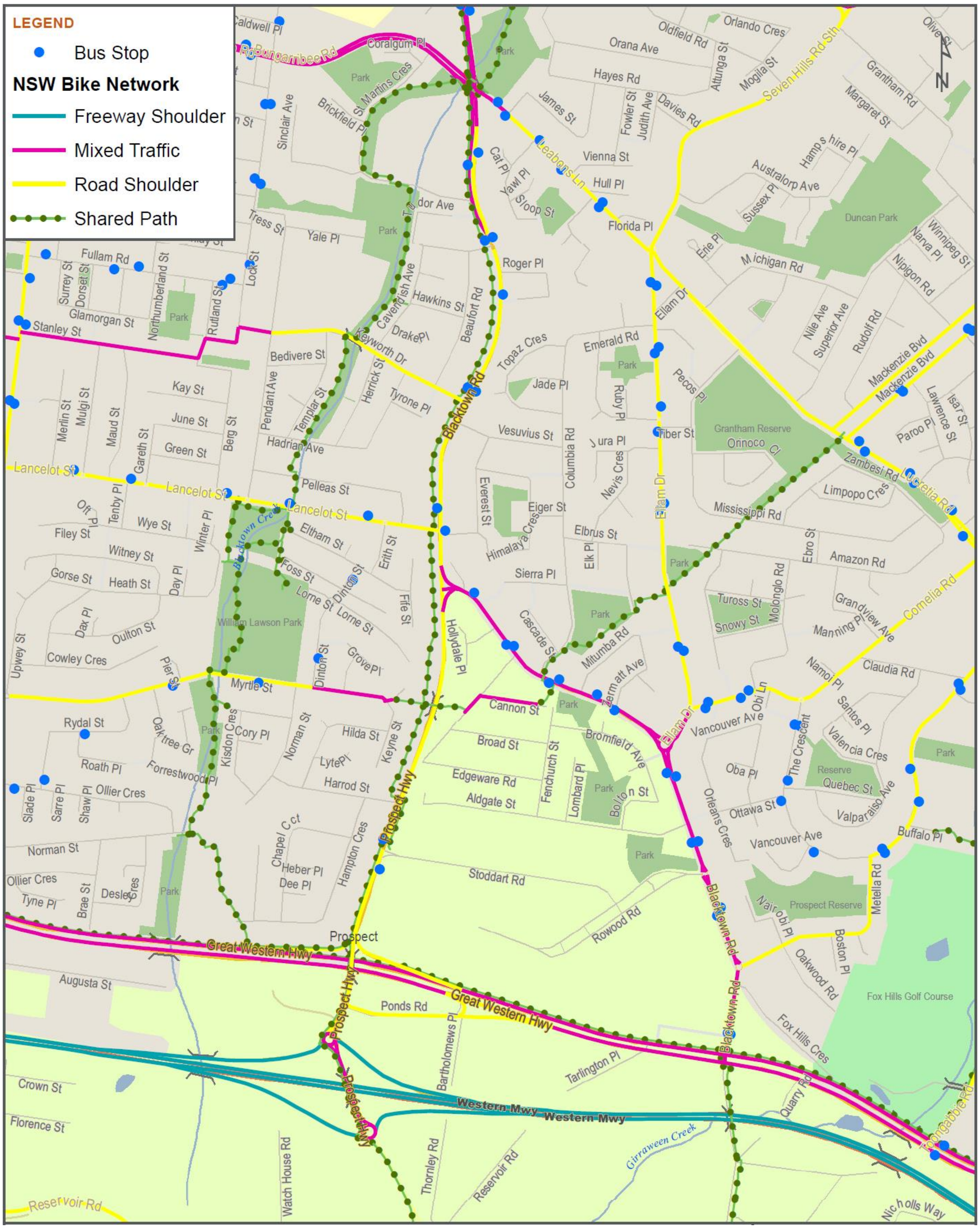
1.2 metre wide concrete footpath links the Prospect Highway corridor with Cat Place cul-de-sac.

- Three metre wide shared path along the western side of the Prospect Highway corridor between St Martins Crescent and the traffic diverge into the Blacktown Mega Centre.

The following pedestrian crossing facilities are provided along the Prospect Highway corridor:

- Signalised pedestrian and cyclist crossings of the left turn slip lane from the Prospect Highway (southbound) into the M4 Western Motorway entry ramp and the M4 Western Motorway entry ramp.
- Pedestrian activated signalised crossing of the M4 Western Motorway eastbound exit ramp.
- Pedestrian activated signalised crossing of the Great Western Highway eastbound exit ramp.
- Signalised pedestrian and cyclist crossings of Harrod Street and the northern approach and departure of the Prospect Highway.
- Marked zebra crossings of the left turn slip lanes from Blacktown Road into the Prospect Highway southbound and southbound from the Prospect Highway corridor into Blacktown Road eastbound. Signalised crossing of Blacktown Road eastern approach and departure.
- Signalised pedestrian and cyclist crossings of Lancelot Street and both approaches of the Prospect Highway corridor.
- Signalised pedestrian crossings of Keyworth Drive and both approaches of the Prospect Highway corridor.
- Signalised pedestrian and cyclist crossings of St Martins Crescent and the northern approach of the Prospect Highway corridor.

Figure 2.13 illustrates the existing bicycle network and bus stop locations within the proposal area.



Source: NSW Bike Network, Roads and Maritime, 2012

Figure 2.13: Existing cyclist network

Pedestrian underpass

Surveys were undertaken to understand how the pedestrian underpass of the Prospect Highway located between Old Church Lane and Keyne Street is currently used. Surveys were conducted for a one week period from 21 November to 27 November 2013 inclusive, between 6am and 8pm. The weather during the survey period was fine. A summary of the survey results is provided in Table 2.11.

Table 2.11: Summary of pedestrian underpass survey, November 2013

	Total number of pedestrians	Adults	Children	Cyclists
Average weekday	61	42	11	7
Average weekend	26	16	2	8
Weekly average	51	34	9	8

The pedestrian survey of the underpass reveals:

- An average of 61 and 26 pedestrians use the underpass on weekdays and weekend days, respectively.
- The primary group using the underpass are adults (between 62 per cent on a weekend and 69 per cent on a weekday).
- The second most dominant user group during weekdays is school children (weekday average of 18 per cent).
- The second most dominant user group on weekends is cyclists (weekend average of 31 per cent).

Two incidents were observed during the survey period, including:

- An altercation at the entrance of the pedestrian underpass on the first survey day.
- Graffiti was painted on the wall of the underpass in the morning of the Saturday survey.

These incidents were reported to Blacktown Police by Roads and Maritime. Due to the reduced resolution of the cameras used for privacy reasons, the people involved in the incidents are unable to be identified.

2.4 Traffic volumes and patterns

2.4.1 Roads and Maritime SCATS data

Roads and Maritime SCATS data details the volumes passing over detectors at signalised intersections. This data was provided for the purpose of this Traffic and Transport Assessment report for the days between 8 and 14 October 2013. Data was provided for the following eight locations:

- Prospect Highway/ M4 Western Motorway Westbound Ramp, site number 4523.
- Prospect Highway/ Harrod Street, site number 3327.
- Prospect Highway/ Blacktown Road, site number 3022.
- Blacktown Road/ Lancelot Street, site number 4131.

- Blacktown Road/ Keyworth Drive, site number 2439.
- Blacktown Road/ St Martins Crescent, site number 2375.
- Blacktown Road/ Leabons Lane/ Bungarribee Road, site number 2566.
- Leabons Lane/ Seven Hills Road South/ Bowen Place, site number 4167.

The data provided is in the form of total vehicles per detector per 15 minutes for the entire week. No vehicle classification information is available through the detector technology.

The SCATS data was used to calibrate the base year model, using two one-hour peak volumes for each turning movement. To calculate the 'observed' hourly turning movement, the sum of the four 15-minute volumes was taken for the signal detector that corresponds with the required turning movement. Where there is a shared lane and the turn designation cannot be explicitly measured from the detector data, the combined turning movements were used for calibration purposes.

2.4.2 Mid-block traffic counts

To support the data collected at the various traffic signals in the study area, a number of classification surveys were carried out. These surveys were conducted between 8 and 14 October 2013 at the following locations:

- Reconciliation Road, south of Reservoir Road.
- Prospect Highway, 200 metres north of the Great Western Highway.
- Blacktown Road, east of Mitumba Road.
- Columbia Road, north of Sierra Place.
- Columbia Road, north of Jade Place.
- Cavendish Avenue, north of Ridley Place.
- Ellam Drive, north of Myuna Crescent.
- Blacktown Road, south of Roger Place.

The classification surveys recorded the traffic volume in both directions in 15-minute intervals and included vehicle classification breakdown into the following categories:

- Motorcycle.
- Cars.
- Light goods vehicle.
- Buses and public service vehicles.
- Trucks.

The classification surveys have been used to understand the daily traffic profile, the weekly traffic profile, the heavy vehicle profile and the peak hour traffic for model calibration purposes.

2.4.3 Weekly traffic profile

Figures 2.14 and 2.15 illustrate the existing weekly traffic profile extracted from the traffic surveys conducted between 8 and 14 October 2013 for the following two survey locations:

- Prospect Highway, 200 metres north of the Great Western Highway.
- Blacktown Road, south of Roger Place.

The peak periods for each survey day are indicated in red on Figures 2.13 and 2.14.

The weekly profiles indicate that:

- There are defined morning and afternoon peaks during the weekdays.
- During the weekends, traffic volumes are generally lower with slight peaks evident around the middle of the day.
- Traffic volumes are higher on the Prospect Highway 200 metres north of the Great Western Highway and exhibit more defined peaks compared with Blacktown Road, south of Roger Place.

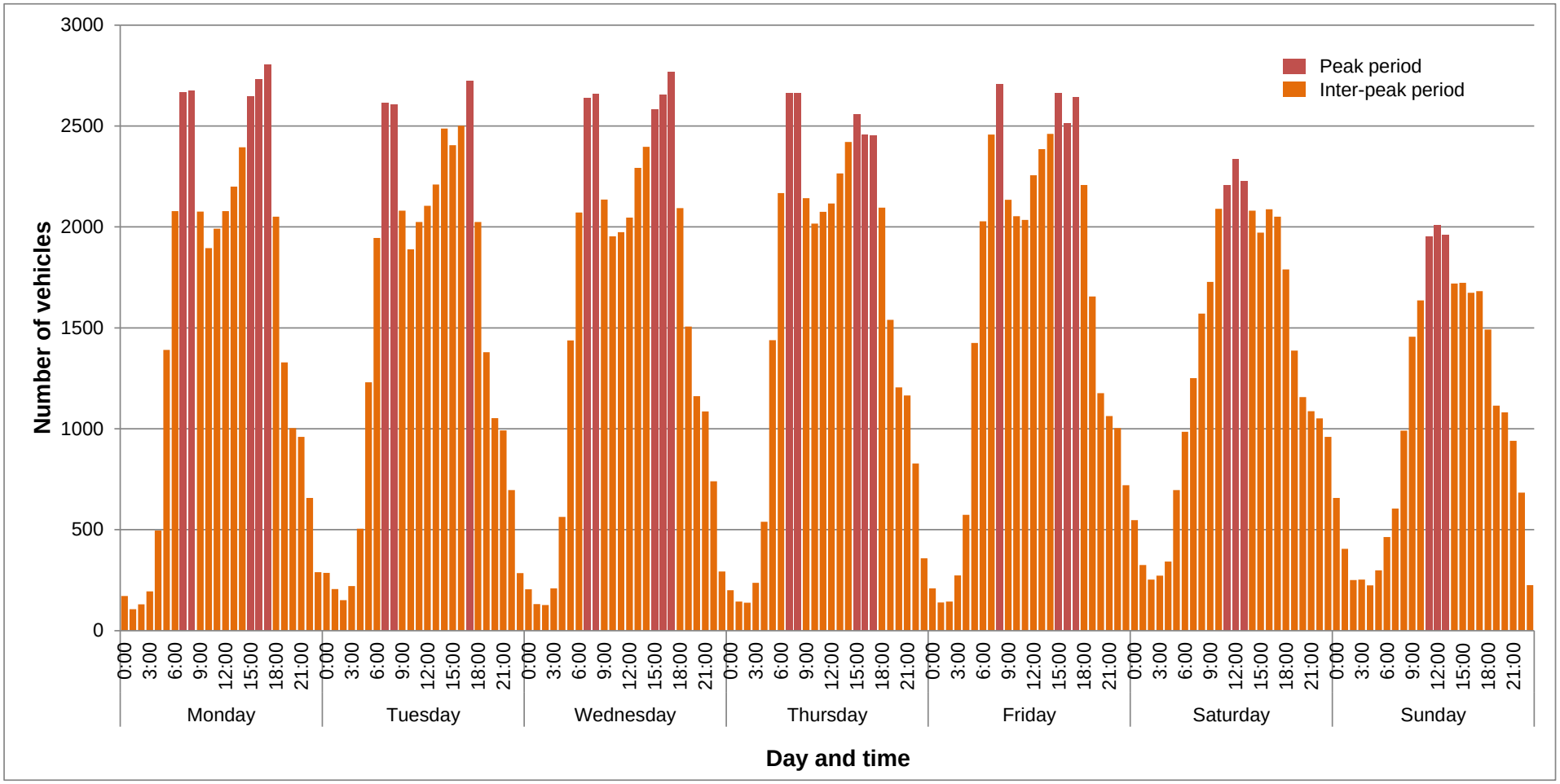


Figure 2.14: Weekly traffic volume profile, Prospect Highway, 200 metres north of Great Western Highway

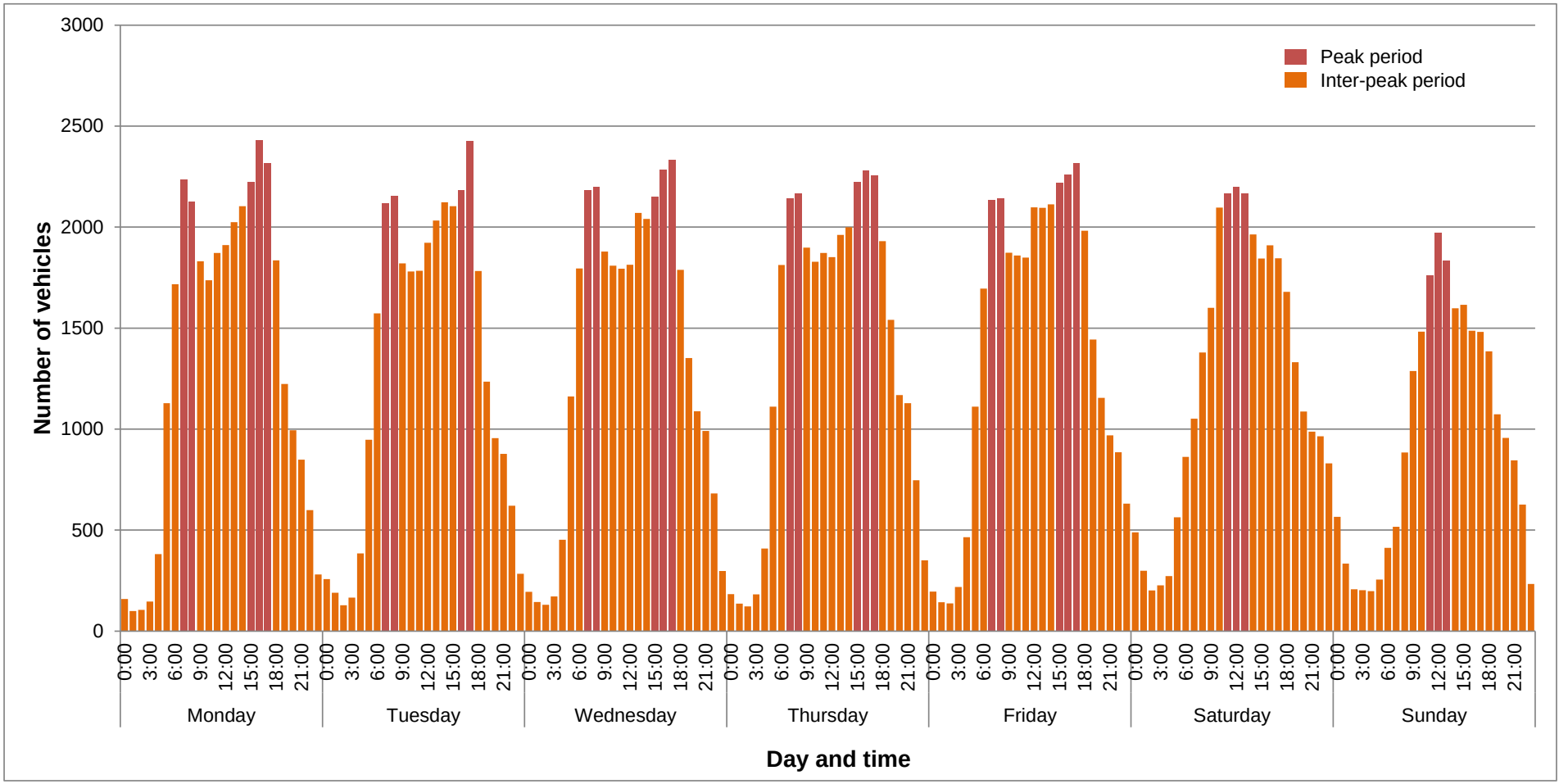


Figure 2.15: Weekly traffic volume profile, Blacktown Road, South of Roger Place

2.4.4 *Daily traffic profile*

Figures 2.16 and 2.17 illustrate the daily profile for the two survey locations on the proposal corridor. The daily profiles for both survey locations indicate:

- The AM peak period occurs between 7am and 9am on weekdays.
- The PM peak period occurs between 3pm and 6pm on weekdays.
- The AM peak is more defined that the PM peak period, which tends to be spread over a longer period.

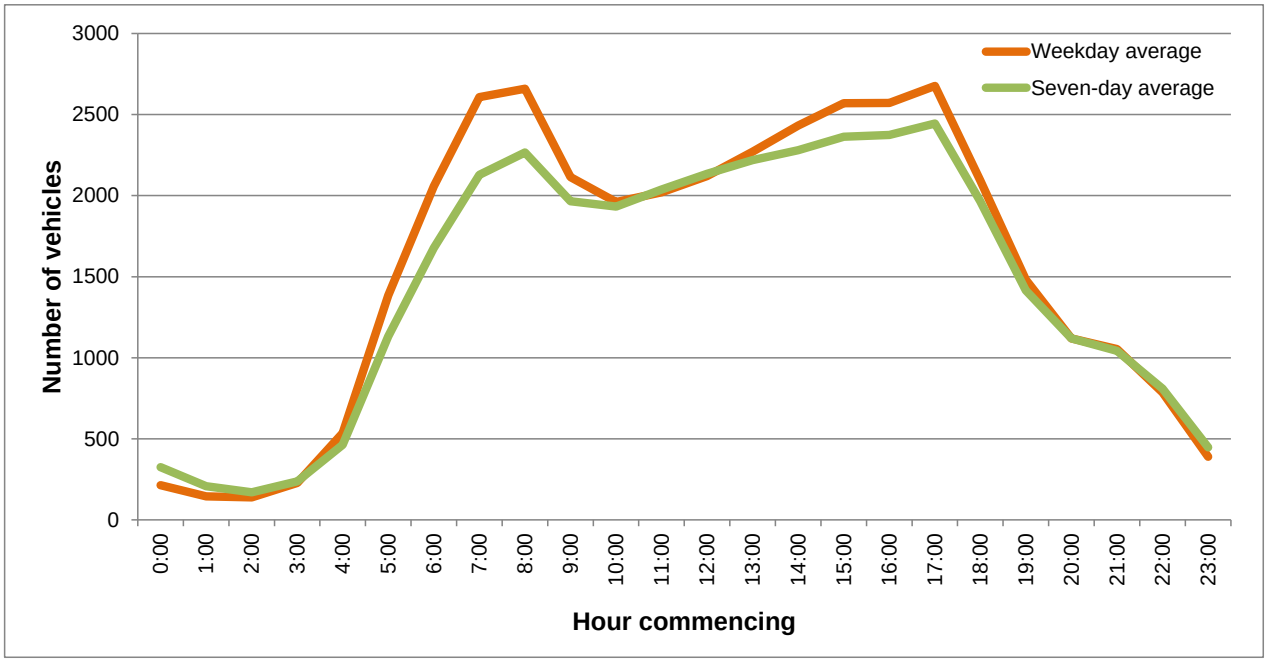


Figure 2.16: Daily traffic profile, Prospect Highway, 200 metres north of Great Western Highway

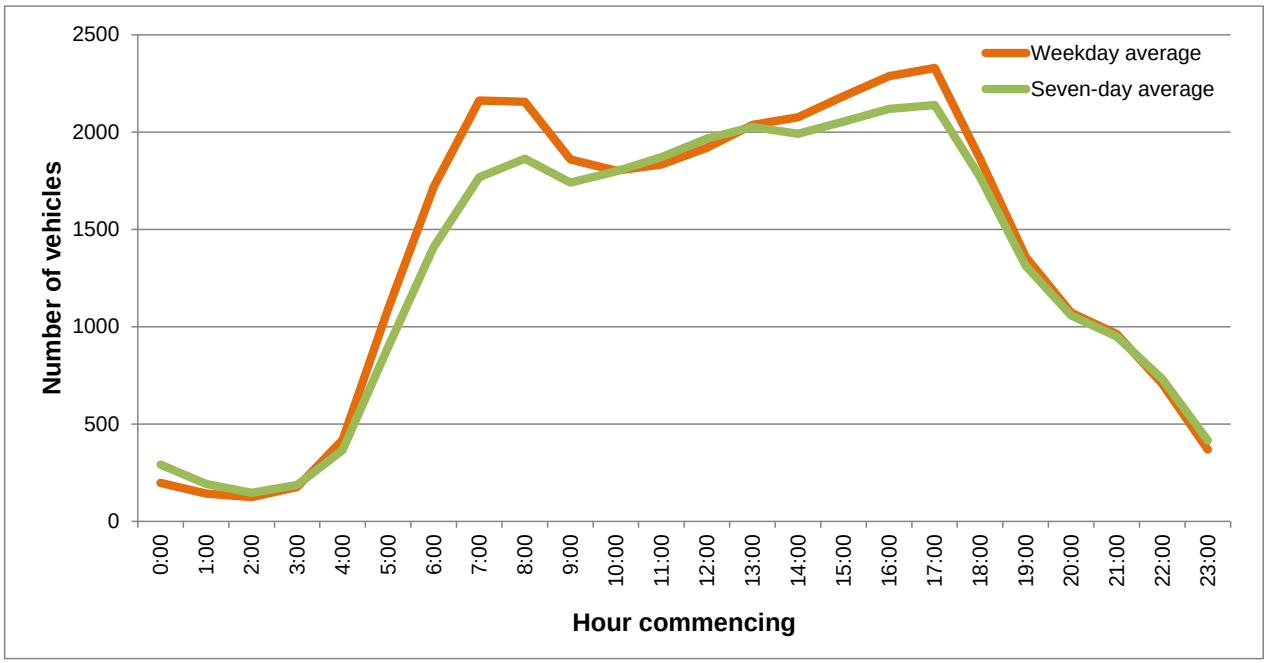


Figure 2.17: Daily traffic profile, Blacktown Road, south of Roger Place

2.4.5 Freight transport

The Prospect Highway corridor links a number of industrial areas within the region. Figure 2.18 illustrates the industrial areas relative to the proposal location.

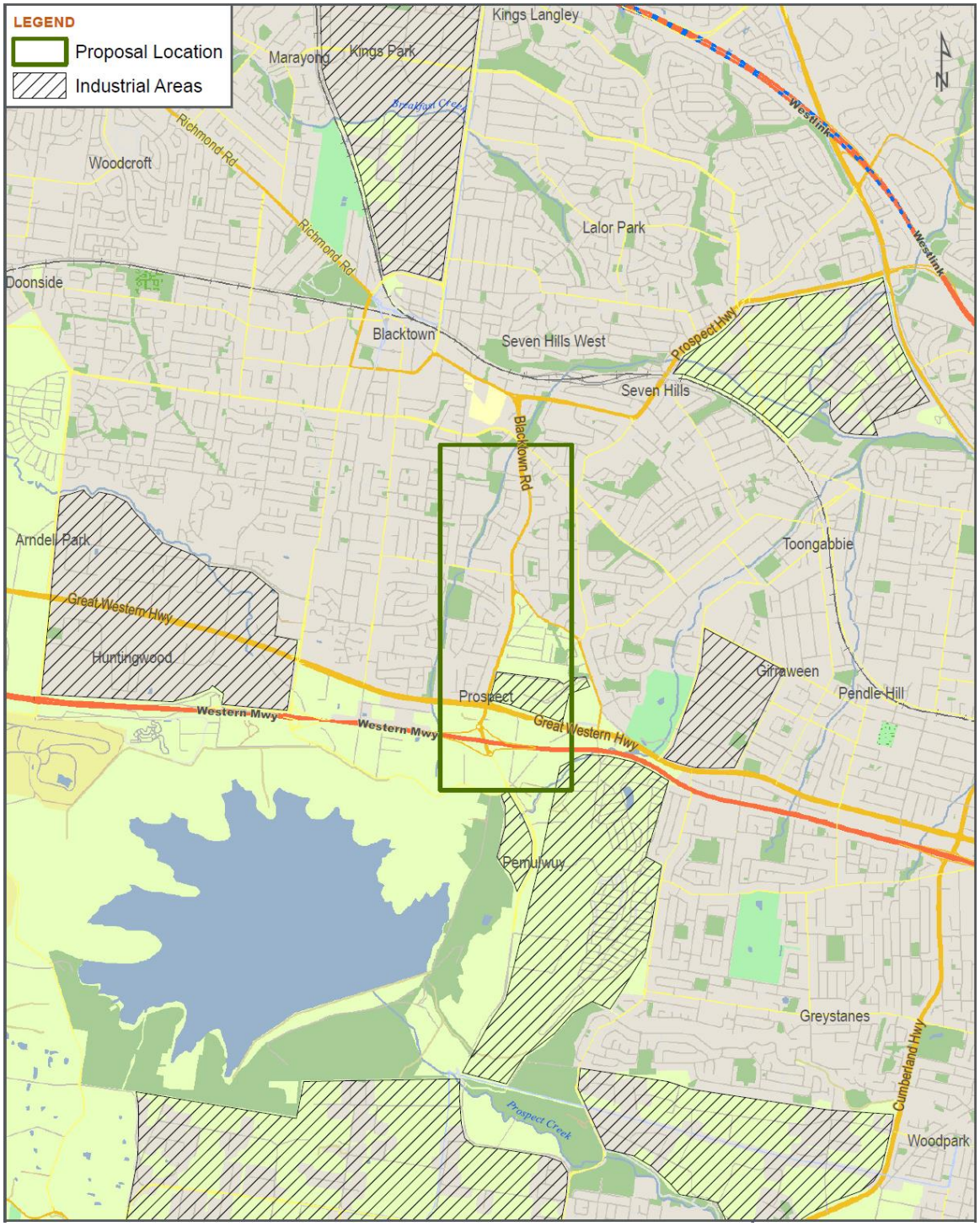


Figure 2.18: Location of industrial areas surrounding the proposal location

The mid-block traffic surveys have been used to assess the proportion of heavy vehicles on the Prospect Highway corridor. Surveys at three locations on the corridor have been analysed and presented in Table 2.12. This shows that there are a large number of heavy vehicles to the south of the corridor, where the industrial precinct is located, at 18 per cent over an average weekday, while to the north of Great Western Highway there

are fewer heavy vehicles in line with a typical urban highway with 11 to 12 per cent heavy vehicles.

The hourly heavy vehicle rate peaks at 47 per cent in the southern section at 10am and is at its lowest at 9pm on the middle section at four per cent.

Table 2.12: Heavy vehicle summary

Location	Average daily traffic	Average weekday traffic				
		Daily	AM peak	PM peak	Maximum (hour)	Minimum
Reconciliation Road	17%	18%	25%	14%	47% (10am)	10% (10pm)
Prospect Highway	10%	12%	10%	6%	20% (2am)	4% (9pm)
Blacktown Road	9%	11%	10%	6%	17% (11am)	4% (10pm)

2.5 Operational assessment

2.5.1 Mid-block capacity

The volume / capacity ratio is a measure that reflects the mobility and quality of travel of a section of road. It compares the demand with the road capacity. For example, a volume / capacity ratio of 1.0 indicates that a road corridor is operating at its capacity. Table 2.13 summarises the flow conditions for volume / capacity ratio ranges.

Table 2.13: Volume / capacity ratio operational condition descriptions

Volume / capacity	Flow description
0.0 to 0.6	Free flow conditions with unimpeded manoeuvrability.
0.61 to 0.7	Reasonably unimpeded flow conditions with slightly restricted manoeuvrability.
0.71 to 0.8	Stable flow conditions with somewhat more restrictions in making mid-block lane changes.
0.81 to 0.9	Approaching unstable flow conditions where small increases in volume produce substantial increases in delay and decreases in speed.
0.91 to 1.0	Flow conditions with substantial intersection approach delays and low average speed.
Greater than 1.0	Flow conditions with extremely low speeds, caused by intersection congestion, high delay and adverse signal progression.

Table 2.14 outlines the volume and volume / capacity ratio on the Prospect Highway corridor at two key locations under the existing conditions. It shows that the volumes are at capacity in both peaks at both locations in both directions. The exception is northbound on Blacktown Road in the PM peak (0.9) and southbound on Blacktown Road in the AM peak (0.8).

Table 2.14: Existing volume / capacity ratio assessment

Location	Direction	AM		PM	
		Volume (veh)	Volume capacity ratio	Volume (veh)	Volume capacity ratio
Prospect Highway, north of Great Western Highway	Northbound	1,401	1.0	1,349	1.0
Prospect Highway, north of Great Western Highway	Southbound	1,260	1.0	1,329	1.0
Blacktown Road, south of Roger Place	Northbound	1,195	1.0	1,127	0.9
Blacktown Road, south of Roger Place	Southbound	962	0.8	1,203	1.0

2.5.2 Intersection performance

Table 2.15 summarises the level of service criteria adopted for this assessment. It is based on the Roads and Maritime delay method.

Table 2.15: Intersection level of service criteria (Roads and Maritime method of delay)

Level of service	Average delay per vehicle (seconds)	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	At capacity and requires alternative control method

Level of service	Average delay per vehicle (seconds)	Traffic signals, roundabout	Give-way and stop signs
		control method to roundabouts.	
F	70.5<	At capacity and small increases in traffic volumes are likely to cause dis-proportionately greater increases in delay.	At capacity and small increases in traffic volumes are likely to cause dis-proportionately greater increases in delay

The calibrated base year AIMSUN models (AM and PM peak) have been used to assess the intersection performance at each intersection under existing conditions along the project corridor and the intersection of Leabons Lane / Ellam Drive.

The volume and delay for each turning movement has been recorded in the AIMSUN model and analysed to calculate the average delay for each movement through the intersections. The level of service has been calculated based on the Roads and Maritime method of delay. Tables 2.16 and 2.17 provide a summary of each intersection's overall performance during the AM and PM peak hours, respectively. For signalised intersections the delay is a measure of the average delay across all of the movements, and the level of service is based on the average delay. For unsignalised intersections including roundabouts, the delay and level of service represent the delay and level of service for the worst movement through the intersection. The worst movement at the roundabout and unsignalised intersections is indicated in brackets.

The results show that all of the intersections operate at an acceptable level of service of D or better, except for:

- The Great Western Highway exit ramp merge with Prospect Highway in the AM peak, which operates at level of service E with a delay of 63 seconds for the vehicles approaching from the Great Western Highway eastbound exit ramp.
- The intersection of Blacktown Road / Vesuvius Street, where the vehicles exiting Vesuvius Street wait longer than 200 seconds in both peaks at level of service F. There are only a small number of vehicles currently exiting Vesuvius Street and waiting for this period of time. Other vehicles leaving Vesuvius Street are likely to be using alternative routes.

Queues in the models are not able to be readily and accurately recorded, which is typical of most micro-simulation models. Instead, queues throughout the model are observed during the running of the model and reported qualitatively.

Observation of the operation of the AM peak model showed that for a majority of turning movements the queues are adequately contained within the turning lanes provided, or clear within a single traffic signal cycle, with the exception of:

- Vehicles on the Great Western Highway westbound exit ramp attempting to merge left onto the Prospect Highway at around 75 metres.

- Vehicles on Vesuvius Street turning right or left onto Blacktown Road at around 130 metres.

Observation of the operation of the PM peak model showed that for a majority of turning movements the queues are adequately contained within the turning lanes provided, or clear within a single traffic signal cycle, with the exception of:

- Vehicles on Vesuvius Street turning right or left onto Blacktown Road, at around 100 metres.

Table 2.16: Existing intersection operation, 2013 AM peak hour

Intersection	Total vehicles	Average delay (seconds)	Level of service
Prospect Highway / Reservoir Road	870	5	A (north through)
Prospect Highway / M4 Western Motorway westbound ramps	1,740	19	B (nortn right)
Prospect Highway / M4 Western Motorway eastbound ramps	2,750	8	A (north through)
Prospect Highway / Ponds Road	2,680	35	C (east left)
Prospect Highway / Great Western Highway eastbound exit ramp	1,470	63	E (west left)
Prospect Highway / Stoddart Street	2,810	29	C (south right)
Prospect Highway / Harrod Street	2,600	16	B
Prospect Highway / Blacktown Road	2,850	16	B
Blacktown Road / Lancelot Street	2,560	14	A
Blacktown Road / Vesuvius Street	2,380	>200	F (east left)
Blacktown Road / Keyworth Drive	2,360	7	A
Blacktown Road / Roger Place	2,200	42	C (east right)
Blacktown Road / Tudor Avenue	2,310	39	C (west right)
Blacktown Road / St Martins Crescent	2,550	20	B

Intersection	Total vehicles	Average delay (seconds)	Level of service
Blacktown Road / Bungarribee Road	3,470	32	C
Leabons Lane / Ellam Drive	1,590	21	B

Table 2.17: Existing intersection operation, 2013 PM peak hour

Intersection	Total vehicles	Average delay (seconds)	Level of service
Prospect Highway / Reservoir Road	530	2	A (south through)
Prospect Highway / M4 Western Motorway westbound ramps	1,870	25	B (east right)
Prospect Highway / M4 Western Motorway eastbound ramps	2,340	8	A (west through)
Prospect Highway / Ponds Road	2,420	41	C (east right)
Prospect Highway / Great Western Highway eastbound exit ramp	1,150	15	B (west left)
Prospect Highway / Stoddart Street	2,330	2	A (south through)
Prospect Highway / Harrod Street	2,360	9	A
Prospect Highway / Blacktown Road	2,720	14	A
Blacktown Road / Lancelot Street	2,580	10	A
Blacktown Road / Vesuvius Street	2,530	>200	F (east right)
Blacktown Road / Keyworth Drive	2,540	7	A
Blacktown Road / Roger Place	2,500	22	B (east left)
Blacktown Road / Tudor Avenue	2,440	48	D (west right)
Blacktown Road / St Martins Crescent	2,740	21	B

Intersection	Total vehicles	Average delay (seconds)	Level of service
Blacktown Road / Bungarribee Road	3,800	32	C
Leabons Lane / Ellam Drive	2,320	34	C

2.5.3 Travel time analysis

On Thursday 10 October 2013, travel time surveys were conducted along the Prospect Highway corridor. The surveys were conducted for three hours in the morning peak between 6am and 9am and for four hours during the PM peak between 3pm and 7pm. A total of 24 survey runs were conducted in each direction across the two peak periods. For the purpose of the modelling exercise the results that were recorded during the one-hour peak in each period were used.

The travel time survey runs started at the intersection of the Prospect Highway and Reservoir Road and finished at the intersection of Blacktown Road and Bungarribee Road / Leabons Lane. Six intermediate timing points were used and recorded.

The results of the survey are summarised in Table 2.18.

Table 2.18: Travel time survey result summary

Direction	Peak	Average time (one-hour peak)	Minimum time (whole survey period)	Maximum time (whole survey period)
Northbound	AM peak	6:57 minutes	4:35 minutes	9:24 minutes
	PM peak	6:26 minutes	5:16 minutes	9:28 minutes
Southbound	AM peak	6:24 minutes	4:35 minutes	9:02 minutes
	PM peak	5:28 minutes	4:11 minutes	13:52 minutes

2.6 Crash analysis

2.6.1 Historical crash data

Analysis of the historical crash data has been conducted based on the crash data provided by Roads and Maritime for a five year period from 1 January 2008 to 31 December 2012, between Reconciliation Road and Bungarribee Road.

During this period, a total of 223 crashes were recorded on Prospect Highway, between Reconciliation Road and Bungarribee Road, including 87 crashes that resulted in injury. There were no fatal crashes recorded on the proposal corridor during this period.

Table 2.19 summarises the crashes recorded along the proposal corridor. Table 2.20 provides the number of crashes by year and number of casualties.

Table 2.19: Recorded crashes for the proposal corridor, 2008 to 2012

Section	Section length (km)	Total crashes	Fatal crashes	Injury crashes	Non-injury crashes
Prospect Highway, south of Blacktown Road	2.0 km	125	0	44	81
Blacktown Road, north of Prospect Highway	1.5 km	98	0	43	55

Table 2.20: Crashes by year and number of casualties

Section	2008	2009	2010	2011	2012
Crashes	37	54	49	47	36
Casualties	20	26	23	23	21

Analysis of the historical timeline for crashes indicates:

- The number of crashes that occurred increased by about 46 per cent from 2008 to 2009.
- The number of crashes recorded from 2009 to 2011 is relatively consistent.
- The number of crashes recorded reduced by about 23 per cent from 2011 to 2012.

Analysis of the crash types recorded indicates:

- The majority of crashes (67.7 per cent) occurred at intersections.
- Rear-end crashes represented the most dominant crash type along the proposal corridor with 46.2 per cent of crashes.
- Crashes that involved opposing vehicles turning represented 18.8 per cent of the crashes.
- Crashes involving vehicles on adjacent approaches at intersections accounted for 10.3 per cent of crashes.

Based on a review of the crash locations a substantial proportion of crashes occurs at unsignalised intersections, namely Ponds Road, Great Western Highway eastbound exit ramp and Stoddart Road. The dominant crash type at Ponds Road involves vehicles on adjacent approaches, which indicates that drivers are turning into the Prospect Highway within insufficient gaps and conflicting with vehicles from the adjacent approach. The dominant crash type at the Great Western Highway eastbound exit ramp and Stoddart Road involves rear end crashes, which indicates that vehicles approaching the

intersection are stopping suddenly (potentially to turn or avoid turning vehicles) and causing rear end collisions.

2.6.2 Crash severity index

Crash severity indices provide a basis for assessing road safety relative to the number of crashes that occur on a route and their severity. For example, fatal, injury and non-injury crashes are weighted according to severity using the following formula:

$$\text{Severity index} = [(\text{number of fatal crashes} \times 3.0) + (\text{number of injury crashes} \times 1.5) + (\text{number of non injury crashes})]/(\text{Total number of crashes})$$

The Prospect Highway corridor has a crash severity index of 1.20 for the period between 2008 and 2012. This indicates that this corridor has a lower number of fatal and injury crashes recorded than the remainder of NSW, which has an average crash severity index of 1.25 in 2011[1].

2.6.3 Crash rates

The crash rate per 100 million vehicle kilometres (100 MVKM) provides a measurement of the number of crashes recorded relative to the volume of traffic on the corridor and the length of the corridor analysed. The following formula is used to calculate the crash rate per 100 million vehicle kilometres:

$$Crash\ rate\ per\ 100\ MVKM = number\ of\ crashes \times 100{,}000{,}000/(number\ of\ years \times 365 \times length(km) \times AADT)$$

For the traffic volume component of this calculation the average daily traffic was based on the traffic surveys conducted in October 2013. Table 2.21 summarises the crash rates for the Prospect Highway corridor.

Table 2.21: Recorded crashes for the proposal corridor, 2008 to 2012

Section	Section length (km)	2013 traffic volume	Crash rate per 100 MVKM			
			All crashes	Fatal crashes	Injury crashes	Non-injury crashes
Prospect Highway, south of Blacktown Road	2.0 km	35,159	97.40	0	34.29	63.12
Blacktown Road, north of Prospect Highway	1.5 km	31,075	115.20	0	50.55	64.65

[1] *Road traffic crashes in NSW, Statistical Statement for the year ended 31 December 2011* (Roads and Maritime, 2011).

The typical crash rate for urban undivided roads with less than four lanes is 110 crashes per 100 million vehicle kilometres[2]. The Prospect Highway south of Blacktown Road is below this typical crash rate. The section of the proposal corridor north of the Prospect Highway and Blacktown Road intersection is above this typical crash rate.

[2] *NSW speed zoning guidelines* (Roads and Maritime, 2009).

3. TRAFFIC MODELLING

3.1 Previous modelling results

In 2010 Roads and Maritime developed and calibrated 2008 AM and PM peak base case PARAMICS micro-simulation model of the proposal corridor between Reservoir Road and Lancelot Street. Traffic models were prepared under 2016, 2021 and 2031 forecast traffic volumes, based on a combination of Roads and Maritime's strategic EMME model outputs and first principle calculations.

Roads and Maritime developed a preferred corridor layout based on the outcomes of a post options workshop held in August 2012. SMEC was subsequently commissioned in 2012 to:

- Convert the PARAMICS models to an AIMSUN model to make them compatible with the models being developed for other projects in the region.
- Extend the AIMSUN models north to St Martins Crescent to encompass the increased proposal scope.
- Expand the adjacent road network to include Beaufort Road so that the access strategy detours for residents could be modelled.
- Assess the access strategy options for Vesuvius Street, Roger Place and Tudor Avenue.
- Update the signal phasing data in accordance with the phasing arrangements and green-splits provided by Roads and Maritime.
- Update the forecast trip matrices based on the data provided by Roads and Maritime to reflect the new delivery timeframes, modelling 2018, 2028 and 2038 forecast years.

Three access strategy options were assessed for the arrangements at the intersections of Vesuvius Street, Roger Place and Tudor Avenue:

- 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.
- Option 3: Provision of left-in / left-out only access to the minor approach for Vesuvius Street and Tudor Avenue and left-in / right-in and left out only access for Roger Place.

Option 3 was developed to address the issue that 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.

The report documenting the results and outcome of the modelling previously conducted by SMEC is included in Appendix F. In summary, the results of the assessment of the access strategy options demonstrate 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 this shortcoming of Option 1, Option 3 was selected as the preferred option since it provides the second best network performance statistics, whilst providing Roger Place with viable access arrangements.

3.2 Modelling purpose and scenarios

The purpose of the traffic modelling exercise is to create a tool that can be used to assess the operational characteristics of the proposed upgrade to the Prospect Highway corridor. The future year traffic models are based on a calibrated base year model as detailed in Appendix B. The future year models provide a good platform to assess overall network performance, travel times on the corridor, travel times of the public transport facilities and other more detailed measures.

The future year models can also be used to test various sub-options and assess their relative merits. In addition, the 'do-nothing' future year models are used as a baseline for comparison purposes to understand the scale of the potential changes to key operating characteristics as a result of the proposed upgrade of the Prospect Highway.

There are three future years that have been assessed:

- 2018 (opening year).
- 2028 (ten years after opening).
- 2038 (20 years after opening).

For each future year, two peak periods have been assessed. The following peak periods were chosen based on the traffic surveys, as discussed in the Model Calibration and Validation report in Appendix B:

- AM peak 8am to 9am.
- PM peak 5pm to 6pm.

Two network scenarios have been modelled for each future year and peak period:

- Do nothing scenario, includes:
  - Road network as per October 2013 with no modifications, except for the connection of Reconciliation Road through to Wetherill Park and Wet 'n' Wild Sydney open.
  - Forecast increases to traffic demand, based on the future do nothing strategic modelling, using Roads and Maritime's EMME forecasts.
  - Increased bus services, based on advice from Transport for New South Wales.
  - Modified traffic signal timings to accommodate the increase in traffic demand.
- The proposed upgrade scenario, includes:

+ Proposed road network upgrades as per the design in Appendix C, including the connection of Reconciliation Road through to Wetherill Park and the Wet ‘n’ Wild Sydney open.
+ Forecast increases to traffic demand, based on the future upgrade strategic modelling, using Roads and Maritime’s EMME forecasts.
+ Increased bus services, based on advice from Transport for New South Wales.
+ Implementation of proposed M4 Motorway ramp works by 2019.
+ Modified traffic signals to accommodate the increase in traffic demand.

3.3 Modelling approach

The core of the modelling task is a micro-simulation of the Prospect Highway corridor. The micro-simulation is a technique where the path of every trip through the corridor is simulated. The congestion that results from all trips in the corridor and the impact of the congestion on each individual trip is then measured for options of road network upgrades. The performance of each road network scenario was compared to identify the best option and its worth.

The models describe morning and afternoon peak hours, which are generally the most congested periods of the day. Current traffic conditions were surveyed for use in identifying the peak periods and for comparison to the model's outputs in the process of calibrating the model to present day traffic.

Road network and driver behaviour

The micro-simulation model was developed using purpose-built traffic simulation software called AIMSUN. AIMSUN uses input data in the form of a description of the road network in terms of:

- Road links and intersections.
- Lengths of road sections.
- Numbers of lanes.
- Speed limits on roads.
- Public transport routes and facilities.
- Intersection operation details, in terms of intersection type and traffic signal timings.

The model uses driver behaviour measures, such as their response times to traffic conditions and the sizes of gaps in traffic that they are prepared accept, as well as performance measures of vehicles, including their size and acceleration and deceleration details.

Trip making

Central to the model are trip matrices, which are tables that describe the number of trips that travel between origins and destinations. As an initial estimate of this trip matrix,

SMEC used a trip matrix for each peak period from Roads and Maritime's EMME strategic transport model that models the transport networks of the entire Greater Sydney Metropolitan Area. These matrices represent a cut-out of trips that travel into, out of and through the Prospect Highway corridor during the morning and afternoon peak periods.

The matrices are for peak two-hour periods. The morning matrix represents trips made in the period 7am to 9am and the afternoon matrix represents trips in the period 4pm to 6pm.

The EMME model does not include all road links, instead focussing on the major road links across the metropolitan area. Its transport networks are necessarily broad and are missing details, such as the smaller, more local roads and services. Strategic transport models seldom account for intersection delay and there are usually many more right turn movements in the models than in reality. Using a strategic transport model to focus on a small area is akin to using a map of mainland Australia to navigate from Parramatta to Blacktown. At the detailed level, small errors at the large scale may become highly magnified at the small scale. In addition, the Road and Maritime's EMME works with peak two-hour periods while SMEC's micro-simulation model works with the peak one-hour.

Matrix estimation

In order to refine the two-hour trip matrices from the strategic model into a peak hour trip matrix for the micro-simulation, SMEC used traffic counts to modify the strategic trip matrices for 2013. This technique involves using the strategic trip matrix as a prior trip matrix and adjusting the number of trips in its cells so that the traffic on road links in the model match the traffic counted. This process has the aim of producing model traffic that matches the traffic counts with the minimum of change to the prior matrix.

SMEC produced a matrix for each of the peak hours in this way.

Calibration

Once the 2013 trip matrices were finalised, each of the models (morning and afternoon) was calibrated. This process involves adjusting the myriad parameters available in AIMSUN models so that the model reproduces turning movements at intersections, traffic flow on road links and travel times. These parameters include:

- Driver response parameters.
- Vehicle performance parameters.
- Route choice parameters.

A detailed account of the calibration procedures and results are provided in Appendix B.

Forecasting

To assess the impact of the proposal, forecasts of traffic for a do nothing case and various options of the proposal case were produced for years 2018, 2028 and 2038.

The expected road networks in the corridor for each of the forecast horizons were coded into the model and the forecast trip matrices were used to generate the traffic for each tested option. Trip matrices were forecast by using the 2013 estimated trip matrix for each peak hour and using origin and destination factors to grow the matrices to the future years.

The matrices were then applied to each of the network options in each of the peak hours and the resulting traffic conditions were evaluated with a view to being able to express the impact of the road network upgrades on traffic.

3.4 Modelling assumptions

3.4.1 Future base case

The future base case, do nothing scenario is based on the calibrated base 2013 model. It contains the same road network and the same traffic signals. It does not include the proposed ramp works at the M4 Western Motorway on ramps, but it does include the extension of Reconciliation Road through to Wetherill Park.

The traffic demand is based on a strategic model that does not include the proposed upgraded Prospect Highway as discussed in Section 3.2 Modelling purpose and scenarios. However the increase in bus frequencies is included as per the discussion in in Section 3.2 Modelling purpose and scenarios.

Traffic signal timing changes have been included to maximise the capacity of the road network in the future.

3.4.2 Road network

The proposed road network has been coded into the model based on the following:

- Prospect Highway Upgrade, 50% concept design drawings prepared on 17 August 2013.
- M4 Western Motorway entry ramp, Draft 80% concept design prepared on 3 July 2013.

The proposed upgrade primarily involves the upgrade of the Prospect Highway from an undivided two-lane two-way road to a divided four-lane road between Reservoir Road and Blacktown Road and the upgrade of Blacktown Road from an undivided two-lane two-way road to a divided four-lane road between Lancelot Street and just north of Tudor Avenue where it ties into Blacktown Road north of St Martins Crescent. The cross-section over the M4 Western Motorway comprises four lanes in each direction, including two through lanes in each direction and two right-turn lanes onto the M4 Western Motorway entry ramps for each direction.

In addition there is a new dedicated bus lane running in both the north and southbound directions between Lancelot Street and north of St Martins Crescent. All of the bus stops between these points are located within the bus lanes. The proposed bus stop locations are illustrated in Figure 5.1.

The proposal includes the implementation of a new two way link road between the Great Western Highway and the Prospect Highway, which replaces the existing Great Western Highway eastbound exit ramp.

The proposed road network includes five new traffic signalised intersections as described Section 3.5.1 Signalised intersections.

Two new bridges are proposed over the M4 Western Motorway and Great Western Highway, on the western side of the existing bridges.

The M4 Western Motorway ramp meter signals have been coded into the model after 2019 to operate with the signal phase times provided by Roads and Maritime on 10 December 2013, which specify the following signal timings and storage length provisions:

- Eastbound: Two lanes at the stop line, with 620 metres total storage and seven second cycle time.
- Westbound: Three lanes at the stop line, with 770 metres total storage and eight second cycle time.

3.4.3 Traffic growth

The engine of growth in model traffic is growth in the trip matrices.

Roads and Maritime supplied trip matrices for the morning and afternoon peak periods for 2013, 2016, 2026 and 2036 for a do nothing case and a road network proposal case from Roads and Maritime's strategic EMME model. SMEC used the 2013 strategic trip matrices to derive a micro-simulation trip matrix for 2013.

SMEC calculated annual growth rates from 2013 for the matrix row totals (origins) and row columns (destinations) for each of the years and each of the do nothing and upgrade network options using the 2016, 2026 and 2036 strategic model trip matrices. SMEC then used these annual growth rates to calculate factors for origins and destinations from 2013 to 2018, 2013 to 2028, 2013 to 2038.

SMEC then applied the calculated growth rates to the total origins and destinations of the 2013 micro-simulation trip matrix. With these origin and destination totals for each matrix, SMEC balanced the values of the cells of the matrix by factoring them alternately to origin totals and destination totals until the resultant matrix stabilised. This method of factoring matrices is called Furness factoring. It has a limitation in that that cells that contain larger numbers in the base matrix tend to grow more quickly than others, at the expense of cells containing smaller values. There were two sources of this type of issue in our matrix forecasting:

- Reservoir Road, west of Reconciliation Road on which significant development is expected to take place, including Wet 'n' Wild Sydney.
- The eastbound movement of traffic on the Great Western Highway travelling to Reconciliation Road southbound. This right turn movement is not directly catered for in the 2013 road network and there are consequently few trips in this cell of the 2013 micro-simulation matrix.

Growth of the number of trips in these cells in the proposed upgrade matrices was unacceptably low. As a result, SMEC assessed the growth of traffic demand in these cells individually and replaced cell value in the micro-simulation matrix with the number of additional trips forecast by the strategic model for these cells. The matrices show that the number of trips in the corridor will grow from 2013 to 2018 at about 2.3 per cent per year. This growth will be largely fuelled by the additional traffic generated by the extension of Reconciliation Road. Beyond 2018, annual growth will ease. From 2018 to 2028, traffic will grow at about 1.2 per cent per year and beyond 2028 will grow at about one per cent per year.

3.4.4 Public Transport

There are only buses in the public transport network within the Prospect Highway corridor. Based on advice received by Transport for NSW (27 November 2013), for 2018, it has been assumed that buses would operate at current (2013) frequencies. For 2028, it has been assumed that buses would operate at 15-minute intervals along the corridor during peak periods. In 2038 buses would operate at 10 minute intervals along the corridor during peak periods.

3.5 Network description

3.5.1 Signalised intersections

There are 13 signalised intersections included in the AIMSUN model for the future upgraded network. The intersections include eight existing signalised intersections and five new signalised intersections. These intersections are:

- Prospect Highway / Reservoir Road (new signalised intersection).
- Prospect Highway/ M4 Western Motorway westbound entry and exit ramps (existing signalised intersection, site number 4523).
- Prospect Highway / M4 Western Motorway eastbound entry and exit ramps (new signalised intersection).
- Great Western Highway / two way link road (new signalised intersection).
- Prospect Highway / two-way link road (new signalised intersection).
- Prospect Highway / Stoddart Road (new signalised intersection).
- Prospect Highway / Harrod Street (existing signalised intersection, site number 3327).
- Prospect Highway / Blacktown Road (existing signalised intersection, site number 3022).
- Blacktown Road / Lancelot Street (existing signalised intersection, site number 4131).
- Blacktown Road / Keyworth Drive (existing signalised intersection, site number 2439).

- Blacktown Road / St Martins Crescent (existing signalised intersection, site number 2375).
- Blacktown Road / Leabons Lane / Bungarribee Road (existing signalised intersection, site number 2566).
- Leabons Lane / Seven Hills Road South / Bowen Place (existing signalised intersection, site number 4167).

SCATS Data

Roads and Maritime provided traffic signal data to aide in the configuration of the traffic signal configuration within the model. The following traffic signal data was sourced and supplied by Roads and Maritime:

- SCATS traffic volumes.
- Intersection Diagnostic Monitor (IDM).
- LX data.
- EPROM personality data.
- Traffic signal layouts.
- SCATS time settings.

The SCATS traffic volume data was provided for each intersection along the Prospect Highway corridor as well as nominated sites along the Great Western Highway. This data was used to validate the origin destination matrices generated by the strategic modelling exercise as well as gain a general understanding of where the traffic is travelling along the network.

The IDM data is used to record traffic signal operation statistics at each site on a cycle by cycle basis. The IDM data is then filtered and reported at 15-minute intervals. The IDM records what split plan and link plan is selected during each 15-minute interval. The IDM also records which traffic signal phases run, their duration, the average cycle time and which pedestrian movements operated during each 15-minute interval. Overall, the IDM provides a comprehensive snapshot of how the traffic signals operate at each site.

The LX file and the EPROM personality file (SFT file) were provided. These files provide intricate operating details of each signalised intersection. These files were deciphered and all relevant traffic signal information was then input into the model.

The traffic signal layouts were supplied for each site, with the exception of the Blacktown Road / Leabons Lane / Bungarribee Road. The signal plans were used to confirm the signal hardware on-site, which can be then used to confirm the traffic signal phasing inputs in the model.

The SCATS time settings were used to provide accurate information regarding the duration of the intergreen periods, late start intervals and duration of various signal groups (for example, signalised slip lanes and bus signal groups). This information was incorporated into the signal plan for each intersection within the model.

The signal data provided by Roads and Maritime for each signalised intersection is included in Appendix E.

Cycle time and phase splits

Each of the signalised intersections has been coded as fixed time. All of the existing signalised intersections along the Prospect Highway corridor (seven in total) are configured in the same sub system. As such, these intersections all share a common cycle time. The new signalised intersections proposed along the Blacktown Road/ Prospect Highway corridor (four in total) have also been configured to share the same cycle time as the existing intersections. All of these signalised intersections along the Prospect Highway corridor operate with a 130 second cycle time in the peak periods.

The existing signalised intersection of Leabons Lane/ Seven Hills Road South/ Bowen Place are running as isolated intersections. As such, it adopts a shorter 90 second cycle time to minimise delays. The cycle times were derived from the IDM data.

For the remaining new signalised intersections proposed on the Great Western Highway, a shorter cycle time of 90 seconds was adopted to minimise delays to all vehicle movements. This signalised intersection is not linked to adjacent sites along the Great Western Highway as the distance between the intersections is too great. They are configured to operate in isolated mode.

For the existing signalised intersections, all the signal phase operations and phase times have been manually configured based on the IDM data. The IDM data indicates what signals phases ran during the peak periods and the average duration that each phase ran for. This information was then used as the basis to create the signal plan in AIMSUN and is a true reflection of the existing operating conditions of the route.

For the new signalised intersections, the signal phase operation has been configured on the phasing sequence proposed by Road and Maritime.

The phase timings for each signalised intersection for the forecast years and peak periods are included in Appendix E.

Signal optimisation

For the future proposed upgrade scenario, traffic signal optimisation has been undertaken to ensure that traffic flow and road performance is optimised. To achieve this, the phase sequence and phase time have been adjusted to cater for the future traffic demand.

Signal coordination

The traffic signal offsets have been adopted from SCATS data to coordinate the signals. As all of the intersections (with the exception of Leabons Lane/ Seven Hills Road South/ Bowen Place) are configured in the same sub system, they are all linked via internal signal offsets. These offsets values are provide in the LX file for each site.

During the AM peak the signals are coordinated in the northbound direction which relates to the Blacktown bound traffic flow, while the PM peak signals are coordinated in the southbound direction which relates to the Prospect bound traffic flow.

Existing intersections

The existing signalised intersections along are describe in the Model Calibration and Validation report, which can be found in Appendix B. The phasing sequence at these intersections has remained unchanged. Where modifications have been made to the intersections, they are described in more detail in the following subsections.

Prospect Highway / Reservoir Road

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.1.

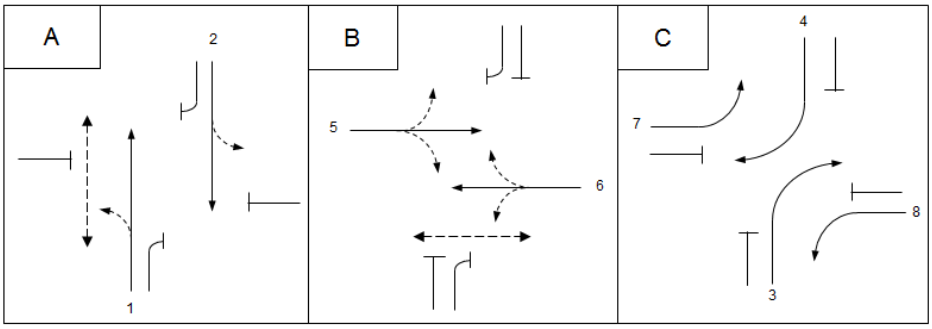


Figure 3.1: Prospect Highway/ Reservoir Road phase sequence

The following signal operation details were included in the model:

- Signal Group 3 and Signal Group 4 are fully controlled right turns, they are not permitted to filter in A phase.
- The right turns from Reservoir Road are not controlled movements. They are permitted to filter in B phase. Due to the low demand on Reservoir Road, these signal groups do not operate in their exclusive right turn phase as these right turns generally clear within B phase.
- Signal Groups 7 and 8 are bonus left turns.

Prospect Highway / M4 Western Motorway westbound entry and exit ramps

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.2.

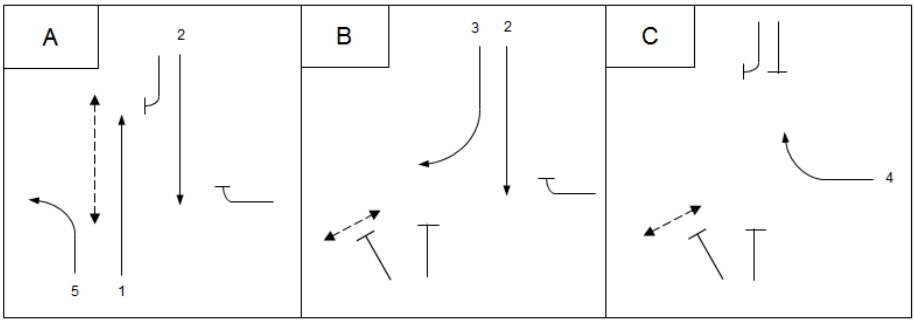


Figure 3.2: Prospect Highway/ M4 Western Motorway westbound entry and exit ramps phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a fully controlled right turn and it is not permitted to filter in A phase.
- Signal Group 5 is a signalised slip lane.

Prospect Highway / M4 Western Motorway eastbound exit ramps

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.3.

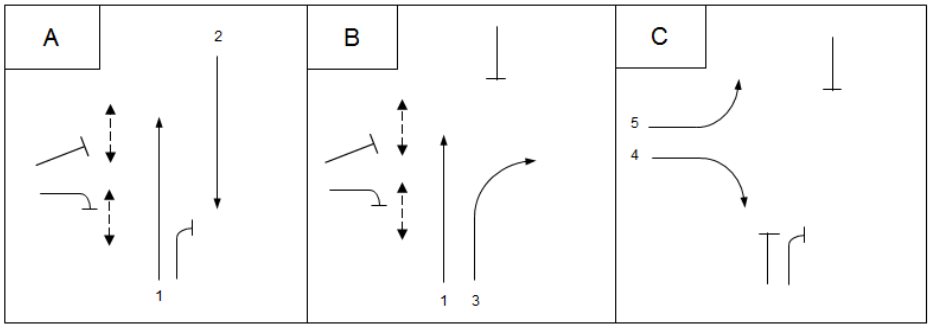


Figure 3.3: Prospect Highway/ M4 Western Motorway eastbound exit ramp phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a fully controlled right turn, it is not permitted to filter in A phase.
- Signal Group 5 is a signalised slip lane.

Great Western Highway / two way link road

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.4.

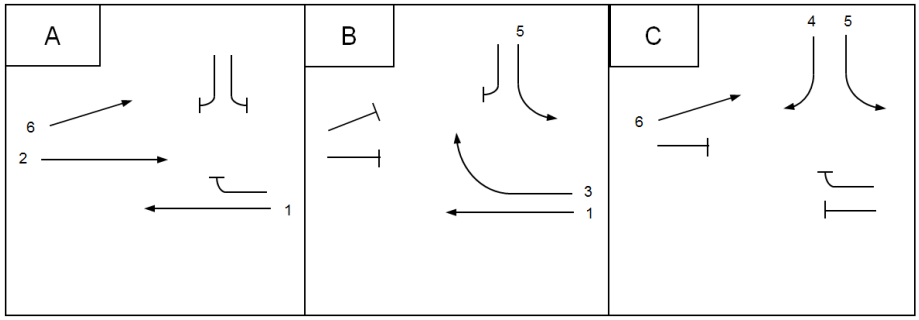


Figure 3.4: Great Western Highway/ two way link road phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a fully controlled right turn and it is not permitted to filter in A phase.
- Signal Groups 5 and 6 are signalised slip lanes.

Prospect Highway / two way link road

This site is a two-phase site that operates with a phase sequence A-B. A summary of the phasing sequence and phase times is provided in Figure 3.5.

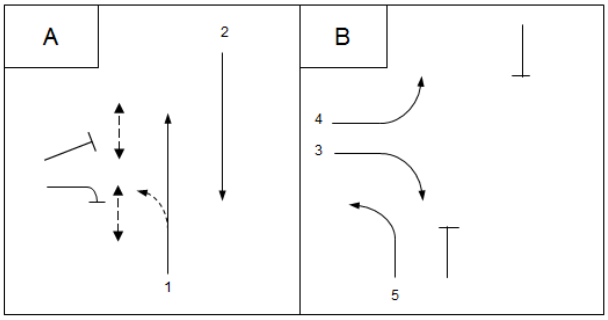


Figure 3.5: Prospect Highway/ two way link road phase sequence

The following signal operation details were included in the model:

- Signal Group 4 is a signalised slip lane.
- Signal Group 5 is a bonus left turn that operates in B phase.

Prospect Highway / Stoddart Road

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.6.

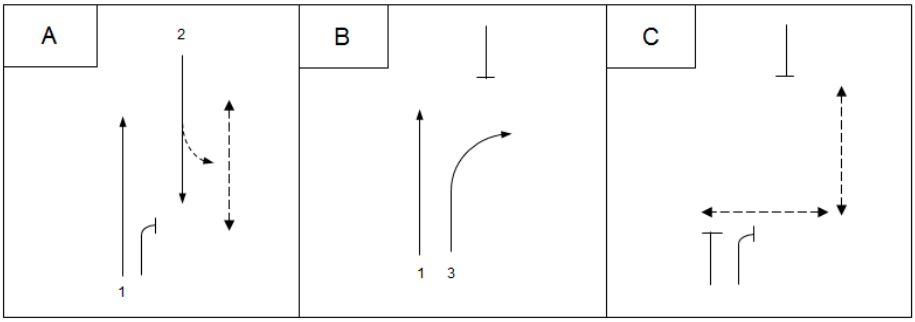


Figure 3.6: Prospect Highway/ Stoddart Road phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a fully controlled right turn and it is not permitted to filter in A phase.
- B phase operates as a lagging right turn phase.

Prospect Highway / Harrod Street

This site is a three-phase site that operates with a phase sequence A-C. A summary of the phasing sequence and phase times is provided in Figure 3.7.

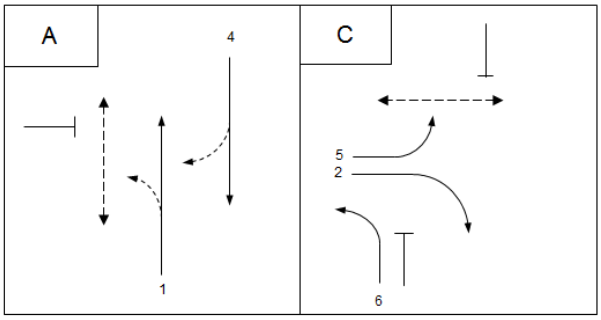


Figure 3.7: Prospect Highway/ Harrod Street phase sequence

The following signal operation details were included in the model:

- The lagging right turn phase (B phase) has been omitted from the phase sequence as the demand for this right turn is low.
- Signal Group 6 is a bonus left turn that operates in C phase.

Prospect Highway / Blacktown Road

This site is a three-phase site that operates with a phase sequence A-D-B. A summary of the phasing sequence and phase times is provided in Figure 3.8.

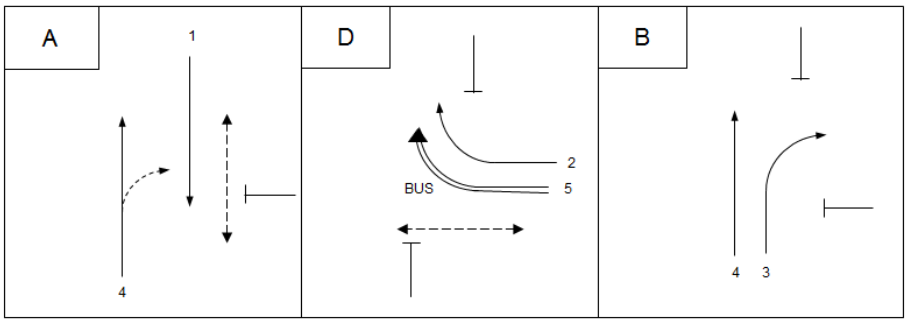


Figure 3.8: Prospect Highway/ Blacktown Road phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a partially controlled right turn, it is permitted to filter in A phase after a five second late start interval.
- C phase is a bus only phase. For the purpose of this model, C phase has been omitted from the phase sequence as it runs less than five times in both the AM and PM peak periods. The bus phase (C phase) would typically be allocated five seconds of green time.
- In order to provide bus priority at this site, we have modified the operation of D phase accordingly. In D phase, the bus signal group (Signal Group 5) receives a four seconds early start, after which Signal Group 2 commences. This means that the introduction of Signal Group 2 is delayed by four seconds in D phase every cycle. This approach has been adopted to best replicate the bus priority operation at this site.

- The exclusive right turn phase has been changed to a 'leading right turn' as opposed to the 'lagging right turn' as it improves the linking with the Lancelot Street.

Blacktown Road / Lancelot Street

This site is a three-phase site that operates with a phase sequence A-B-C. A summary of the phasing sequence and phase times is provided in Figure 3.9.

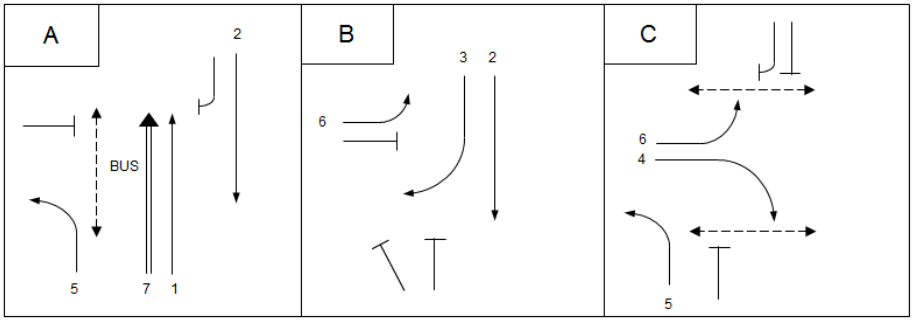


Figure 3.9: Blacktown Road / Lancelot Street phase sequence

The following signal operation details were included in the model:

- Signal Group 3 is a fully controlled right turn, it is not permitted to filter in A phase.
- Signal Group 7 is a bus signal group. As the bus lane has been extended further north along the Prospect Highway corridor, the bus early start has been removed, as there is no benefit of providing an early start for the bus signal group. This approach has been adopted to best replicate the bus priority operation at this site.
- Signal Group 5 is a signalised slip lane signal group that operates in A phase and C phase.
- Signal Group 6 overlaps from B phase to C phase as there are no pedestrian demands.

3.6 Future base case modelling results

3.6.1 Network performance

Tables 3.4 and 3.5 show the network performance characteristics for the future do nothing model scenarios in the AM and PM peaks, respectively. This represents a base case for comparison with the upgraded network presented in Section 6.3 Operational impacts. The results show an increasing number of vehicles (flow) into the future years, and a corresponding increase to the total vehicle kilometres travelled (VKT). However, the increase in total vehicle hours travelled (VHT) increases at a much larger rate into the future years. This corresponds to the dramatic increase in the delay during 2038 compared to the two previous years.

The AM model experiences larger delays than the PM model during the first two future years 2018 and 2028. Inspection of the models reveals that the congestion is primarily in the southbound direction, the cause of which is the limited capacity of the roundabout at the eastbound M4 Western Motorway ramps. This creates a queue in the southbound direction that eventually reaches the north end of the model including the local roads to

the east of the corridor, being Columbia Road and Blacktown Road. The northbound direction operates relatively smoothly beyond the M4 Western Motorway interchange, where the capacity is only limited by the roundabout. A number of vehicles are queued in the northbound direction, south of the M4 Western Motorway, waiting to get onto the M4 Western Motorway or north onto Prospect Highway.

The PM peak models operate relatively smoothly in both peaks during the 2018 and 2028 future years, however in 2038 the flow breaks down and forms severe congestion throughout the model.

The 'vehicles waiting to enter' statistic represents the total number of vehicles that did not make it onto the model network at the end of the peak hour. This is due to queuing that occurs into the edges of the model, which means that the full traffic demand is not able to be released onto the model. This is an undesirable outcome as it means that the network performance measures do not represent the entire traffic demand, just the vehicles that made it onto the network.

Table 3.4: Do nothing, AM peak network performance

Values	2013	2018	2028	2038
Flow (veh/hr)	12,680	16,220	17,960	17,880
VKT (km)	40,660	40,951	45,702	45,821
VHT (hr)	777	1,164	1,443	1,883
Delay (sec/km)	27	66	92	146
Speed (km/h)	66	63	62	58
Vehicles waiting to enter	0	530	1,130	3,060

Table 3.5: Do nothing, PM peak network performance

Values	2013	2018	2028	2038
Flow (veh/hr)	12,760	16,840	16,180	17,260
VKT (km)	37,116	39,463	37,879	40,465
VHT (hr)	753	848	1,066	1,656
Delay (sec/km)	37	43	75	209
Speed (km/h)	61	59	59	56
Vehicles waiting to enter	0	0	880	3,540

3.6.2 Travel times

Tables 3.6 and 3.7 summarise the modelled travel times on the Prospect Highway corridor, from Reservoir Road to Bungarribee Road.

The results show that in the AM peak, the northbound direction is travelling much faster than the southbound direction in all future years, which is in line with the discussion in Section 3.6.1 Network performance. The southbound direction flow breaks down completely and as a result the traffic moves at less than ten kilometres per hour across the whole corridor.

In the PM peak, the flow along the corridor is similar to the AM peak in the northbound direction, but much faster in the southbound direction, with minimal delays due to the reduced flows and coordinated traffic signals.

Table 3.6: Do nothing, AM peak travel time on the Prospect Highway corridor

	Northbound				Southbound			
	2013	**2018**	**2028**	**2038**	**2013**	**2018**	**2028**	**2038**
Travel Time (min)	7	8	10	11	6	34	44	67
Speed (km/h)	34	30	25	21	40	9	7	6

Table 3.7 Do nothing, PM peak travel time on the Prospect Highway corridor

	Northbound				Southbound			
	2013	**2018**	**2028**	**2038**	**2013**	**2018**	**2028**	**2038**
Travel Time (min)	7	8	10	11	5	5	5	5
Speed (km/h)	34	27	21	20	49	45	44	44

3.6.3 Intersection performance

The future year AIMSUN models (AM and PM peak hour) have been used to assess the intersection performance at each intersection along the proposal corridor without the proposed upgrade (do nothing). The primary focus of the signal optimisation phase was conducted on the upgrade scenario models, in particular 2038. The operation of the traffic signals in the future do nothing scenarios, largely adopts the operation of the upgrade scenarios. Signal optimisation was carried out visually at key locations along the corridor to minimise the extent of excessive queuing at intersections. The do nothing scenarios generally indicate substantial congestion on the road network and no amount of optimisation of the signals results in effectively addressing the congestion on the road network.

Tables 3.8 and 3.9 summarise the intersection performance for forecast years, under the do nothing scenario.

The following intersections operate at unacceptable levels of service of E or worse in the future years, without the proposed upgrade:

- Prospect Highway / Reservoir Road, 2038 AM and PM peak.
- Prospect Highway / M4 Western Motorway westbound ramps, 2038 AM and PM peak.
- Prospect Highway / Ponds Road, 2018 PM peak, 2028 and 2038 AM and PM peaks.
- Prospect Highway / Stoddart Road, 2028 and 2038 AM peak.
- Prospect Highway / Harrod Street, 2038 AM peak.
- Blacktown Road / Vesuvius Street, 2018, 2028 and 2038 AM and PM peaks.
- Blacktown Road / Roger Place, 2038 AM peak.
- Blacktown Road / Tudor Avenue, 2018, 2028 and 2038 AM peak.
- Blacktown Road / St Martins Crescent, 2038 AM peak.
- Blacktown Road / Bungarribee Road, 2018 and 2028 AM peak, 2038 AM and PM peaks.
- Leabons Lane / Ellam Drive, 2038 AM and PM peaks.

With a significant number of intersections reaching capacity by 2028, particularly in the AM peak hour, the proposed upgrade would be required to accommodate forecast traffic growth before 2031.

Table 3.8: Future intersection operation, do nothing, AM peak

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
Prospect Highway / Reservoir Road	2018	2,470	15	B (north through)
	2028	2,630	41	C (north through)
	2038	3,090	91	F (north through)
Prospect Highway / M4 Western Motorway westbound ramps	2018	2,950	19	B
	2028	3,200	22	B
	2038	3,100	62	E
Prospect Highway / M4 Western Motorway eastbound ramps	2018	3,280	39	C (north through)
	2028	3,400	42	C (north through)

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
	2038	3,600	94	F (north through)
Prospect Highway / Ponds Road	2018	2,710	53	D (east right)
	2028	2,750	106	F (east left)
	2038	2,700	190	F (east left)
Prospect Highway / Great Western Highway ramps	2018	1,660	86	F(west left)
	2028	1,720	164	F(west left)
	2038	1,840	370	F(west left)
Prospect Highway / Stoddart Road	2018	2,750	42	C (south right)
	2028	2,750	59	E (south right)
	2038	2,630	71	F (south right)
Prospect Highway / Harrod Street	2018	2,480	49	D
	2028	2,440	54	D
	2038	2,320	75	F
Prospect Highway / Blacktown Road	2018	2,650	14	B
	2028	2,650	34	C
	2038	2,620	38	C
Blacktown Road / Lancelot Street	2018	2,390	21	B
	2028	2,360	26	B
	2038	2,260	34	C
Blacktown Road / Vesuvius Street	2018	2,230	486	F (east right)
	2028	2,270	1066	F (east right)
	2038	2,420	1779	F (east right)

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
Blacktown Road / Keyworth Drive	2018	2,110	18	B
	2028	2,080	22	B
	2038	1,960	31	C
Blacktown Road / Roger Place	2018	2,050	44	D (east right)
	2028	1,910	54	D (east right)
	2038	1,740	90	F (east right)
Blacktown Road / Tudor Avenue	2018	2,110	61	E (west right)
	2028	1,990	89	F (west right)
	2038	1,850	145	F (west right)
Blacktown Road / St Martins Crescent	2018	2,310	39	C
	2028	2,410	51	D
	2038	2,410	67	E
Blacktown Road / Bungarribee Road	2018	3,130	56	E
	2028	3,180	77	F
	2038	3,110	106	F
Leabons Lane / Ellam Drive	2018	1,650	22	B
	2028	1,680	40	C
	2038	2,360	97	F

Table 3.9: Future intersection operation, do nothing, PM peak

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
Prospect Highway / Reservoir Road	2018	1,340	5	A (south through)
	2028	1,820	44	D (south through)
	2038	2,540	134	F (south through)
Prospect Highway / M4 Western Motorway westbound ramps	2018	2,240	22	B
	2028	2,520	45	D
	2038	2,620	65	E
Prospect Highway / M4 Western Motorway eastbound ramps	2018	2,500	9	A (west through)
	2028	2,590	14	A (west through)
	2038	2,750	16	B (west through)
Prospect Highway / Ponds Road	2018	2,100	71	F (east right)
	2028	1,920	75	F (east right)
	2038	2,050	82	F (east right)
Prospect Highway / Great Western Highway ramps	2018	1,430	21	B (west left)
	2028	1,530	26	B (west left)
	2038	1,740	31	C (west left)
Prospect Highway / Stoddart Road	2018	2,570	3	A (south through)
	2028	2,260	5	B (south through)
	2038	2,870	26	B (south through)
Prospect Highway / Harrod Street	2018	2,580	13	A
	2028	2,240	20	A

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
	2038	2,850	28	A
Prospect Highway / Blacktown Road	2018	3,010	18	B
	2028	3,410	23	B
	2038	3,250	25	B
Blacktown Road / Lancelot Street	2018	2,850	10	A
	2028	2,930	12	A
	2038	2,860	14	A
Blacktown Road / Vesuvius Street	2018	2,740	282	F (east right)
	2028	2,750	338	F (east right)
	2038	2,710	522	F (east right)
Blacktown Road / Keyworth Drive	2018	2,740	8	A
	2028	2,850	12	A
	2038	2,700	15	B
Blacktown Road / Roger Place	2018	2,700	17	B (east right)
	2028	2,710	19	B (east right)
	2038	2,620	21	B (east right)
Blacktown Road / Tudor Avenue	2018	2,660	17	B (west right)
	2028	2,490	27	B (west right)
	2038	2,650	28	B (west right)
Blacktown Road / St Martins Crescent	2018	3,120	33	C
	2028	3,130	38	C
	2038	3,140	45	D
Blacktown Road / Bungarribee Road	2018	4,160	37	C
	2028	4,200	42	C

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
	2038	4,120	57	E
Leabons Lane / Ellam Drive	2018	2,740	35	C
	2028	2,930	45	C
	2038	2,730	114	F

4. THE PROPOSAL

4.1 Overview of the proposal

The key features of the Prospect Highway proposal are:

- Construction of two new bridge structures over the M4 Western Motorway and the Great Western Highway on the western side of the existing bridge structures. The existing bridges would function as the new southbound carriageway and the new bridges would function as the new northbound carriageway. The new bridges include provision of a shared pedestrian and cyclist path on the western side of the structures.
- Construction of a new two way link road between the Great Western Highway and the Prospect Highway (replacing the eastbound exit ramp). The two way link road comprises two lanes in each direction with dedicated left and right turn lanes at its intersections with the Great Western Highway and the Prospect Highway.
- Two lanes in each direction with a central median between the Reservoir Road and Prospect Highway intersection and the M4 Western Motorway westbound entry and exit ramps.
- Two lanes in each direction between the M4 Western Motorway westbound entry and exit ramps and Ponds Road. This section includes a central median between the M4 Western Motorway exit ramp and Ponds Road.
- Two lanes in each direction between Ponds Road and the two way link road divided by two separate bridge structures.
- Two lanes in each direction with a central median between the two way link road and Blacktown Road.
- Retention of the existing four lanes plus left turn auxiliary lanes into Blacktown Road and Lancelot Street between Blacktown Road and Lancelot Street.
- Three lanes in each direction with a central median between Lancelot Street and Roger Place. The kerbside lane in each direction is a dedicated bus lane. This section includes:
  - A right turn lane into Lancelot Street for southbound traffic on the Prospect Highway.
  - A left turn auxiliary lane into Keyworth Drive for northbound traffic on the Prospect Highway.
  - A right turn lane into Keyworth Drive for southbound traffic on the Prospect Highway.
  - A right turn lane into Roger Place for northbound traffic on the Prospect Highway.
- Three lanes in each direction with a central median between Roger Place and Tudor Avenue. The kerbside lane in each direction would be a dedicated bus lane.

- Three lanes in both directions with a central median between Tudor Avenue and around 200 metres north of St Martins Crescent. The kerbside lane in each direction would be a dedicated bus lane. The proposed upgrade ties into the existing configuration north of St Martins Crescent. This section includes a right turn lane into St Martins Crescent for southbound traffic on the Prospect Highway.
- Upgrading four existing signalised intersections with Prospect Highway, including:
  - M4 Western Motorway westbound entry and exit ramp, upgrade to include two dedicated right turn lanes for southbound traffic on the Prospect Highway to travel west on the M4 Western Motorway and two dedicated through lanes for northbound and southbound traffic on the Prospect Highway.
  - Harrod Street, upgrading of the existing intersection to provide two lanes in each direction on the Prospect Highway with a dedicated right turn bay into Harrod Street for southbound traffic on the Prospect Highway.
  - Blacktown Road, upgrading of the existing intersection to provide a signalised pedestrian crossing on the southern approach of the intersection. The proposed intersection configuration comprises a right turn lane into Blacktown Road for northbound traffic on the Prospect Highway.
  - Keyworth Drive, upgrading of existing intersection to provide two lanes and a dedicated bus lane in each direction on the Prospect Highway. The proposal also includes a dedicated right turn bay into Keyworth Drive for southbound traffic on the Prospect Highway.
- Construction of five new signalised intersections by:
  - Converting the existing Reservoir Road / Reconciliation Road and Prospect Highway roundabout intersection to a signalised four way intersection. The configuration of the proposed intersection comprises two through lanes in each direction on the Prospect Highway, with dual southbound right turn lanes into Reservoir Road and a single northbound right turn lane into Reservoir Road. The western arm of Reservoir Road has two lanes in each direction and the eastern arm of Reservoir Road has one lane in each direction. Signalised pedestrian crossings are proposed for the southern and western arms of the intersection.
  - Converting the existing M4 Western Motorway eastbound exit and entry ramps roundabout to a signalised intersection. The intersection configuration comprises two lanes in each direction on the Prospect Highway with dual northbound right turn lanes into the M4 Western Motorway eastbound entry ramp and a southbound left turn auxiliary lane into the M4 Western Motorway eastbound entry ramp. The M4 Western Motorway eastbound exit ramp has two lanes in each direction at this intersection. Signalised pedestrian crossings are provided on the western arm of the intersection.
  - Installing a new signalised intersection at the two way link road at its intersection with the Great Western Highway. The configuration of this intersection comprises three lanes in each direction on the Great Western Highway with a westbound right turn lane into the two way link road and an eastbound left turn signalised slip

lane into the two way link road. The two way link road has two lanes in each direction with separated left and right turn lanes into the Great Western Highway.

  - Installing a new signalised intersection at the two way link road at its intersection with the Prospect Highway. The configuration of this intersection comprises two lanes in each direction on the Prospect Highway and two lanes in each direction on the two way link road, with separate left and right turn lanes on the approach. Signalised pedestrian crossings are provided on the western arm of the intersection.

  - Converting the existing priority controlled intersection at Stoddart Road to a signalised intersection. The configuration of this intersection comprises two lanes in each direction on the Prospect Highway, with a northbound right turn lane into Stoddart Road and a southbound left turn auxiliary lane into Stoddart Road. Stoddart Road has a left turn only lane and a single departure lane. A signalised pedestrian crossing is provided on the southern arm of the intersection.

- Conversion of three priority controlled intersections to left in and left out movements only at the following locations:

  - Ponds Road / Prospect Highway.

  - Vesuvius Road / Prospect Highway.

  - Tudor Avenue / Prospect Highway.

- Conversion of the existing priority controlled intersection of the Roger Place / Prospect Highway intersection to left-in, right-in and left-out movements only.

- Relocation of five bus stops:

  - Northbound bus stops north of Keyworth Drive and north of Tudor Avenue would be relocated from the existing informal service road to behind the kerb of the new alignment.

  - Northbound bus stop north of Stoddart Road wold be relocated to north of Harrod Street.

  - Northbound and southbound bus stops north of St Martins Crescent would be relocated towards the south, closer to the intersection of Prospect Highway and St Martins Crescent.

- Installation of two new bus stops (northbound and southbound adjacent to the intersection of the Prospect Highway / Reservoir Road / Reconciliation Road).

- Upgrade of the pedestrian underpass beneath the Prospect Highway linking Old Church Lane and Keyne Street.

- Upgrade of the temporary shared path between the M4 Western Motorway westbound exit ramp and Harrod Street.

- Realigning the existing footpath between Harrod Street and Blacktown Road to accommodate the proposed alignment of the Prospect Highway and provide

connectivity to the proposed signalised pedestrian crossing on the southern side of the Prospect Highway and Blacktown Road intersection.

- Provision of a footpath on the eastern side of the Prospect Highway between Keyworth Drive and Roger Place.
- Provision of three retaining walls ranging from about two metres to about seven metres in height at the following locations:
  - St Bartholomew's Cemetery for a length of about 80 metres.
  - Proposed Great Western Highway / Prospect Highway link road for a length of about 270 metres.
  - Great Western Highway / Prospect Highway intersection and along the northbound carriageway of the Prospect Highway for a length of about 200 metres.
- Establishment of temporary site compounds and stockpiles during construction.
- Upgrade of the existing pavement and cross drainage systems including the construction and extension of pavement drainage lines.
- Utilities relocation where required.
- Upgrade of street lighting along the proposal length.
- Landscaping of the corridor.

Appendix C includes the latest proposal design prepared by Roads and Maritime.

4.2 Design criteria

4.2.1 Design speed

A design speed of 70 kilometres per hour is proposed for the Prospect Highway corridor.

4.2.2 Cross section

The typical cross section of the Prospect Highway corridor comprises four lanes (4.2 metres wide on kerbside lanes and 3.5 metres wide lane adjacent to the median). The median varies in width from 3.5 metres to 5.9 metres. North of Lancelot Street, an additional kerbside bus lane is provided in both directions. North of Lancelot Street, the cross section typically consists of four 3.5 metre wide traffic lanes (two lanes each direction) and 4.2 metre kerbside bus lanes.

Figure 4.1 illustrates the typical cross sections at various locations along the Prospect Highway corridor.

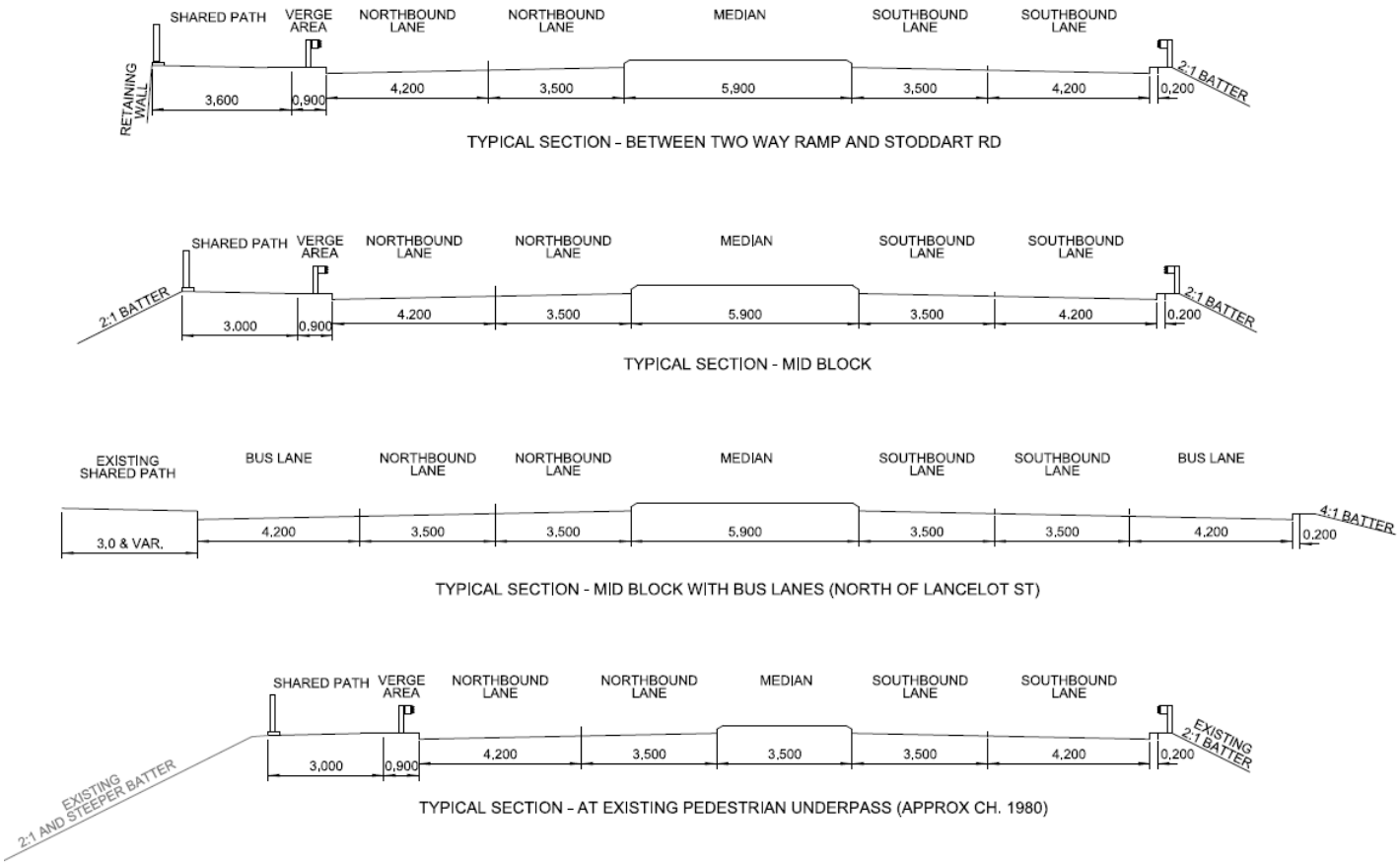


Figure 4.1: Typical sections

4.3 Staging of works

The proposed upgrade would be constructed along the existing Prospect Highway corridor with the exception of the two way link road and the auxiliary works on the Great Western Highway to connect the two way link road. The preliminary strategy for construction staging was prepared by Roads and Maritime. The period of construction is anticipated to be two years.

Table 4.1 summarises the stages of construction. The construction staging strategy and methodology would be developed further during the detail design phase.

Table 4.1: Construction staging strategy

Construction stage	Description of construction activity
Stage 1	▪ Construct temporary pavement within existing median and roundabout at the intersection of Prospect Highway / Reconciliation Road / Reservoir Road. ▪ Construct the northbound carriageway, west of the existing Prospect Highway corridor between Reconciliation Road and Blacktown Road. ▪ Construct the southern side of Reservoir Road up to Picrite Close, west of the Prospect Highway / Reconciliation Road intersection. ▪ Construct the proposed two span bridges over the M4 Western Motorway and Great Western Highway, west of the existing bridges. ▪ Construct the new two way link road. ▪ Construct the median on the Great Western Highway, west of the Prospect Highway corridor. ▪ Additional staging at the intersection of Reservoir Road / Picrite Close would be required to maintain all movements at the intersection during stage 1 works.
Stage 2	▪ Switch traffic onto the newly constructed northbound carriageway between Reconciliation Road and Blacktown Road. ▪ Switch traffic onto the southern side of Reservoir Road, west of the Prospect Highway / Reconciliation Road intersection. ▪ Open the two way link road to traffic. ▪ Construct the southbound carriageway. ▪ Additional staging at the intersections of Prospect Highway / Reservoir Road / Thornley Road, Prospect Highway / M4 Western Motorway westbound exit ramp, Prospect Highway / M4 Western Motorway eastbound entry ramp, Prospect Highway / two way link road and Prospect Highway / Stoddart Road would be required to maintain all movements at the intersection during stage 2 works.
Stage 3	▪ Open both the northbound and southbound carriageways to traffic. ▪ Reconstruct temporary pavement on the northbound Prospect Highway carriageway, for a length of about 120 metres north of Reservoir Road. ▪ Additional staging at the intersections of Prospect Highway / Reservoir Road, Prospect Highway / M4 Western Motorway westbound entry ramp, Prospect Highway / M4 Western Motorway eastbound exit ramp, Prospect Highway / Harrod Street and Prospect Highway / Blacktown Road would be required to maintain all movements at the intersection during stage 3 works.

Construction stage	Description of construction activity
Stage 4	▪ Construct the northbound carriageway between Lancelot Street and St Martins Crescent. ▪ Construct about 30 metres of temporary pavement of the existing southbound shoulder, south of Vesuvius Street to strengthen the pavement for traffic. ▪ Reduce the width of the existing left turn bay into the child care centre. ▪ Remove existing pedestrian crossing on Prospect Highway, south of Keyworth Drive. ▪ Relocate existing northbound bus stop, north of Keyworth Drive to temporary verge area. ▪ Divert Tudor Avenue traffic to Keyworth Drive. ▪ Remove the existing northbound bus stop north of Tudor Avenue.
Stage 5	▪ Construct the southbound carriageway between Lancelot Street and St Martins Crescent. ▪ Replace existing informal service road with formal property accesses, west of the Prospect Highway corridor. ▪ Divert Vesuvius Street traffic to alternative route via Blacktown Road. ▪ Temporarily remove the southbound bus stop north of Keyworth Drive. ▪ Temporarily remove the southbound bus stop adjacent to Roger Place. ▪ Relocate southbound bus stop north of Tudor Avenue, about 50 metres south.

5. TRANSPORT APPRAISAL

5.1 Public transport

Traffic modelling of existing public bus routes (700, 800 and 812) was undertaken to assess the ability of the proposed upgrade to support public transport. The modelling of bus performance considered the following factors:

- Buses would dwell at all bus stops, including new bus stops when modelling the proposed upgrade.
- Buses would stop at all existing bus stops and not stop at the new bus stops in the do nothing scenario.
- Buses would travel and accelerate / decelerate slower than modelled light vehicles.
- Buses would travel in accordance with traffic signal phasing. Bus priority phasing of traffic signals was not considered in this study.

Tables 5.1, 5.2 and 5.3 summarise the results of the bus operations under the do nothing and proposed upgrade scenarios for 2018, 2028 and 2038 respectively. The results indicate that:

- In the AM peak, bus travel speeds and travel times improve in all forecast years with the proposed upgrade compared with the do nothing scenario.
- In the PM peak, the bus travel speeds and travel times improve for the majority of bus routes along the proposal corridor. Bus route 812 is the exception, which has travel times increasing by up to one minute and the average travel speed reducing slightly in both directions in 2018 and in the southbound direction in 2028 and 2038.

The proposed road upgrade includes additional bus stops and changes to the road corridor which impact bus travel patterns. The majority of the additional travel time is caused at the southern extent of the proposal with the new bus stops requiring additional dwell times compared to the do nothing scenario, which does not factor the additional dwell time.

Table 5.1: 2018 modelled bus travel times

		AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
812 NB	**Average of speed (km/h)**	28	38	29	26
	Sum of travel time (min)	8.6	6.2	8.2	9.1
812 SB	**Average of speed (km/h)**	11	37	37	32
	Sum of travel time (min)	22.8	6.4	6.4	7.4
700/800 NB	**Average of speed (km/h)**	24	28	21	28
	Sum of travel time (min)	9.9	8.5	11.6	8.2
700/800 SB	**Average of speed (km/h)**	10	35	30	34
	Sum of travel time (min)	24.5	6.8	8.0	7.0

Table 5.2: 2028 modelled bus travel times

		AM		PM	
		Do nothing	**Upgrade**	**Do nothing**	**Upgrade**
812 NB	**Average of speed (km/h)**	18	22	10	15
	Sum of travel time (min)	13.3	10.8	26.9	16.2
812 SB	**Average of speed (km/h)**	7	20	26	21
	Sum of travel time (min)	34.6	11.9	9.2	11.4
700/800 NB	**Average of speed (km/h)**	14	15	15	16
	Sum of travel time (min)	17	16.2	16.2	15
700/800 SB	**Average of speed (km/h)**	4	14	14	16
	Sum of travel time (min)	60	17	17.1	14.8

Table 5.3: 2038 modelled bus travel times

		AM		PM	
		Do nothing	**Upgrade**	**Do nothing**	**Upgrade**
812 NB	**Average of speed (km/h)**	11	22	5	12
	Sum of travel time (min)	21.7	10.8	47.6	19.9
812 SB	**Average of speed (km/h)**	6	20	25	20
	Sum of travel time (min)	39.7	11.6	9.5	11.6
700/800 NB	**Average of speed (km/h)**	13	16	13	17
	Sum of travel time (min)	18.3	14.9	18.3	14
700/800 SB	**Average of speed (km/h)**	4	15	12	16
	Sum of travel time (min)	59.6	15.9	20.2	14.9

Figure 5.1 illustrates the modifications to the existing bus stop locations resulting from the proposal. The key features of the proposed bus stop arrangement are:

- Two new bus stops (one each direction) are proposed adjacent to the intersection of Prospect Highway / Reservoir Road / Reconciliation Road.
- The existing northbound bus stop adjacent to Stoddart Road is proposed for relocation to north of Harrod Street.
- The existing northbound bus stops north of Keyworth Drive and north of Tudor Avenue are proposed to be relocated from the existing informal service road to the shared user path within the proposal corridor.
- The existing northbound and southbound bus stops north of St Martins Crescent, adjacent to the St Martins Village shopping centre and pedestrian link on the eastern side of the Prospect Highway, respectively would be relocated south towards St Martins Crescent intersection.

The proposed bus stop locations provide the Prospect Highway corridor with additional bus stops to service Wet ‘n’ Wild Sydney. The removal of the northbound bus stop at Stoddart Road would be replaced by the bus stop north of Harrod Street, which is less than 150 metres from the existing bus stop, resulting in an appropriate walking distance for passengers currently using the existing bus stop.

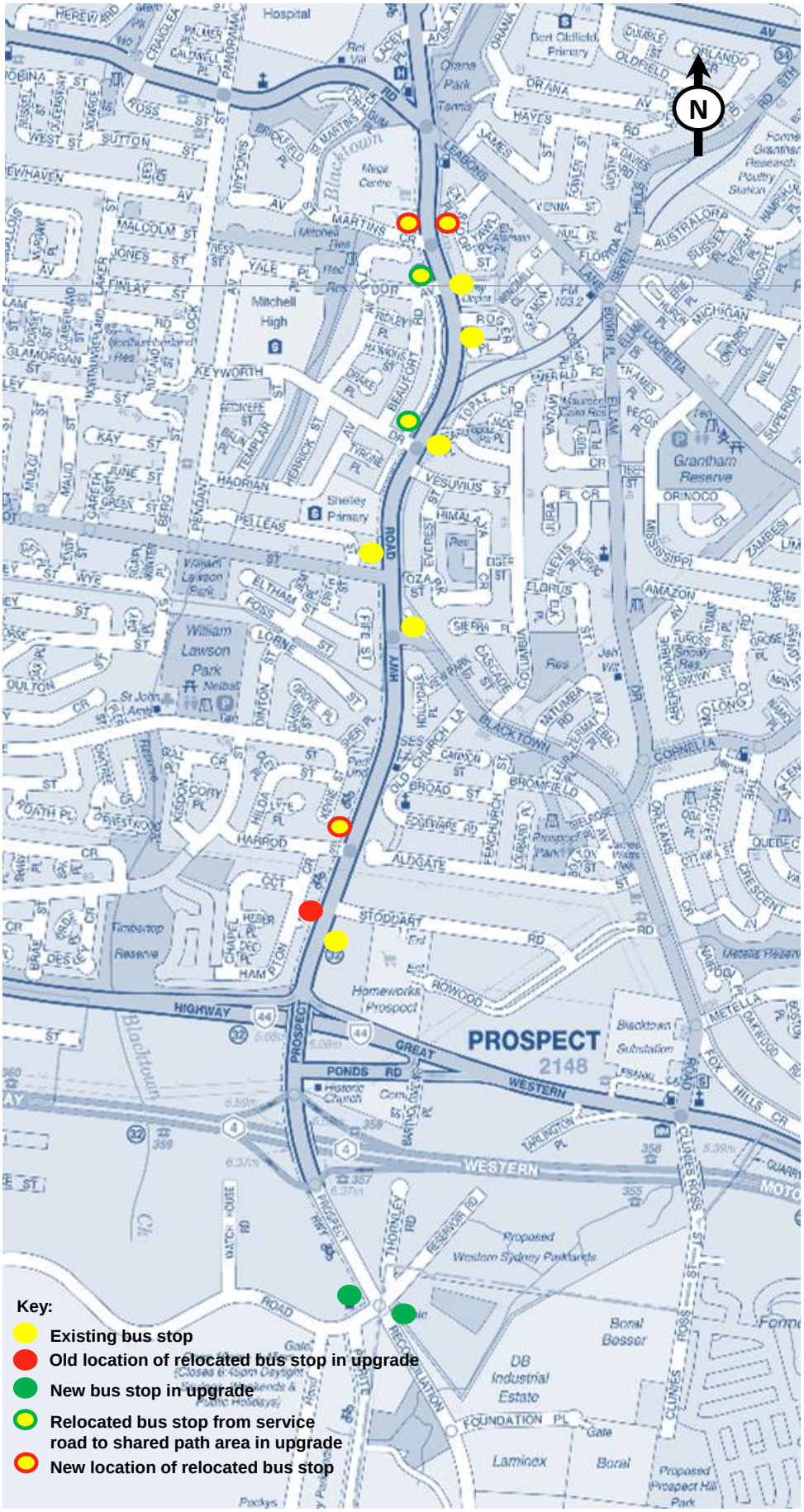


Figure 5.1: Proposed bus stop locations

5.2 Walking and cycling

Pedestrian crossings would be provided at the new signalised intersection of Prospect Highway / Reservoir Road / Reconciliation Road, facilitating pedestrian movements between the proposed bus stops as well as pedestrian access to Wet 'n' Wild Sydney.

The proposal includes upgrading the temporary shared path between the M4 Western Motorway westbound exit ramp and Harrod Street and realigning the existing footpath between Harrod Street and Blacktown Road to accommodate the proposed road alignment and provide connectivity with the proposed pedestrian crossing south of the Prospect Highway / Blacktown Road intersection. A new pedestrian path is proposed between Keyworth Drive and Roger Place on the eastern side of the Prospect Highway.

A signalised pedestrian crossing of the Prospect Highway is proposed on the northern side of the Stoddart Road intersection connecting Stoddart Road and the southbound bus stop with the proposed shared user path on the western side of the Prospect Highway corridor. This is an improvement on the existing arrangement at Prospect Highway / Stoddart Road, which has no pedestrian or cyclist crossing facilities.

Signalised pedestrian crossings are proposed on all arms of the Prospect Highway / Harrod Street intersection. This is an improvement to the existing arrangement, which has crossings on the northern arm and across Harrod Street.

A signalised pedestrian crossing is proposed on the southern arm of the Prospect Highway / Blacktown Road intersection. This is an improvement to the existing arrangement, which has no signalised pedestrian crossings of the Prospect Highway corridor at this intersection.

For the new signalised intersections, the following exemptions have been granted for provision of pedestrian crossings on particular approaches:

- Eastern approach of the Prospect Highway / Reservoir Road intersection: The north eastern corner of the intersection contains steep grades. There is no desire for pedestrians to cross along the eastern side of the road and travel north along the Prospect Highway.
- Northern approach of the Prospect Highway / Reservoir Road intersection: There is no desire to cross Prospect Highway and access the eastern side of the corridor, since the shared user path is provided on the western side of the Prospect Highway.
- Southern, eastern and northern approaches of the M4 Western Motorway westbound ramps: The terrain on the eastern side of the corridor is steep, isolated and the road is controlled access. No pedestrian crossings are currently provided on these intersection approaches, which were recently constructed.
- Southern, eastern and northern approaches of the M4 Western Motorway eastbound ramps: The terrain on the eastern side of the corridor is steep, a retaining wall is proposed adjacent to the entry ramp with no pedestrian provisions. The M4 Western Motorway and the Prospect Highway are controlled access corridors with no development anticipated on the eastern side of the corridor.
- Southern, eastern and northern approaches of the Prospect Highway / two-way link road intersection: The terrain on the eastern side of the road is steep with

embankments leading to the home base centre. No pedestrian access is provided to the home base fronting the Prospect Highway. The existing Great Western Highway overbridge is narrow with no pedestrian desire line on either side. Therefore there is no requirement for pedestrians to cross from the western to the eastern side of the Prospect Highway. The proposed bridge would have a shared path on the western side of the Prospect Highway only.

- Northern approach of the Prospect Highway / Stoddart Road intersection: The adjacent 132 kV Endeavour Energy stanchion would be located within six metres of the proposed kerb. As a condition of the development of the proposed Prospect Highway upgrade, Endeavour Energy's asset would be protected with crash barriers to prevent errant vehicles from colliding with the electrical stanchion. The proposed Type F concrete barrier would extend south from the electrical stanchion to midway through the Stoddart Road intersection. Pedestrians would not be able to traverse the barrier for its length.
- Southern approach of the Prospect Highway / Harrod Street intersection: There is no existing crossing. To ensure the safety of pedestrians conflicting with unopposed right turning vehicles the existing situation has been retained as part of the proposal. There are two crossings of Prospect Highway servicing the same desire line within 180 metres of this intersection. The location of signal posts would be located for the possible future provision of a crossing of the southern approach of the intersection.
- Great Western Highway / two-way link road intersection: No crossings would be provided at this new signalised intersection. There is no development fronting the Great Western Highway since it is a controlled access road, with a high speed environment and steep terrain approaching the Prospect Highway bridge abutments. There is no desire for pedestrians to walk along the two-way link road or the Great Western Highway.

In summary, the proposal would improve pedestrian and cyclist connectivity and amenity along the Prospect Highway corridor, providing safer crossing provisions at signalised intersections and implementing additional shared user path facilities.

5.3 Freight transport

There would be no impacts to the existing B-double and 4.6 metre high vehicle route network surrounding the Prospect Highway corridor. The proposal is likely to improve safety and travel times along the Prospect Highway corridor. Additionally, the additional lane in each direction provides opportunities for vehicles to pass slower moving heavy vehicles on the corridor.

5.4 Road safety

The road safety of the Prospect Highway corridor is likely to improve in the following examples:

- Vehicles entering the Prospect Highway from Ponds Road are required to find gaps in the southbound traffic on the Prospect Highway to turn left. Under the proposal, the signalised intersection at the Prospect Highway and the new two way link road

creates gaps for traffic turning left out of Ponds Road, which could potentially reduce the number of crashes recorded at this intersection.

- Head-on collisions (accounting for 2.7 per cent of crashes between 2008 and 2012) would be reduced with the introduction of the divided carriageway.
- The introduction of signals at Stoddart Road would control right turn movements from the Prospect Highway, allowing sufficient green time for vehicles to turn and reducing the length of queues for this movement. During the site investigation it was observed that drivers became impatient and frequently turned right into Stoddart Road within small gaps in southbound Prospect Highway traffic. The introduction of traffic signals would reduce the high concentration of crashes at this intersection.
- The pedestrian underpass of the Prospect Highway between Old Church Lane and Keyne Street would be upgraded to incorporate Crime Prevention through Environmental Design principles as far as practicable to improve user safety. The existing pedestrian underpass is poorly lit with minimal passive surveillance.
- Additional signalised pedestrian crossings are proposed along the Prospect Highway corridor, which facilitate safe crossing opportunities to connect pedestrians between residential areas, bus stops and shared user path facilities.
- The revised access arrangements at the intersections of the Prospect Highway with Vesuvius Street, Roger Place and Tudor Avenue remove vehicles turning right from the minor approaches across the Prospect Highway traffic. This potentially reduces the occurrence of drivers becoming impatient and turning within insufficient gaps.

There is one outstanding safety issues identified with the current design of the proposal, including:

- There is a short distance between Ponds Road and M4 Western Motorway eastbound entry ramp. Under the proposal, southbound traffic is required to select the left lane to enter the M4 Western Motorway eastbound entry ramp at this location. This presents a potential weave conflict between vehicles entering from Ponds Road to travel southbound on Prospect Highway and southbound traffic on the Prospect Highway accessing the M4 Western Motorway eastbound entry ramp. This is expected to be address during the detail design with the development of an appropriate guide sign strategy.

6. TRAFFIC ASSESSMENT

6.1 Consequence of do nothing

As presented in Section 2.5.1 Mid-block capacity, the volume / capacity ratios on the Prospect Highway corridor at two key locations under the existing conditions indicate that the volumes are at or over capacity in both peaks.

The results of the do nothing scenario provided in Section 3.6.1 Network performance indicate that an increasing number of vehicles (flow) into the future years would result in a substantial increase in the delay experienced on the network, particularly in 2038. The AM model experiences substantial delays during the first two future years 2018 and 2028, primarily in the southbound direction, resulting from the limited capacity of the roundabout at the eastbound M4 Western Motorway ramps. This creates a queue in the southbound direction that eventually reaches the north end of the model including the local roads to the east of the corridor.

The PM peak models operate relatively smoothly in both peaks during the 2018 and 2028 future years, however in 2038 the flow breaks down and forms severe congestion throughout the model.

The results of the do nothing scenario provided in Section 3.6.3 Intersection performance, indicate that a significant number of intersections operate at an unacceptable level of service of E or worse by 2028, which indicates the requirement for the proposed upgrade before 2031.

6.2 Preliminary construction impacts

6.2.1 Construction methodology

The construction staging strategy and methodology would be developed in more detail during the detail design phase. The overall construction activities for the proposal include:

- Site establishment:
  - Set out.
  - Establishment of site compounds.
  - Implementation of environmental safeguards, including temporary erosion, sediment and water quality controls.
- Site preparation:
  - Implementation of traffic control.
  - Clearing and grubbing of vegetation.
  - Stripping and stockpiling of topsoil.
  - Demolition of existing pavement.

- Utilities adjustment.

- Earthworks:
  - Cuttings.
  - Fill embankments.
- Drainage:
  - Cross drainage works.
  - Corridor drainage.
  - Construction of culverts.
- Structures:
  - Foundation works for bridges and retaining walls.
  - Bridge over the M4 Western Motorway.
  - Bridge over the Great Western Highway.
- Pavement works:
  - Preparation of subgrade.
  - Construct new pavement.
- Other works:
  - Landscaping.
  - Safety barriers.
  - Lighting, signposting and delineation.
- Finishing works:
  - Removal of temporary works.
  - Restore and landscape temporary stockpiling and compound sites.
  - Restoration of local roads.

Section 4.3 Staging of works, summarises the preliminary construction staging strategy developed by Roads and Maritime.

6.2.2 Construction hours

The construction hours are expected to be 7am to 7pm on Mondays to Fridays and 8am to 3pm on Saturdays.

6.2.3 Plant and equipment

The plant and equipment required for the proposal would be determined during the detail design and construction phases. The likely equipment required during construction for various activities is summarised in Table 6.1.

Table 6.1: Plant and equipment requirements

Activity	Description of construction activity
Site establishment	▪ Fences. ▪ Sheds. ▪ Fuel storage tanks. ▪ Plant parking areas. ▪ Equipment storage areas.
Site preparation	▪ Excavators. ▪ Scrapers. ▪ Graders. ▪ Dozers. ▪ Backhoes. ▪ Trenchers. ▪ Trucks. ▪ Wood chipping / mulching machines. ▪ Hand tools.
Earthworks	▪ Dozers. ▪ Scrapers. ▪ Water carts. ▪ Compactors. ▪ Rollers. ▪ Trucks.
Drainage	▪ Excavators. ▪ Backhoes. ▪ Drills. ▪ Trucks.
Structures	▪ Piling rigs. ▪ Cranes. ▪ Concrete trucks. ▪ Trucks. ▪ Concrete pumps.
Pavement works	▪ Concrete trucks. ▪ Loaders. ▪ Concrete agitator trucks. ▪ Concrete saws. ▪ Asphalt paver. ▪ Rollers. ▪ Milling machine. ▪ Concrete pumps.

Activity	Description of construction activity
	▪ Kerb extending machine. ▪ Trucks.
Other works	▪ Delineation plant. ▪ Graders. ▪ Backhoes. ▪ Trucks. ▪ Water carts. ▪ Compactors. ▪ Bitumen sprayers. ▪ Rollers.
Finishing works	▪ Trucks. ▪ Road sweepers.

The period of construction is anticipated to be two years. Truck movements during the construction phase are likely to increase by an average of 40 and up to 80 truck movements per day during peak construction periods. The heavy and light vehicle movements associated with the construction phase would be confirmed during the detail design and construction planning stage of the proposal. Based on the traffic surveys conducted on the Prospect Highway corridor in October 2013, the existing heavy vehicle volumes are about 4,500 vehicles per weekday south of Blacktown Road and 3,600 vehicles per weekday north of the Prospect Highway and Blacktown Road intersection. Therefore, the additional peak heavy vehicle movements associated with construction would not have a substantial impact on existing heavy vehicle volumes.

6.2.4 Worksite access, compound and stockpile locations

Figure 6.1 illustrates the proposed site compound and stockpile locations. Each site would be used as a site compound and stockpile location to service various stages of construction, with the exception of the site located adjacent to Thornley Road, which would only be used as a stockpile location.

Direct access at each of the site compound and stockpile location would be provided with adequate sight distances relating to the posted road speed. This would allow vehicles on the main road to see vehicles emerging from the ancillary facilities and would allow ample room to slow down and stop if necessary. Similarly, it would allow vehicles waiting to emerge from the site access, adequate sight distance to see approaching vehicles and determine acceptable gaps for them to enter the main road traffic.

Left-in / left-out only access would be provided at the entry and exit points to site compound and stockpile locations. Sufficient turning provisions would be provided within site to allow construction vehicles to enter and exit the access in the forward direction. Each site compound and stockpile location would generally employ a traffic controller at the access to manage vehicular traffic into and out of each site and guide pedestrians crossing the site accesses.

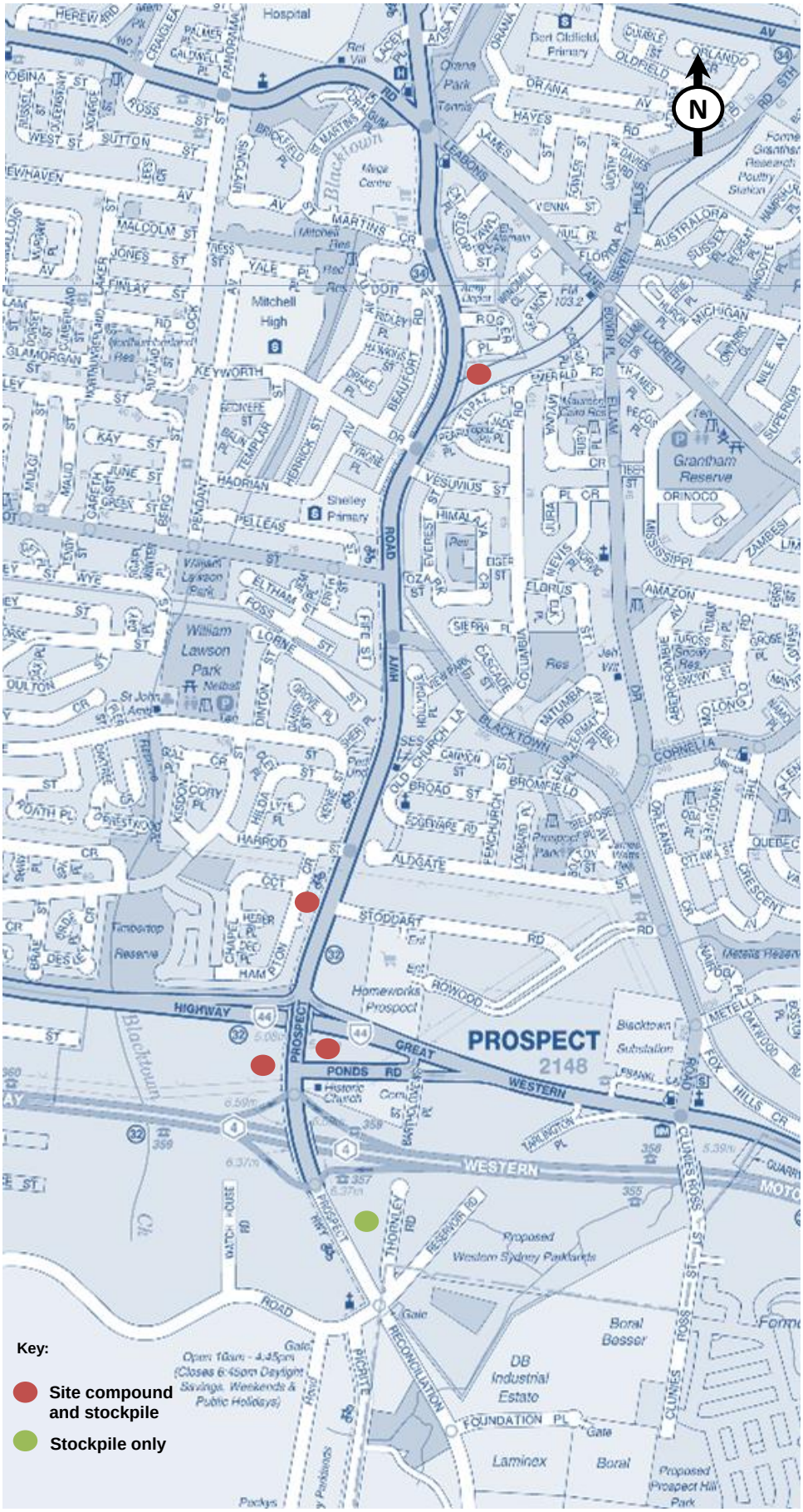


Figure 6.1: Proposed site compound and stockpile locations

6.2.5 Property and local access

Under the construction staging strategy developed by Roads and Maritime, access to existing properties along the Prospect Highway corridor would be maintained during all stages of construction, detailed as follows:

- During stages one to three works, property accesses are not impacted by construction.
- During stage four works, access to the properties located on the western side of the Prospect Highway corridor would be maintained by providing temporary access via the existing informal service road, with the exception of the existing driveway to the Shelley Public School waste collection.
- During stage five works, access to the properties on the eastern side of the eastern side of the Prospect Highway corridor would be maintained by providing temporary access through the works area. In this stage of works, the left turn lane into the Blacktown Road Children's Centre would be narrowed and access to this property would be provided under traffic control to maintain safety for vehicles entering and exiting the site.

During stage four works, the garbage collection site for Shelley Public School currently accessed via the informal service road would need to be temporarily relocated. A temporary location would be identified with the school. However, a temporary garbage collection site could potentially be established within the school grounds.

Local road access is likely to be impacted during construction as follows:

- During stages one to three works, access to all movements into and out of local roads would be maintained.
- During stage four works:
  - The radii for turning manoeuvres into and out of Keyworth Drive are likely to be reduced.
  - Traffic accessing Tudor Avenue is likely to be detoured to Keyworth Drive.
  - Existing access to all other local roads would be maintained.
- During stage five works:
  - Traffic accessing Vesuvius Street is likely to be detoured via Blacktown Road, Columbia Road, Ellam Drive, Emerald Road and Leabons Lane.
  - Intersection works at Roger Place would be staged so that access is maintained.

6.2.6 Bus services

A number of bus stops are likely to be relocated or removed during the construction, namely:

- Relocate existing northbound bus stop, north of Keyworth Drive to temporary verge area (stage four).
- Remove the existing northbound bus stop north of Tudor Avenue (stage four).
- Temporarily remove the southbound bus stop north of Keyworth Drive (stage five).
- Temporarily remove the southbound bus stop adjacent to Roger Place (stage five).
- Relocate southbound bus stop north of Tudor Avenue, about 50 metres south (stage five).

The existing northbound bus stop north of Tudor Avenue has adjacent bus stops located about 200 metres north and 400 metres south, which are appropriate walking distances to bus services. Therefore, the impact of removing the northbound bus stop north of Tudor Avenue is not substantial.

The existing southbound bus stop north of Keyworth Drive has an adjacent bus stop located about 400 metres south, which is an appropriate walking distances to bus services. Therefore, the impact of temporarily removing the northbound bus stop north of Keyworth Drive is not substantial.

The existing southbound bus stop at Roger Place would have an adjacent bus stop located about 130 metres north (relocated southbound bus stop north of Tudor Avenue), which is an appropriate walking distances to bus services. Therefore, the impact of temporarily removing the northbound bus stop at Roger Place is not substantial.

During construction buses would continue to use the Prospect Highway corridor. Apart from removal and relocation of bus stops, the impacts on bus services during construction are likely to result from decreased travel speeds.

6.2.7 Pedestrians and cyclists

Pedestrian and cyclist access would be maintained or alternative routes provided throughout the construction phase. Provisions for pedestrian and cyclist access to Shelley Public School, Blacktown Children's Centre and bus stops would be maintained for all stages of construction.

Pedestrians would be separated from the works areas with appropriate control measures. The temporary pedestrian and cyclist access arrangements would be determined in the detail design and construction planning phases of the proposal.

6.2.8 Traffic management

The design of the proposal and associated construction staging would be developed to maintain existing road capacity throughout the construction phase, minimising the restrictions to existing traffic movements where possible. The number of traffic switches would be minimised to reduce the impacts and disruption to general traffic.

6.3 Operational impacts

6.3.1 Mid-block volume capacity

Table 6.2 outlines the volume and volume-capacity ratio on the Prospect Highway at two key locations. It shows that the volumes are over capacity in almost all do nothing future years and peaks. However, under the proposed upgrade scenarios, the volume-capacity ratios are reduced substantially. The highest ratio in the proposed upgrade scenarios is the 2038 AM peak at the Prospect Highway, north of the Great Western Highway, which has a volume capacity ratio of 0.7, which indicates that there is some spare capacity.

Table 6.2: Forecast mid-block capacity

Location	Direction	AM				PM			
		Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio
		2018 - Do nothing		2018 - Upgrade		2018 - Do nothing		2018 - Upgrade	
Prospect Highway, north of Great Western Highway	Northbound	1,660	1.4	1,720	0.7	1,490	1.2	1,530	0.6
Prospect Highway, north of Great Western Highway	Southbound	1,090	0.9	1,680	0.7	1,060	0.9	1,040	0.4
Blacktown Road, south of Roger Place	Northbound	1,370	1.1	1,430	0.6	1,530	1.3	1,410	0.6
Blacktown Road, south of Roger Place	Southbound	660	0.5	1,450	0.6	1,090	0.9	1,270	0.5
		2028 - Do nothing		2028 - Upgrade		2028 - Do nothing		2028 - Upgrade	
Prospect Highway, north of Great Western Highway	Northbound	1,710	1.4	1,820	0.8	1,270	1.1	1,510	0.6
Prospect Highway, north of Great Western Highway	Southbound	1,040	0.9	1,710	0.7	910	0.8	840	0.3
Blacktown Road, south of Roger Place	Northbound	1,380	1.1	1,540	0.6	1,310	1.1	1,390	0.6

Location	Direction	AM				PM			
		Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio	Traffic volume (vehicles)	Volume capacity ratio
Blacktown Road, south of Roger Place	Southbound	530	0.4	1,410	0.6	940	0.8	1,210	0.5
		2038 - Do nothing		**2038 - Upgrade**		**2038 - Do nothing**		**2038 - Upgrade**	
Prospect Highway, north of Great Western Highway	Northbound	1,740	1.4	2,090	0.9	1,490	1.2	1,640	0.7
Prospect Highway, north of Great Western Highway	Southbound	890	0.7	2,020	0.8	1,310	1.1	1,280	0.5
Blacktown Road, south of Roger Place	Northbound	1,370	1.1	1,770	0.7	1,360	1.1	1,420	0.6
Blacktown Road, south of Roger Place	Southbound	370	0.3	1,680	0.7	1,200	1.0	1,470	0.6

6.3.2 Intersection performance

The future year AIMSUN models (AM and PM peak hours) have been used to assess the intersection performance at each intersection along the proposal corridor with the proposed upgrade. The signal optimisation process was primarily focused on the 2038 future year scenario, which has the most traffic on the network. In this instance, each site was optimised in the AM and PM peak to minimise queues based on a visual inspection of the model's operation. The interim years were modelled subsequent to the optimisation conducted for the 2038 models, using the 2038 optimised signal timings. The signalised intersections for the interim years were further optimised to reduce excessive queuing observed.

The volume and delay for each turning movement has been recorded in the AIMSUN model. The level of service has been calculated based on the Roads and Maritime method of delay. Tables 6.3 and 6.4 provide a summary of each intersection overall performance for AM peak hour and PM peak hour. For signalised intersections the delay is a measure of the average delay across all of the movements, and the level of service is based on the average delay. For unsignalised intersections including roundabouts, the delay and level of service represent the delay and level of service for the worst movement through the intersection. The worst movement for the unsignalised intersections is indicated in brackets.

The results show that all of the intersections operate at an acceptable level of service D or better with the proposed upgrade.

Queues in the models are not able to be readily and accurately recorded, which is typical of most micro-simulation models. Instead, queues throughout the model are observed during the running of the model and reported qualitatively.

Observation of the operation of the 2038 AM peak model showed that for a majority of turning movements the queues are adequately contained within the turning lanes provided, or clear within a single traffic signal cycle, with the exception of:

- Prospect Highway/ M4 Western Motorway westbound ramps, north approach, right turn. Vehicles fill up the 200 metre double turn lane pocket and occasional overflow into the southbound through lanes.
- M4 Western Motorway westbound entry ramp, ramp meter. Vehicles fill up the 240 metre double turn lane storage, but do not overflow into the intersection of the Prospect Highway.
- Prospect Highway/ M4 Western Motorway eastbound ramps, west approach. Queues of about 200 metres, but they do not extend back onto the M4 Western Motorway, which is 500 metres from the intersection.
- Prospect Highway/ M4 Western Motorway eastbound ramps, south approach, right turn. Vehicles fill up the 200 metre double turn lane pocket but do not overflow into the northbound through lanes.
- Blacktown Road/ Bungarribee Road, south approach, right turn. Not all vehicles make it through in one traffic signal cycle, but the queues do not extend beyond the 125 metre auxiliary lane.

Observation of the operation of the PM peak model showed that for a majority of turning movements the queues are adequately contained within the turning lanes provided, or clear within a single traffic signal cycle, with the exception of:

- Prospect Highway/ Reservoir Road, south approach, through movement. As discussed above, there are queues at this location because the capacity of the two through lanes does not meet the demand. On rare occasions, the queue is exacerbated by the downstream queuing at the intersection of the M4 Western Motorway westbound ramps not clearing adequately.
- Prospect Highway/ M4 Western Motorway westbound ramps, south approach, left turn. Vehicles queue to get onto the westbound entry ramp and occasionally the queue black the through lanes at the Reservoir Road intersection.
- M4 Western Motorway westbound entry ramp. Vehicles fill up the 240 metre double turn lane storage but queues form because of the narrowing of the downstream ramp to one lane.
- Blacktown Road/ Bungarribee Road, east approach, through movement. Not all vehicles make it through in one traffic signal cycle, but the queues do not extend beyond 150 metres.

Table 6.3: Future intersection operation with proposed upgrade, AM peak

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
Prospect Highway / Reservoir Road	2018	2,290	10	A
	2028	3,870	17	A
	2038	4,540	19	B
Prospect Highway / M4 Western Motorway westbound ramps	2018	3,370	23	B
	2028	4,610	27	B
	2038	5,410	35	C
Prospect Highway / M4 Western Motorway eastbound ramps	2018	3,090	14	A
	2028	4,550	19	B
	2038	5,430	37	C
Prospect Highway / Ponds Road	2018	570	0	A (east left)
	2028	2,080	6	A (east left)
	2038	2,440	9	A (east left)

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
Great Western Highway / two way link road	2018	3,040	20	B
	2028	3,380	22	B
	2038	3,880	31	C
Prospect Highway / Great Western Highway ramps	2018	2,570	20	B
	2028	4,030	31	C
	2038	4,680	52	D
Prospect Highway / Stoddart Road	2018	2,640	5	A
	2028	3,530	7	A
	2038	4,110	11	A
Prospect Highway / Harrod Street	2018	2,610	6	A
	2028	3,330	11	A
	2038	3,860	19	B
Prospect Highway / Blacktown Road	2018	3,030	11	A
	2028	3,570	13	A
	2038	4,280	19	B
Blacktown Road / Lancelot Street	2018	2,760	9	A
	2028	3,340	11	A
	2038	4,000	17	B
Blacktown Road / Vesuvius Street	2018	1,320	9	A (east left)
	2028	1,650	12	A (east left)
	2038	2,030	16	B (east left)
Blacktown Road / Keyworth Drive	2018	2,770	8	A
	2028	3,090	10	A
	2038	3,660	15	B

Intersection	Year	Total Vehicles	Average Delay (sec)	Average level of service
Blacktown Road / Roger Place	2018	2,740	10	A (east left)
	2028	2,960	11	A (east left)
	2038	3,440	12	A (east left)
Blacktown Road / Tudor Avenue	2018	1,490	11	A (west left)
	2028	1,580	17	B (west left)
	2038	1,810	18	B (west left)
Blacktown Road / St Martins Crescent	2018	3,040	13	A
	2028	3,140	13	A
	2038	3,670	18	B
Blacktown Road / Bungarribee Road	2018	3,830	30	C
	2028	3,910	31	C
	2038	4,440	39	C
Leabons Lane / Ellam Drive	2018	2,810	31	C
	2028	1,700	29	C
	2038	2,080	20	B

Table 6.4: Future intersection operation with proposed upgrade, PM peak

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
Prospect Highway / Reservoir Road	2018	2,290	10	A
	2028	2,880	12	A
	2038	6,190	37	C
Prospect Highway / M4 Western Motorway westbound ramps	2018	3,370	23	C
	2028	3,790	27	C
	2038	8,340	51	D

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
Prospect Highway / M4 Western Motorway eastbound ramps	2018	3,090	23	B
	2028	3,420	27	B
	2038	7,810	52	D
Prospect Highway / Ponds Road	2018	570	0	A(north through)
	2028	860	1	A (north through)
	2038	1,850	1	A (east left)
Great Western Highway / two way link road	2018	3,040	20	B
	2028	3,210	21	B
	2038	6,990	41	C
Prospect Highway / Great Western Highway ramps	2018	2,570	20	B
	2028	2,840	22	B
	2038	6,530	45	D
Prospect Highway / Stoddart Road	2018	2,640	20	B
	2028	2,400	22	B
	2038	6,330	43	D
Prospect Highway / Harrod Street	2018	2,610	6	A
	2028	2,390	7	A
	2038	6,280	28	B
Prospect Highway / Blacktown Road	2018	3,030	11	A
	2028	2,870	14	A
	2038	7,290	24	B
Blacktown Road / Lancelot Street	2018	2,760	9	A
	2028	2,640	10	A

Intersection	Year	All Vehicles	Average Delay (sec)	Average level of service
	2038	6,340	19	B
Blacktown Road / Vesuvius Street	2018	1,320	9	A (east left)
	2028	1,240	11	A (east left)
	2038	3,130	19	B (north through)
Blacktown Road / Keyworth Drive	2018	2,770	8	A
	2028	2,730	9	A
	2038	6,160	16	B
Blacktown Road / Roger Place	2018	2,740	10	A (east left)
	2028	2,670	9	A (east left)
	2038	6,030	34	C (north left)
Blacktown Road / Tudor Avenue	2018	1,490	11	A (west left)
	2028	1,440	10	A (west left)
	2038	3,140	25	B (south through)
Blacktown Road / St Martins Crescent	2018	3,040	13	A
	2028	2,990	17	B
	2038	6,800	27	B
Blacktown Road / Bungarribee Road	2018	3,830	30	C
	2028	3,920	31	C
	2038	8,620	51	D
Leabons Lane / Ellam Drive	2018	2,810	31	C
	2028	2,670	29	C
	2038	5,580	54	D

6.3.3 Local access

Residential access

The proposed upgrade project results in reduced access to three side streets due to the presence of a median without median breaks:

- Vesuvius Street, right turn in and right turn out not available.
- Tudor Avenue, right turn in and right out not available.
- Roger Place, right turn out not available.

The right turn into Roger Place has been maintained as part of the proposal, due to no viable diversion for banning the right turn movement into Roger Place. The right turn out of Roger Place has been banned since it is unsafe for vehicles to turn right across three lanes of traffic under the proposed arrangement. There are viable alternative routes for vehicles currently turning right out of Roger Place under the proposed upgrade.

The AIMSUN model has been used to measure the effects on drivers who would otherwise have used the blocked movements to reach their destination. The nature of the road network and travel demand matrix meant that two movements could be explicitly measured, while all other movements either contained no vehicles, or were part of too many origin-destination pairs to accurately measure their effect. It is noted that in reality a small number of residents currently perform these manoeuvres. The movements that were explicitly measured are:

- Right turn out of Vesuvius Street.
- Right turn in to Tudor Avenue.

The change in average trip distance and trip time has been recorded for these two movements across each future year and peak period. The results are shown in Tables 6.5, 6.6 and 6.7 for the 2018, 2028 and 2038 forecast years, respectively.

The results show that for the right turn into Tudor Avenue, vehicles have to travel further to reach their destination. This corresponds to a delay of less than one minute in the PM peak, however since the do nothing scenario in the AM peak has severe congestion in the southbound direction a substantial reduction in travel time is realised.

The results show that for the right turn out of Vesuvius Street, vehicles have to drive further to reach their destination. This corresponds to a delay of less than one minute in the PM peak, however since the do nothing scenario in the AM peak has severe congestion a substantial reduction in travel time is realised.

The residential properties with existing accesses on the eastern side of the Prospect Highway would no longer have direct access with the northbound carriageway of the Prospect Highway, due to the introduction of a central median. The worst case would be for properties on the southern corner of an intersecting local road, which would experience the greatest additional travel distance.

The impacts on local residents resulting from the proposal would be offset by the benefits of improved travel times and speeds along the Prospect Highway corridor.

The properties on the western side of the Prospect Highway, which currently have driveway accesses onto the informal service road and cannot directly turn right into or out of the Prospect Highway to access their properties. Therefore, the access arrangements for the properties on the western side of the Prospect Highway will not be changed from existing conditions under the proposed arrangement.

Based on these results, the blocking of a number of turns due to the median does not have a substantial negative impact when compared with the do nothing scenario.

Table 6.5: 2018 Impacts to vehicles from blocked medians

		AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Right turn into Tudor Avenue	Travel time (min)	14.0	3.5	2.7	2.9
Right out of Vesuvius Street	Travel time (min)	10.0	4.3	4.0	4.2

Table 6.6: 2028 Impacts to vehicles from blocked medians

		AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Right turn into Tudor Avenue	Travel time (min)	23.1	3.5	2.5	2.9
Right out of Vesuvius Street	Travel time (min)	23	4.2	3.8	4.6

Table 6.7: 2038 Impacts to vehicles from blocked medians

		AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Right turn into Tudor Avenue	Travel time (min)	23.1	4.8	2.5	2.9
Right out of Vesuvius Street	Travel time (min)	23	5.4	3.8	4.6

Parking

A number of vehicles currently use the informal service road for parking to access the residential properties along the Prospect Highway corridor. Traffic surveys commissioned by SMEC indicate that up to five vehicles park within the existing informal service road access the residential properties on the western side of the Prospect Highway.

All the properties located along the existing informal service road have off-street parking provisions. Additionally, the surrounding local roads have unrestricted kerbside parking provisions. During the site investigations conducted, the local roads were observed to have sufficient capacity to accommodate the five additional vehicles for parking.

There were not observed to be any residents parking on the eastern side of the Prospect Highway. All the properties located along the eastern side of the Prospect Highway have off-street parking. Additionally, the surrounding local roads have unrestricted kerbside parking provisions.

The eastern side of the Prospect Highway corridor, north of Vesuvius Street is currently being used as an informal car sales yard with about 15 vehicles observed to be parked in this location. These vehicles are parked illegally on Roads and Maritime land. These cars would be required to move under the proposed upgrade. This is considered to be a negligible impact.

Shelley Public School access

Shelley Public School parents currently use the existing informal service road to pick-up and set-down students who access the school via the rear emergency access gate located on the northern boundary of the school.

Under the proposal, the informal service road would not be available to use as a pick-up and set-down location for the school and alternative school accesses would need to be utilised.

Shelley Public School has two accesses on Hadrian Avenue and Pelleas Street that could be used by vehicles currently using the informal service road. The surveys commissioned by SMEC include surveys of the two alternative accesses.

A review of other schools in the Blacktown area was conducted to determine the number of students and aerial photography was used to determine the number of accesses. Shelley Public School has 584 students enrolled. In comparison, Blacktown South Public School has 802 students and appears to have only one access for pick-up and set-down of students.

SMEC commissioned surveys to be conducted of the pick-up and set-down arrangements of Shelley Public School to quantify the number of students currently using the informal service road as an access to the school. The survey results revealed that up to 26 vehicles parked during school pick-up periods and 13 vehicles parked during school set-down periods, north and south of the school gate on the Prospect Highway informal service road. These vehicles could be accommodated within Hadrian Avenue and Pelleas Street with the implementation of a school pick-up and set-down

zone. Roads and Maritime would discuss this with Blacktown Council and Shelley Public School.

Medlife Medical Centre access

A review of Blacktown City Council's development control plans, the medical centre is required to provide off-street parking spaces at a rate of two spaces per surgery plus one space per employee. For a medical centre with only one surgery, a minimum of four off-street parking spaces is to be provided.

Based on a review of the Medlife Medical Centre's website, there appears to be two doctors working at the centre. Assuming that each doctor has a separate surgery and one administration staff is employed at the centre, the development control plan requires at least five off-street parking spaces. Use of the informal service road for parking provisions for the centre would not be permitted by Roads and Maritime or Blacktown City Council.

The surveys commissioned by SMEC observed that up to eight vehicles parked within the informal service road adjacent to the Medlife Medical Centre to access to the medical centre at a given time. Assuming that five off-street parking spaces are provide within the Medlife Medical Centre premises in accordance with Blacktown City Council's development control plans, parking for additional three vehicles could be accommodated within the surrounding local road network.

6.3.4 Network performance

Tables 6.8 and 6.9 show the network performance characteristics for the future do nothing and proposed upgrade model scenarios in the AM and PM peaks, respectively.

2018 results

The 2018 results show that the proposal reduces delay and VHT in both the AM and PM peak hours. This is because the do nothing scenario in the AM and PM peak hours experiences severe congestion in the southbound direction, and the proposal addresses this problem. The number of unreleased vehicles is substantially reduced from do nothing with the proposed upgrade during the AM and PM peak hours, with the AM peak hour indicating no vehicles unreleased.

2028 results

The 2028 results show a similar pattern to 2018 in that the AM and PM peak hours is improved under the proposal. The number of unreleased vehicles is substantially reduced from do nothing with the proposal in the AM and PM peak hours, with the AM peak hour indicating negligible vehicles unreleased and the PM peak with 429 unreleased vehicles. In reality, the unreleased vehicles would enter the network within the extended peak period and would not be stuck outside the network waiting to get to their destination.

2038 results

The 2038 results show that the AM and PM peak hours is improved under the proposal. The number of unreleased vehicles is substantially reduced from do nothing with the proposal in the AM and PM peak hours, with the AM peak hour indicating negligible vehicles unreleased and the PM peak with 512 unreleased vehicles. In reality, the unreleased vehicles would enter the network within the extended peak period and would not be stuck outside the network waiting to get to their destination.

Table 6.8: Network performance, AM peak

	Do nothing			Upgrade		
	Cars	**Trucks**	**Buses**	**Cars**	**Trucks**	**Buses**
2018						
Total VHT (hr)*	1,066	96	2	751	70	2
Total VKT (km)*	38,107	2,816	27	40,475	3,171	36
Total released vehicles	16,370	1,240	20	16,620	1,310	20
Total unreleased trips	470	60	<10	0	0	0
Total stops	19,060	1,660	80	10,990	970	60
2028						
Total VHT (hr)*	1,322	116	5	873	81	4
Total VKT (km)*	42,571	3,089	42	46,407	3,581	59
Total released vehicles	18,380	1,380	20	19,010	1,490	30
Total unreleased trips	1020	100	10	<10	0	<10
Total stops	24,550	2,110	130	13,240	1,200	120

	Do nothing			Upgrade		
	Cars	**Trucks**	**Buses**	**Cars**	**Trucks**	**Buses**
2038						
Total VHT (hr)*	1,719	158	6	1,109	106	5
Total VKT (km)*	42,732	3,043	46	51,805	4,147	81
Total released vehicles	18,990	1,410	30	21,580	1,740	40
Total unreleased trips	2,750	300	20	<10	0	<10
Total stops	32,400	2,890	180	19,420	1,760	180

*Note: The VHT and VKT take into account blocked vehicles on the network. Under the proposed upgrade scenario the VKT and VHT are higher as a result of more vehicles entering the network due to decreases in congestion.

Table 6.9: Network performance, PM peak

	Do nothing			Upgrade		
	Cars	Trucks	Buses	Cars	Trucks	Buses
2018						
Total VHT (hr)*	798	48	2	562	35	2
Total VKT (km)*	37,422	2,003	39	39,746	2,255	52
Total released vehicles	16,780	920	20	17,030	920	20
Total unreleased trips	140	10	0	70	10	0
Total stops	17,540	900	80	20,510	2,920	160
2028						
Total VHT (hr)*	1,006	56	4	673	32	3
Total VKT (km)*	35,997	1,826	56	39,214	2,269	78
Total released vehicles	16,110	820	30	16,660	1,090	30
Total unreleased trips	830	50	<10	430	30	<10
Total stops	17,860	850	120	11,310	600	60

	Do nothing			Upgrade		
	Cars	Trucks	Buses	Cars	Trucks	Buses
2038						
Total VHT (hr)*	1,561	89	6	1,007	60	4
Total VKT (km)*	38,320	2,072	72	46,457	2,824	127
Total released vehicles	17,260	930	40	19,620	1,060	40
Total unreleased trips	3,350	180	10	510	30	<10
Total stops	26,270	1,340	170	18,270	980	150

*Note: The VHT and VKT take into account blocked vehicles on the network. Under the proposed upgrade scenario the VKT and VHT are higher as a result of more vehicles entering the network due to decreases in congestion.

6.3.5 Travel speeds and time

Tables 6.10 to 6.12 show the modelled travel time on the Prospect Highway corridor from Reservoir Road to Bungarribee Road, comparing the future do nothing scenarios with the proposed upgrade.

The results show that the proposal provides two to four minutes of travel time savings in the northbound direction in all future years. The travel time savings are very large in the southbound direction in the AM peak due to the severe congestion in the do nothing model. In the PM peak there are travel time savings of two to four minutes in the northbound direction and about one minute in the southbound direction.

Table 6.10: 2018 peak travel time on the Prospect Highway corridor

Direction	Measure	AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Northbound	**Travel Time (min)**	8	5	8	6
	Speed (km/h)	30	43	27	52
Southbound	**Travel Time (min)**	34	5	5	4
	Speed (km/h)	9	40	34	38

Table 6.11: 2028 peak travel time on the Prospect Highway corridor

Direction	Measure	AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Northbound	Travel Time (min)	10	6	10	6
	Speed (km/h)	25	42	21	50
Southbound	Travel Time (min)	44	5	5	6
	Speed (km/h)	7	38	50	39

Table 6.12: 2038 peak travel time on the Prospect Highway corridor

Direction	Measure	AM		PM	
		Do nothing	Upgrade	Do nothing	Upgrade
Northbound	Travel Time (min)	10	7	10	6
	Speed (km/h)	25	38	21	49
Southbound	Travel Time (min)	44	5	5	6
	Speed (km/h)	7	36	50	34

6.3.6 Induced traffic assessment

The impact of induced traffic is built into the process used for forecasting trip-making in the Prospect Highway corridor.

Induced traffic represents the increased traffic volumes that are observed after a new highway is opened or a previously congested highway is widened. Induced traffic is often used as a support to the argument that highway upgrades do not solve congestion problems because any increases in highway capacities are filled with additional traffic.

In metropolitan areas, new or widened highways attract trips that previously took other routes or travelled at other times. Improved congestion may also attract trips from public transport and trips may also be distributed to different, more distant destinations. In some cases, a new transport facility may affect the number of trips made, because trips are shortened and become easier to make.

Because SMEC used Roads and Maritime's strategic transport model as the basis for the trip matrices in the micro-simulation modelling, changes in route choice and mode choice are accounted for and the number of trips in the matrices for base case and upgrade case reflect changes in route choice and mode choice. The number of trips resulting from mode choice is likely to remain primarily unchanged, since public transport provisions in the study area are unlikely to change significantly. Table 6.14 shows the number of trips induced into the corridor for each peak hour and each forecast year.

Table 6.14: Traffic induced by the proposal in 2018, 2028 and 2038

	AM			PM		
	Base	**Upgrade**	**Induced**	**Base**	**Upgrade**	**Induced**
2018	17,030	17,200	170	16,720	17,040	320
2028	19,500	19,800	300	16,670	17,570	900
2038	21,430	22,120	690	19,700	20,810	1,110

These figures reflect the traffic induced into the study area primarily as a result of changed route choices and should not be confused with an increase in trip making that results directly from the provision of the proposed upgrade.

In the case of the Prospect Highway, the additional road capacity has a small impact on the travel times and then only in the local area. The reduction in travel times are unlikely to be large enough or provide enough benefits for trips travelling through the area to impact on the actual number of trips generated and the induced traffic on the roads would be negligible at best. At worst, they would be too small to account for within the limits of accuracy of forecasts.

In short, the area of influence of the proposal is too limited to encourage any increase in trip generation rates.

7. MITIGATION AND MANAGEMENT MEASURES

7.1 Construction phase

7.1.1 Property and local access

When developing a Traffic Management Plan, it is desirable to maintain pedestrian and vehicle access to adjoining properties throughout the duration of the work.

Properties impacted during construction (accesses or temporary local road closures) would be consulted prior to the commencement of construction and advised to use alternative routes during the construction period (for local road closures) and informed of access arrangements to their properties.

The maintenance access at Shelley Public School, currently accessed via the informal service road would need to be temporarily relocated. This would be addressed in consultation with Shelley Public School.

7.1.2 Bus services

In the case that bus stops require temporary relocation during construction a suitable location would be identified by the contractor. Consultation with affected bus operators would be undertaken in conjunction with any temporary bus stop relocations.

7.1.3 Pedestrians and cyclists

Appropriate signage and way finding provisions relating to changes to pedestrian and cyclist access would be developed and implemented.

Pedestrians are to be kept clear of work sites at all times. Work areas would be defined by plastic pedestrian fencing or more substantial fencing in urban or shopping areas.

Temporary footpaths need to be adequately signposted to indicate the direction of the footpath, be of all-weather standard, consist of equivalent material and performance to adjacent footpath and have an unobstructed width at local constrictions no less than one metre (elsewhere at least two metres).

Crossing facilities and associated signs are to be maintained where possible. If access to an existing crossing cannot be provided, alternative facilities as close as possible to established crossing are to be provided. Crossings where traffic is flowing temporarily in the opposite direction from normal, medians, refuges or other physical devices separate lanes of traffic flowing in the same direction are to be avoided.

Cyclists would be considered when providing lighting at night. Roadworks signs should be positioned above the head height of cyclists. Barrier boards should not be placed so that they direct cyclists away from allocated cycle paths. Adjacent to the work site, pavement surfaces should be maintained in a clean smooth state to ensure cyclist comfort and safety. The edges of temporary surfaces should be ‘feathered’ to remove any hazardous edges.

7.1.4 Traffic management

A range of mitigation and management measures would be needed to manage the impacts to traffic and transport during construction. These are:

- A construction traffic management plan would be prepared and implemented in accordance with the *Traffic Control and Worksites*, version 4.0 (Roads and Maritime, June 2010). The construction traffic management plan would enable the safe management of traffic, provide for the safety of construction personnel and minimise impacts on the local community. The plan should include:
  - Hours of haulage, which do not impose on peak periods and school drop-off and pick-up times.
  - Haulage routes, including the source locations and their access points for the site.
  - Design and construction of access points to the ancillary sites in accordance with Roads and Maritime and Council requirements.
  - Links to a community consultation plan that provides for local residents to be informed prior to and during construction activities. This could include a dedicated telephone contact line for community issues to be registered and addressed. The consultation plan would also include emergency services, bus operators, local business and other major stakeholders to inform them on changes in traffic management during construction.
  - The design of temporary works required to accommodate the heavy vehicle movements along the short sections of local roads required for access to ancillary sites.
  - Designated areas within the proposal area for heavy vehicle turning movements, parking, loading and unloading.
  - On-site parking arrangements for construction, supervisory and management personnel.
  - Sequence for implementing traffic works and traffic management devices.
  - Safety principles for construction activities, such as speed limits around the site and procedures for specific activities.
  - Induction requirements for construction, supervisory and management personnel.
  - Procedures for inspections and record keeping for maintaining traffic control measures.
- For each stage of construction, detailed Traffic Control Plans should be developed and implemented. These should be prepared in accordance with the Traffic Control and Worksites, version 4.0 (Roads and Maritime, June 2010) by suitably qualified personnel.

- Dilapidation surveys of roads around the proposal area should be undertaken prior to their use for construction as well as after construction is complete. Any damage to roads should be repaired.
- Direct access at each of the ancillary facilities frontages should be provided with adequate sight distances relating to the posted road speed. This would allow vehicles on the main road to see vehicles emerging from the ancillary facilities and would allow ample room to slow down and stop if necessary. Similarly, it would allow vehicles waiting to emerge from the site access, adequate sight distance to see approaching vehicles and determine acceptable gaps for them to enter the main road traffic.
- Construction sites and ancillary facilities should generally employ a traffic controller at the site access to manage the vehicular traffic into and out of each site and to manage pedestrian flows across the access.
- All vehicles accessing a construction site or ancillary facility for the purpose of material delivery and construction works should be fitted with safety flashing lights located on the top of the vehicle and functioning reverse beepers. All operators should be licensed for the particular item of plant/equipment, and should demonstrate competence in the use of the plant/equipment as part of the site management and safety plan.
- Only left-in / left-out movements should be provided at ancillary site accesses located on through-roads.
- Routes used for access and haulage during construction should be developed in consultation with relevant stakeholders upon confirmation of material source and disposal locations.
- Reduced temporary construction speed limits associated with traffic switches and temporary lane or road closures should be preferentially scheduled outside peak periods to reduce impacts on traffic on the road network.
- A temporary parking area at designated ancillary facilities should be provided for use by construction staff.
- Appropriate construction speed limits should be implemented in consultation with Roads and Maritime to facilitate safety of road users and construction personnel during construction.
- Traffic management plans should specifically address night works safety issues to protect motorists and construction personnel.
- Temporary accesses, ancillary site entrances and exits, road works and other traffic management measures should be designed and operated to conform with relevant road safety and Roads and Maritime requirements and should not impact upon the safety of the users of the existing road network.

7.2 Operational phase

7.2.1 Property and local access

The following mitigation and management measures would be implemented to minimise the impacts to properties and local access:

- The alternative access routes imposed by the proposal for Vesuvius Street, Roger Place and Tudor Avenue would be communicated to the residents impacted by the changes in access arrangements.
- Properties along the Prospect Highway would be provided with new formal accesses to the corridor, with left-in / left-out access only. The new accesses to properties should be provided to residents impacted in the detail design phase.
- Pick-up and set-down at Shelley Public School would be wholly in either Hadrian Avenue or Pelleas Street. To ease congestion on the roads around the school accesses, the implementation of a school pick-up and set-down zone would be considered. This program would be communicated to parents and guardians by the school's staff and enforced by Council officers or Police.
- The Medlife Medical Centre would require off-street parking to be provided within the existing site in accordance with Blacktown City Council development control plan requirements. The provision of this parking is part of the medical centre's development application requirements.

7.2.2 Bus services

Bus services under the proposal improve in all forecast years during the AM peak. In the PM peak, the bus travel speeds and travel times improve for the majority of bus routes along the proposal corridor. Bus route 812 is the exception, which has travel times increase by up to one minute and the travel speeds reduce in both directions in 2018 and in the southbound direction in 2028 and 2038. This is a result of the addition of a number of traffic signals to the bus route. While the bus lanes provide a delay free mid-block run, the traffic signals are the main cause of the delay. The impact of the introduction of traffic signals is proposed to be mitigated by monitoring the bus travel times and travel speeds and considering the implementation of bus jump starts at key intersections in the future if required.

7.2.3 Pedestrians and cyclists

The impacts on pedestrians and cyclists during operation are minimal with improvements to the pedestrian and cyclist network under the proposal.

7.2.4 Traffic management

The impacts on traffic management during operation are minimal with improvements to the network under the proposal. All traffic devices would be designed and implemented in accordance with current standards, Roads and Maritime and Council requirements.

8. SUMMARY AND RECOMMENDATIONS

The proposal primarily involves the upgrade of the Prospect Highway from an undivided two-lane road to a divided four-lane road between Reservoir Road at Prospect and 200 metres north of St Martins Crescent at Blacktown. The key features of the Prospect Highway proposal include:

- Two lanes in each direction with a central median between the Reservoir Road and Blacktown Road.
- Three lanes in each direction with a central median between Blacktown Road and 200 metres north of St Martins Crescent with dedicated kerbside bus lanes in both directions. The proposal ties into the existing configuration north of St Martins Crescent.
- Construction of two new bridge structures over the M4 Western Motorway and the Great Western Highway on the western side of the existing bridge structures.
- Construction of a new two way link road between the Great Western Highway and the Prospect Highway (replacing the Great Western Highway eastbound exit ramp).
- Upgrading four existing signalised intersections with Prospect Highway.
- Construction of five new signalised intersections.
- Conversion of three priority controlled intersections to left in and left out movements only at Ponds Road, Vesuvius Street and Tudor Avenue.
- Conversion of the existing priority controlled intersection of Roger Place / Prospect Highway to left in, right in and left out movements only.
- Relocation of five bus stops.
- Installation of two new bus stops (northbound and southbound adjacent to the intersection of the Prospect Highway / Reservoir Road / Reconciliation Road).
- Upgrade of the pedestrian underpass beneath the Prospect Highway linking Old Church Lane and Keyne Street.
- Upgrade of the temporary shared path between the M4 Western Motorway westbound exit ramp and Harrod Street.
- Realigning the existing footpath between Harrod Street and Blacktown Road.
- Provision of a footpath on the eastern side of the Prospect Highway between Keyworth Drive and Roger Place.

8.1 Mid-block performance and impacts

The volume / capacity ratio on the Prospect Highway indicates that the volumes are over capacity in almost all do nothing future years and peaks. However, under the proposed upgrade scenarios, the volume-capacity ratios are reduced substantially, with the highest ratio in the proposed upgrade scenarios is the 2038 AM peak at the Prospect Highway,

north of the Great Western Highway, which has a volume capacity ratio of 0.7. The result of the analysis of mid-block performance demonstrates that the Prospect Highway corridor improves substantially with the proposal under forecast traffic volumes, compared with the do nothing scenario (volume capacity ratio of up to 1.4) meeting the objective to provide increased capacity and improved performance for forecast traffic growth to 2031 along the corridor.

8.2 Intersection performance and impacts

The analysis of intersection performance with the proposed upgrade shows that all of the intersections operate at an acceptable level of service D or better during the AM and PM peak hours for all the forecast years. This is a significant improvement to the existing and do nothing scenarios, which have levels of service of E or worse for multiple intersections.

8.3 Other operational impacts

The access arrangements for the following local road intersections would be altered as a result of the proposal:

- Ponds Road would become left-in / left-out only.
- Vesuvius Street would become left-in / left-out only.
- Roger Place would become left-in / right-in and left-out only.
- Tudor Avenue would become left-in / left-out only.

An assessment of the impacts of the changed access arrangements was conducted and revealed that residents would be required to travel further to reach their destination. This corresponds to a delay of less than one minute in the PM peak, however, since the do nothing scenarios have severe congestion, a substantial reduction in travel time is likely to be realised for the residents impacted by the revised access arrangements due to the improvement in travel times on the Prospect Highway corridor.

Shelley Public School would no longer be able to use the informal service road as a pick-up and set-down location under the proposed upgrade. This would result in 13 to 26 additional vehicles using Hadrian Avenue and Pelleas Street to set-down and pick-up school children.

A small number of vehicles currently use the informal service road for parking to access the residential properties along the Prospect Highway corridor. Surveys commissioned by SMEC revealed that up to five vehicles use parking within the existing informal service road to access nearby residential properties. All the properties located along the existing informal service road and the Prospect Highway have off-street parking provisions. Additionally, the surrounding local roads on the eastern and western side of the Prospect Highway have unrestricted kerbside parking provisions. During the site investigations conducted, the local roads were observed to have sufficient capacity to accommodate the number of additional vehicles currently using the informal service road for parking.

In the AM peak hour, bus travel speeds and travel times improve in all forecast years with the proposal compared with the do nothing scenario. In the PM peak, the bus travel speeds and travel times improve for the majority of bus routes along the proposal corridor. Bus route 812 is the exception, which has travel times increase by up to one minute and the average travel speed reduce in both directions in 2018 and in the southbound direction in 2028 and 2038. The proposed road upgrade includes additional bus stops and changes to the road corridor which impact bus travel patterns. The majority of the additional travel time is caused at the southern extent of the proposal with the new bus stops requiring additional dwell times compared to the do nothing scenario, which does not factor the additional dwell time.

8.4 Preliminary construction traffic impacts

Truck movements during the construction phase are likely to increase by an average of 40, and up to 80 truck movements per day during peak construction periods. The heavy and light vehicle movements associated with the construction phase would be confirmed during the detail design and construction planning stage of the proposal. Based on the traffic surveys conducted on the Prospect Highway corridor in October 2013, the existing heavy vehicle volumes are about 4,500 vehicles per weekday south of Blacktown Road and 3,600 vehicles per weekday north of the Prospect Highway and Blacktown Road intersection. Therefore, the additional peak heavy vehicle movements associated with construction are not expected to have a substantial impact on existing heavy vehicle volumes.

Under the construction staging strategy developed by Roads and Maritime, access to existing properties along the Prospect Highway corridor would be maintained during all stages of construction.

During stage four works, the garbage collection site for Shelley Public School currently accessed via the informal service road would need to be temporarily relocated. A temporary location would be identified in consultation with the school.

Local road access is likely to be impacted during construction as follows:

- During stage four works:
  - The radii for turning manoeuvres into and out of Keyworth Drive are likely to be reduced.
  - Traffic accessing Tudor Avenue is likely to be detoured to Keyworth Drive.
- During stage five works:
  - Traffic accessing Vesuvius Street is likely to be detoured via Blacktown Road, Columbia Road, Ellam Drive, Emerald Road and Leabons Lane.

A number of bus stops are likely to be relocated or removed during the construction, namely:

- Relocate existing northbound bus stop, north of Keyworth Drive to temporary verge area (stage four).
- Remove the existing northbound bus stop north of Tudor Avenue (stage four).

- Temporarily remove the southbound bus stop north of Keyworth Drive (stage five).
- Temporarily remove the southbound bus stop adjacent to Roger Place (stage five).
- Relocate southbound bus stop north of Tudor Avenue, about 50 metres south (stage five).

The bus stops that are temporarily removed or relocated are within appropriate walking distance of 400 metres or less from the existing bus stop locations.

During construction buses would continue to use the Prospect Highway corridor. Apart from removal and relocation of some bus stops, the impacts on bus services during construction are likely to result from decreased travel speeds.

Pedestrian and cyclist access would be maintained or alternative routes provided throughout the construction phase. Provisions for pedestrian and cyclist access to Shelley Public School, Blacktown Children's Centre and bus stops would be maintained for all stages of construction.

8.5 Recommended mitigation and management measures

In summary, the proposed mitigation and management measures are presented in Table 8.1.

Table 8.1: Summary of mitigation and management measures

Mitigation and management measure	Detail design	Pre-construction	Construction	Operation
Develop a detailed Traffic Management Plan		✓		
Consult with properties impacted by access arrangement alterations	✓			✓
Temporarily relocate maintenance access at Shelley Public School			✓	
Consultation with bus operators for relocated or removed bus stops	✓			✓
Pedestrian and cyclist access (including crossing facilities) to be maintained and separated from works areas at all times			✓	
Relocate all pick-up and set-down arrangements at Shelley Public School to Hadrian Avenue and Pelleas Street			✓	✓
Monitor bus travel speeds along the Prospect Highway corridor and consider implementing bus jump start phasing at key signalised intersections.				✓

GLOSSARY

100 MVKM

100 million vehicle kilometres
This measurement is used for the number of crashes recorded along a given corridor, relative to the volume of traffic on the corridor and the length of the corridor analysed.

AADT

Annual Average Daily Traffic

AIMSUN

Micro-simulation traffic modelling software package

EMME

Strategic traffic modelling software package.

EP&A Act

Environmental Planning and Assessment Act 1979

EPROM

See erasable programmable read only memory

Erasable programmable read only memory

A type of memory chip that retains its data when its power supply is switched off. It houses the unique program that configures the traffic signal controller to a specific operational design of the intersection its controlling. This includes specifications of which signal groups run in each phase, the sequence of phases, detector functions, detector alarm conditions, conflict points and default time settings.

GEH

The GEH statistic is a self-scaling empirical statistic with similarities to a chi-squared test. The desired target for model calibration is to achieve a GEH value less than 5.0 at more than 85% of sites.

IDM

See intersection diagnostic monitor

Intersection diagnostic monitor

A software feature of SCATS that records (on demand) all of the key operating characteristics of a signalised site for a given time period. Data recorded includes individual and average cycle times, individual and average phase times and number of times a phase runs.

LGA

Local Government Area

LX File

The data file that feeds into the region computer for each signalised intersection. It contains the data necessary for communications, signal timings, intergreen intervals,

pedestrian walk and clearance timings, coordination values, flexilink data and variation routines.

PARAMICS

Micro-simulation traffic modelling software package

R^2

R-squared is a statistical measure of how close the data are to the fitted regression line. It is the percentage of the response variable variation that is explained by a linear model.

REF

Review of Environmental Factors

SCATS

See Sydney coordinated adaptive traffic system

SMEC

SMEC Australia Pty Ltd

Sydney coordinated adaptive traffic system

An intelligent transportation system developed in Sydney, Australia by former constituents of the Roads and Maritime Services in the 1970. SCATS primarily manages the dynamic (on-line, real-time) timing of signal phases at traffic signals, meaning that it tries to find the best phasing (i.e. cycle times, phase splits and offsets) for the current traffic situation (for individual intersections as well as for the whole network). This is based on the automatic plan selection from a library in response to the data derived from loop detectors or other road traffic sensors.

VHT

Vehicle hours travelled.

VKT

Vehicle kilometres travelled.

APPENDIX A: PEDESTRIAN AND CYCLIST FACILTY PHOTOGRAPHIC INVENTORY

Photo A1, shared user path adjacent to St Martins Village shopping centre, towards south

Photo A2, shared user path western side of Prospect Highway, towards south

Photo A3, shared user path, south of St Martins Crescent, towards south

Photo A4, concrete footpath eastern side of Prospect Highway, south of Harrod Street, towards south

Photo A5, pedestrian underpass entrance on western side of Prospect Highway, towards east

Photo A6, concrete footpath adjacent to Blacktown Road Children's Centre, towards north

Photo A7, shared user path on western side of Prospect Highway at the intersection with Keyworth Drive, towards south

Photo A8, concrete path between Prospect Highway and Tudor Avenue cul-de-sac, towards west

APPENDIX B:
MODEL CALIBRATION AND VALIDATION

APPENDIX C: CONCEPT DESIGN

APPENDIX D:
TRAFFIC VOLUME DATA

APPENDIX E: TRAFFIC SIGNAL DATA

APPENDIX F:
PREVIOUS MODELLING RESULTS