Doonside
Transport Management and Accessibility Plan

Bungarribee Precinct, Western Sydney Parklands

Landcom

7 August 2007

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Transport Management and Accessibility Plan

Prepared for

Landcom

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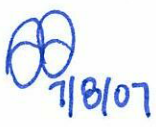
F	07/08/2007	Final Report (increase in lot yield)	Sigrid Sanderson Technical Director	

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Executive Summary

Maunsell has been commissioned by Landcom to prepare a Transport Management and Accessibility Plan (TMAP) for the Doonside residential site.

The site identified for development is currently vacant land located adjacent to Western Sydney Parklands, Doonside Road and Eastern Road. This report forms the second phase of the masterplanning process and follows earlier work undertaken by Maunsell to establish the existing position of the site and current traffic conditions in the area.

It is intended that this TMAP will to support a Part 3a application to the Department of Planning for rezoning of the site for residential uses. The TMAP will:

- Define the transport impacts stemming from development of the site; and
- Develop a package of measures that will assist in meeting the performance measures.

The recommendations of this study are reflected in the package of measures developed for the site which include:

- Provision of a vehicular site access at Doonside Road/ Eastern Road;
- Provision of a vehicular site access at Doonside Road/ Bungarribee Road;
- Provision of a vehicular site access at Doonside Road/ Douglas Road;
- Provision of connections to the existing and proposed cycle network, including two pelican crossings of Doonside Road in the vicinity of Birdwood Avenue and Bowes Place; and
- Personalised travel plans to promote sustainable travel, including incentives such as provision of a bicycle with every new residence.

1.0 Introduction

1.1 Study Purpose

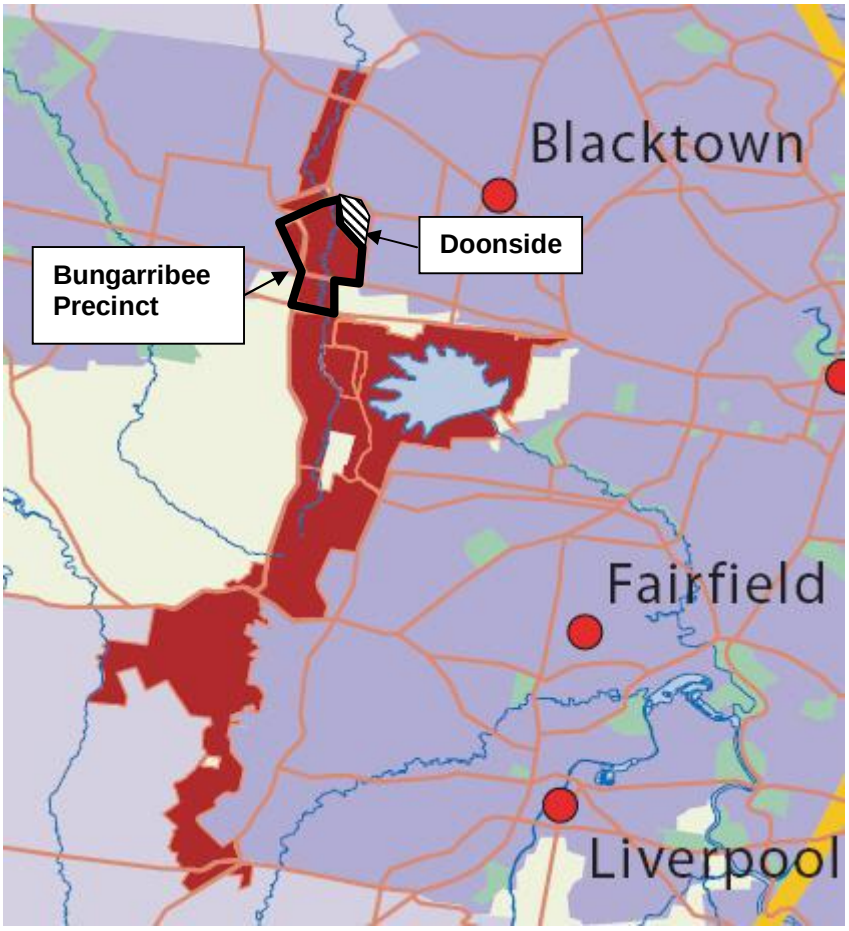
Maunsell has been commissioned by Landcom to prepare a Transport Management and Accessibility Plan (TMAP) for the Doonside site adjacent to the Bungarribee Precinct within the Western Sydney Parklands.

This report has been prepared in accordance with guidelines for TMAPs to support a Part 3a application to the Department of Planning for rezoning of the site for residential uses. This study builds on the Phase 1 analysis completed by Maunsell In January 2006, determining traffic issues that require consideration throughout the rezoning and master planning process and proposing appropriate mitigation measures for identified issues.

1.2 Background

Figure 1.1 illustrates the location of the Doonside site in relation to the Bungarribee Precinct and the Western Sydney Parklands as a whole.

Figure 1.1: Location of the Site in Relation to Western Sydney Parklands



Source: DIPNR, 2004

Phase 1 of the study determined that the majority of the existing transport network performs at an acceptable Level of Service, with the exception of the Doonside Road / Great Western Highway

intersection. Over the next 15 years it is expected that the region surrounding the study area will experience significant growth, resulting in increased transport demands. This would have a considerable impact on the performance of the existing road network.

Key recommendations identified in Phase 1 of the study, include:

- Further investigations to be undertaken to identify mitigation measures for the intersections that are forecast to experience reduced levels of service in the future. Consultation should be undertaken with the NSW Government to confirm proposals for such intersection improvements;
- Access arrangements should be confirmed with the assistance of other team members to minimise conflicts with flora, fauna and / or heritage constraints;
- The Ministry of Transport should be consulted as the sites are planned;
- Opportunities to integrate the sites with adjacent cycle routes and pedestrian paths should be investigated and confirmed with relevant planning authorities; and
- The constraints analysis will help to confirm the site yields, which will affect the traffic generation of the sites. Further traffic advice should also be provided into the site planning/master planning processes to ensure a high quality outcome.

Tasks undertaken in the preparation of this TMAP have addressed each of these recommendations.

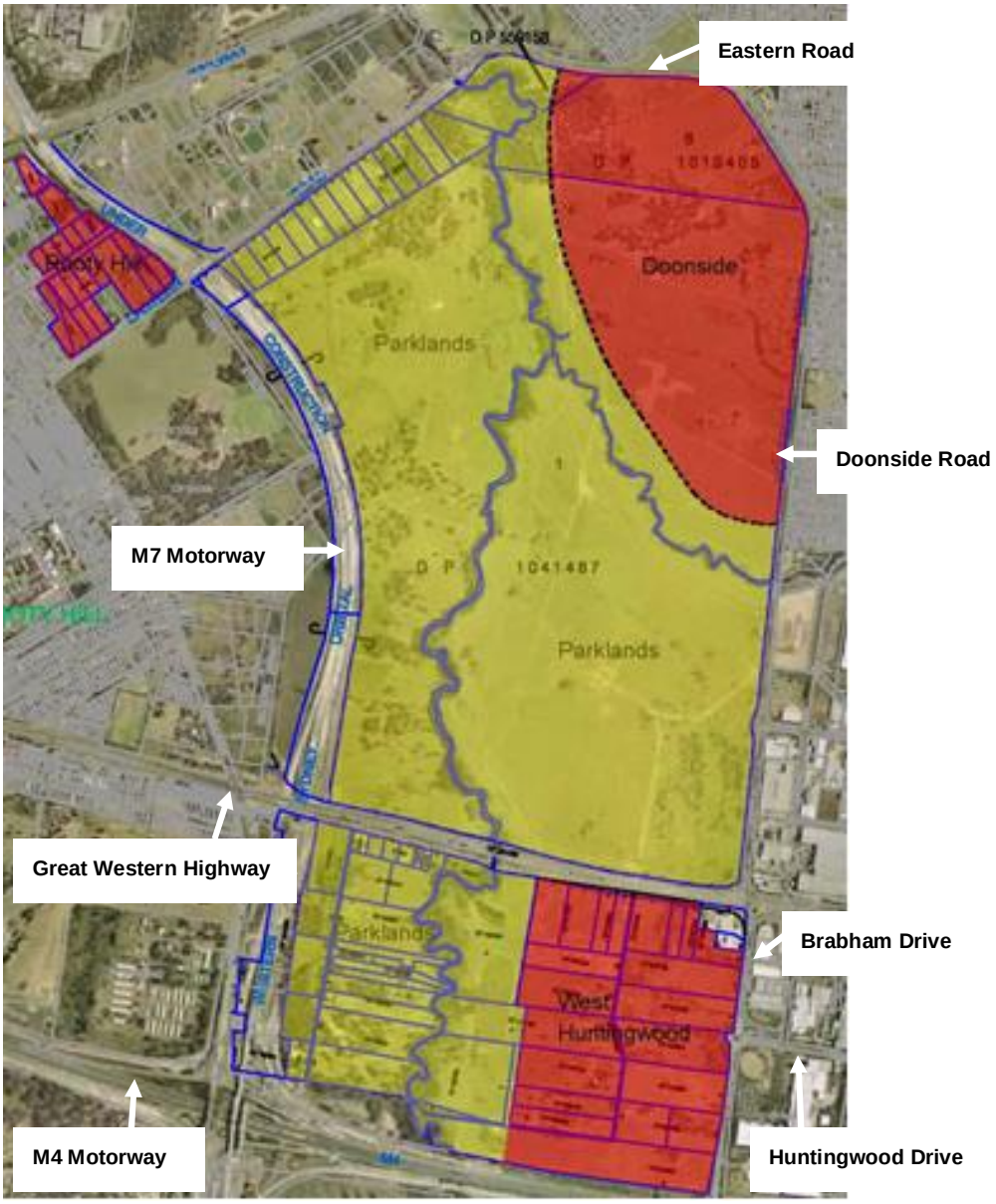
1.3 The Study Area

Figure 1.2 illustrates the position of both the Parklands Bungarribee Precinct and the Doonside residential site relative to the surrounding transport network. The precinct is located in Blacktown LGA.

The Doonside residential site is to the north east of the precinct, bordered by Doonside Road and Eastern Road. Doonside rail station is the nearest heavy rail station and is approximately 1 kilometre walk distance from the centre of the site.

The Huntingwood West industrial site is to the south east of the site and is bordered by the Great Western Highway, the M4 Motorway and Brabham Drive. The site is in close proximity to the Huntingwood industrial area which is located on the east side of Brabham Drive. The site is approximately 3.5 kilometres walk distance from Doonside rail station or approximately four kilometres from Rooty Hill rail station.

Figure 1.2: Location of the Site in Relation to the Local Transport Network



Source: Maunsell 2006

1.4 TMAP Process

This report forms the second stage of the TMAP process and is one of a series of supporting specialist studies being undertaken to support the development of a Masterplan and associated Development Control Plan for the Doonside residential site.

The framework for TMAPs is defined as having six stages:

a) Project Context – outline the strategic context, set objectives and targets / performance criteria (**Sections 2 and 3**);

b) The Project – describe the site and proposed development (**Section 4**);

c) Initial Transport Assessment – outline technical assumptions and assess existing travel patterns (**Section 5**);

d) Transport Assessment of Proposal – estimate travel demand and mode split (**Section 6**), capacity/policy implications, testing of options (**Section 7**);

e) TMAP and Agreement – confirmation of the package of measures (**Section 8**), costing and apportionment (**Section 9**); and

f) Review of TMAP and Agreement – this stage follows at time of development application and at an appropriate future date (usually in the order of two years). This stage is beyond the scope of this study.

2.0 Strategic Context

2.1 Introduction

The strategic context of the study area is governed by three frameworks, being:

a) State and Regional planning policies;
b) Local planning policies; and
c) The local transport context.

Figure 2.1: Site Location in the Regional Context

Source: UBD, 2005

This section provides an overview of the main aspects of each these frameworks and its relevance to the study area. A discussion of the objectives of the TMAP and targets / performance criteria is also provided.

2.2 State and Regional Context

Metropolitan Strategy

The Metropolitan Strategy for Sydney was released by the NSW Government in December 2005. *City of Cities — A Plan for Sydney's Future* is a broad framework for delivering strong and sustainable growth and to secure Sydney's place in the global economy.

The Plan is a strategic document that outlines a vision for Sydney over the next 25 years; the challenges we face, and the directions we will follow to address these challenges and to achieve the vision. It is the start of a process to bring the State Government, local government, stakeholders and the community together to discuss, review and then make decisions to guide the future of Sydney's economy, environment and communities

City of Cities — A Plan for Sydney's Future supports continuing economic growth while balancing social and environmental impacts. It is based on anticipated population, economic and demographic trends. The Plan has been developed with five aims that have been identified to achieve a more sustainable city. These are:

Enhance Liveability – by ensuring a diverse choice of housing for an ageing and changing population, close to services, while protecting the character of our suburbs and communities.

Strengthen Economic Competitiveness – strengthening Sydney's long–term economic prosperity by increasing the city's and region's competitiveness in globalised markets, and sharing the benefits across the city.

Ensure Fairness – providing fair access to jobs, services and lifestyle opportunities by aligning services close to where people live, and by providing access to high quality transport.

Protect The Environment – protecting Sydney's unique environmental setting and reducing the city's use of natural resources and production of waste.

Improve Governance – improving the quality of planning and decision making, and giving the community confidence in its institutions.

The Strategy includes priorities for planning and responsibilities of each level of Government, including investment priorities and a context for decision-making by Local Government and the private sector. The Strategy is not a single policy document, but rather a dynamic action strategy based on a series of key directions – including the announced Land Releases in North West and South West Sydney, Centres Renewal, Key Corridor Revitalisation Plans (Parramatta Road, Sydney Airport – CBD), Metropolitan Water Plan, Rail Clearways and Bus Reform.

Funding is integral to the planning of the new metropolitan strategy. The Government is committed to identifying innovative sources of funding to pay for the infrastructure required to support the growth of the region. The funding and apportionment of the package of measures identified through this TMAP process is discussed in more detail in **Section 9**.

The systematic release of land in the South West and North West growth centres aims to increase the quality of the growth areas by encouraging a mix of land uses and hence improving the accessibility of residents to amenities and employment. This in turn would contribute to achieving ecologically sustainable development (ESD) objectives.

The proposed planning for these release areas proposes to provide:

- Improved public transport, including frequent buses linking with the rail system. Proposals in the North West sector include the duplication of the Richmond railway line to Schofields, which will commence in the first five years of the release of the Metropolitan Strategy;
- A range of land uses to provide the right mix of houses, jobs, open and recreational space and green spaces;
- Easy access to major town centres with a full range of shops, recreational facilities and services along with smaller village centres and neighbourhood shops;
- Employment opportunities available locally and within the region, reducing the demand for transport services into the Sydney CBD and reducing travel times;
- Streets and suburbs, which are planned so that residents can walk to shops for their daily needs;
- A wide range of housing choices to provide for varying needs and incomes. Single residential dwellings on their own block of land will be provided as well as smaller, lower maintenance homes, units and terraces for older people and young singles or couples; and
- Conservation land in and around the development sites will help to protect the region's biodiversity and provide clean air for Western Sydney.

Rail Clearways Plan

The Rail Clearways Plan is a NSW Government initiative to improve the reliability of the CityRail network. The program of works to separate Sydney rail routes into five clearways will be completed by 2010 at an estimated cost of one billion dollars. By removing the congestion in the network that causes delays, CityRail will be able to operate more reliable and frequent services with reduced passenger crowding, with the capacity to increase services as demand grows into the future.

As mentioned within the Metropolitan Strategy summary, a specific project that may benefit passengers travelling on the Western Line and catching a train from Blacktown, Doonside or Rooty Hill is the Quakers Hill to Schofields duplication. The Western Line Richmond branch is a single track route and therefore suffers congestion. A double track will be constructed by 2010 to improve reliability and reducing passenger crowding.

Action for Bikes

Action for Bikes 2010 was released in September 1999 as an accompanying document to Action for Transport 2010. Action for Bikes seeks to increase levels of cycling in Sydney through a four step plan that includes improving the bike network, making it safer to cycle, improving personal and environmental health, and raising community awareness.

A key innovation of Action for Bikes is the development of rail trails, such as the Liverpool-Parramatta rail trail, by the RTA in co-operation with rail agencies.

Draft SEPP 66: Integrating Land Use and Transport

The release of a draft State Environmental Planning Policy (SEPP) on integrated land use and transport planning in 2001 is indicative of the Government's heightened focus on this issue. It is likely that increasing densities, providing public transport, walking and cycling infrastructure and developing travel demand management programs will be critical in the delivery of the Metropolitan Strategy.

The policy represents an integrated approach to urban management and transport planning and is particularly relevant to the future development of the Bungarribee Precinct. The package emphasises the importance of effectively integrating land use and transport planning in order to improve urban environments.

Review of Bus Services in New South Wales ('Unsworth' Review)

The stated objective of the Unsworth Review was "to examine, and make recommendations to improve, the provision of bus services in New South Wales."

The main outcomes of the Review were recommendations for changes to bus operations and licensing (bus reform), contract boundaries and a network of strategic corridors between Centres. The strategic routes will be 'fast, frequent, direct, convenient' links to regional centres. Bus priority measures are suggested to reach these goals but are subject to benefit / cost analysis.

Four routes were included to link Blacktown to other major centres as follows:

- 1 Penrith – Blacktown (northern route)
- 2 Penrith – Blacktown (southern route)
- 3 Blacktown – Castle Hill
- 4 Blacktown – Parramatta

None of these strategic routes will pass directly by the Doonside site, although preliminary planning undertaken by the MoT for feeder routes in the area includes a route from Blacktown to Rooty Hill and

Mount Druitt that services Bungarribee Road, Doonside Road and Eastern Road. Public consultation for and detailed planning of these routes is scheduled during 2007/8.

State Infrastructure Strategy

The State Infrastructure Strategy marks a new direction for the planning and delivery of infrastructure in the next 10 years for New South Wales's six broad regions — Sydney, the Central Coast, the Hunter, the Illawarra and the South East, the North Coast and Inland New South Wales.

In the 2006-07 financial year, the New South Wales Government will invest almost $10 billion in infrastructure, 32% of which will be transport related. Over the next four years it will increase the State's capital spend by 45 per cent over the previous four years. This record investment is about delivering infrastructure for New South Wales that sets it up to manage its projected population growth. The Strategy is explicitly designed to meet the growing demand for infrastructure, which will remain at very high levels over the next decade as the population grows.

The State Infrastructure Strategy also marks a new direction by linking the four year Budget cycle and the 25 year regional plans, including the Sydney Metropolitan Strategy. Furthermore, the integrated nature of this Strategy will allow the private sector, public sector agencies, local councils and the wider community to make decisions based on the NSW Government's priorities and timing for major infrastructure projects.

These infrastructure priorities illustrate the connections between infrastructure planning and long–term planning strategies, including:

- Sydney Metropolitan Strategy — City of Cities;
- A Plan for Sydney's Future;
- Metropolitan Water Plan 2006;
- North West and South West Growth Centres; and
- Draft Regional Strategies for the Far–North Coast, Lower Hunter and the South Coast.

2.3 Local Planning Context

Historical Development

The Western Sydney Parklands encompass the former Eastern Creek, Horsley Park and Hoxton Park open space / special uses corridors, identified in the Sydney Region Outline Plan (SROP) of 1968. The SROP predicted that the required amount of open space would triple by the end of the century, which led to a significant program to acquire 15,000 hectares of open space in Sydney.

In 1974 the boundaries of the Eastern Creek and Hoxton Park corridors were confirmed and controls on the lands in local planning schemes were introduced. The Department of Planning and its predecessors were given the responsibility to acquire the parklands, which would provide a physical break from surrounding development. The parklands were acquired for environmental protection and for major public utilities and special uses in Western Sydney.

By 1978 about 70 percent of the Western Sydney Parklands corridor was publicly owned. In 1989 the area around Eastern Creek was gazetted under State of Environmental Planning Policy (SEPP) No. 29 - Western Sydney Recreation Area, which led to the approval of Eastern Creek Raceway. A number of sporting facilities are located within the parklands, which were constructed for the 2000 Sydney Olympic Games, for the rowing, shooting, equestrian, baseball, softball and mountain biking events.

The Sydney Regional Environmental Plan (SREP) No. 31 was produced in response to the sudden residential development encroaching on the boundaries of the parklands' corridor. SREP 31 considers issues associated with balancing and evaluating development within the parklands, providing the framework to balance the wide range of land use objectives.

SEPP 59 and the Major Projects SEPP

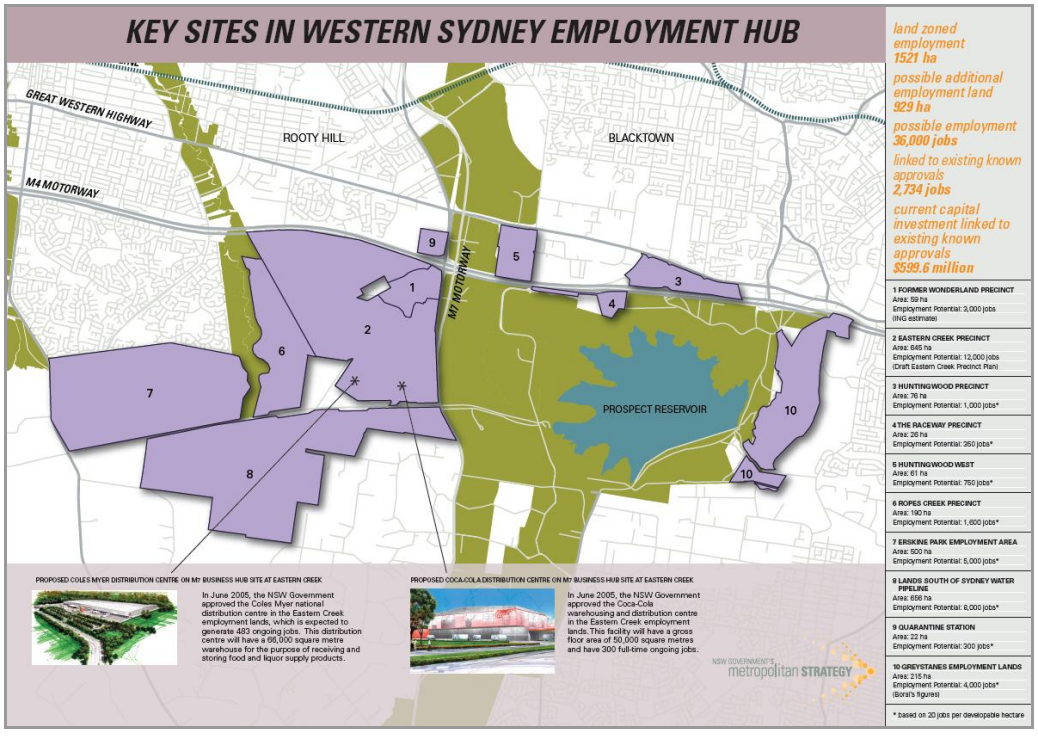
The Bungarribee Precinct of the Western Sydney Parklands is located adjacent to the Western Sydney Employment Hub. The hub was the subject of State Environmental Planning Policy 59 (SEPP 59) but is in the process of absorption to the Major Projects SEPP following an announcement by the Department of Planning in December 2005. The purpose of the Major Projects SEPP is to consolidate planning for growth in the areas adjacent to the M4 Motorway and M7 Motorway.

The Western Sydney Employment Hub will include 10 precincts of varying size as shown in **Figure 2.2**:

- 1: Former Wonderland Precinct (59ha, 3,000 jobs);
- 2: Eastern Creek Precinct (645ha, 12,000 jobs);
- 3: Huntingwood Precinct (76ha, 1,000 jobs);
- 4: The Raceway Precinct (26ha, 350 jobs);
- 5: Huntingwood West (61ha, 750 jobs);
- 6: Ropes Creek Precinct (190ha, 1,600 jobs);
- 7: Erskine Park Employment Area (500ha, 5,000 jobs);
- 8: Lands South of the Sydney Water Pipeline (656ha, 8,000 jobs);
- 9: Quarantine Station (22ha, 300 jobs); and
- 10: Greystanes Employment Lands (215ha, 4,000 jobs).

Details of Precincts 3, 4, 5 and 9 are included in this report at **Section 2.4** and **Section 7.2**.

Figure 2.2: Key Sites in Western Sydney Employment Hub



Source: NSW Department of Planning, 2005

State of the Environment

Blacktown Council has developed a State of Environment Plan, which is aimed to contribute Corporate Management Plans via a "Priority Action Table" summarising the major actions for Council.

Actions identified in the Priority Action Table that are relevant to this study include:

- Implementation of the *Eastern Creek Land Use and Employment Study*, which includes industry attraction and developing strategic partnerships with relocating industry;
- Inclusion of transport-related actions in Council's Blacktown Greenhouse Action Plan;
- Working with the Department of Planning to develop a regional plan for Western Sydney;
- Monitoring future development of the Blacktown LGA and align this development with the principles of Ecologically Sustainable Development (ESD);
- Working with the Western Sydney Regional Organisation of Councils (WSROC) to develop a Greater Western Sydney Regional Planning Framework;
- At Stage 1 of the development of an integrated transport plan, review component of Metropolitan Strategy that relates to public transport options such as cycle paths and pedestrian access with traditional transport modes;
- Continue to monitor the impact of construction of the Westlink M7 on the existing transport network and local communities; and
- Continue to monitor the impact of construction of the T-Way Network on the existing transport network and communities.

Local Land Release Areas

In December 2004, the State Government released an innovative plan, which outlines the future of land releases in the North West and South West of Sydney. For the North West Sector, the plan proposes 60,000 dwellings to be released over the next 25 to 30 years.

As a consequence of Bringelly and North West Sector release areas, the population surrounding the study area would increase by approximately 400,000 residents. The demographics of the projected population would comprise a large proportion of young people and children. Therefore there would be a growth in demand for recreational and sporting parklands facilities in the area.

2.4 Previous Planning

Eastern Creek Precinct Local Traffic Study – ARUP, July 2005

The Eastern Creek Precinct is identified in SEPP 59: Central Western Sydney Economic and Employment Area for the purpose of establishing new employment land to promote economic growth in the area. The precinct is split into the following stages of development.

- Lot 11: Approximately 58 hectares of land comprising the former Sydney Wonderland site.
- Stage 1: Approximately 28 hectares of land adjacent to Wallgrove Road and Wonderland Drive.
- Stage 2: Approximately 12 hectares of land located to the east of the Stage 1 and Lot 11 sites.
- Stage 3: Approximately 598 hectares of land bounded by the M4 Motorway to the north, Stages 1 and 2 to the east, the Sydney Water Supply Pipeline to the south (including Austral Bricks) and the subject site to the west.

Blacktown City Council commissioned consultants ARUP to undertake a traffic study for the Eastern Creek sites so that the impact of development of the entire precinct could be understood. A traffic model was constructed to develop a road network that could manage the large volumes of traffic that will be generated by the site.

The Eastern Creek site is identified as Precincts 1 and 2 within **Figure 2.1**.

East Huntingwood Transport Management and Access Plan – SKM, October 2004

The Huntingwood Precinct is bordered by the Great Western Highway, the Western Motorway (M4), Brabham Drive and designated parklands to the east. This area is designated under SEPP 59.

A portion of the precinct (known as Huntingwood Estate) has already been developed as a light industrial area, with a significant proportion of distribution warehouses and some offices. The 76 hectare eastern portion of the precinct is still to be developed as an industrial area.

Consultants SKM developed a Traffic Management and Access Plan for the site and considered that it would likely generate 630 trips in the morning peak hour. The TMAP reports the results of a NETANAL model which distributed traffic across the road network in the vicinity of the site. The model indicates that the majority of traffic from the site would be distributed to the regional road network via the M4 Motorway and to Blacktown City Centre via Reservoir Road, Flushcombe Road and the Prospect Highway. Minimal traffic is expected to travel in the vicinity of the Huntingwood West site.

The East Huntingwood site is identified as Precinct 3 within **Figure 2.1**.

Erskine Park Employment Area DCP and Section 94 Plan

Erskine Park Employment Area covers a gross area of 540 hectares and a developable area of 276 hectares. Erskine Park Employment Area is within the Penrith City Council area, bounded by Erskine Park residential area and transmission lines to the north, Ropes Creek to the east, the Water Supply Pipeline to the south and Mamre Road to the west.

It is anticipated that an ultimate employment target of between 6,000 to 8,000 jobs will be met when the area is fully developed between 2016 and 2021. The Development Control Plan and Section 94 Contributions Plan for Erskine Park came into force on 3 January 2003. In 2003, Penrith City Council approved the first development applications on the estate including subdivision, road access construction and the first industrial building.

Erskine Park Employment Area is zoned for employment generating development located with easy access to the M4 Motorway and M7 Motorway. Planning of the site has also made provision for an arterial link through the estate linking the estate to SEPP 59 lands and to the proposed Westlink M7. The strategy for the provision of the proposed link road is referred to as the 'Lenore Road Link'.

Other committed developments in the vicinity of the Huntingwood West site have not yet completed traffic and transport studies, such as the Investa development near the Raceway.

The Erskine Park site is identified as Precinct 8 within **Figure 2.1**.

3.0 The TMAP

3.1 TMAP Objectives

There are no set performance measures that need to be achieved through the TMAP process. However, to date TMAPs have tended to include a mode shift target because, despite the limitations of this indicator, it is able to be monitored through the five yearly census data. In line with NSW Government policy, the objectives of the TMAP include:

- Providing an integrated transport network between modes and land uses;
- Providing a choice of travel mode by developing a comprehensively accessible transport network;
- Providing a safe and secure transport network;
- Providing a system that is efficient and equitable;
- Providing a system that is sustainable;
- Supporting the local economy; and
- Providing a healthy environment.

The TMAP objectives are compatible with Landcom's Sustainability Policy, which aims to:

- Deliver sustainable quality of life
- Conserve resources
- Protect biodiversity; and
- Minimise pollution.

The TMAP objectives are consistent with the wider planning context, for example, the Metropolitan Strategy, which does not set any travel targets but does support reduced car travel.

Consideration of the following factors in peoples' travel choice is crucial to successfully reaching these objectives:

- The availability of alternative modes;
- The competitiveness of public transport against private car travel;
- Local accessibility to non-car modes;
- Quality of the pedestrian environment; and
- The availability of parking.

3.2 Targets / Performance Criteria

To monitor the success in reaching the TMAP objectives, suitable performance indicators and targets must be formulated. Suitable performance indicators may include service delivery, local accessibility and competitiveness of public transport. Targets for these indicators would assist in meeting the recommendations of Government policy, but that some form of mode shift target should also be established together with a recommendation of suitable intersection performance.

Service Delivery

In July 2004, the Ministry of Transport replaced the 1991 Minimum Service Level (MSL) requirements with Service Planning Guidelines. The July 2004 guidelines have been updated and were re-released in June 2006. They will be subject to further ongoing periodic reviews.

The Service Planning Guidelines reflect the NSW Government focus on delivering an integrated network of bus services that utilise strategic corridors. The guidelines are also intended to enable greater flexibility for operators to target resources at existing and potential demand, and allow the

provision of flexible 'demand responsive' routes and timetables for services in low demand area and at low demand times.

In terms of coverage, 90 percent of households should be within 400 metres of a bus route or rail station during commuter peaks and day times. During night-time periods 90 percent of households should be within 800 metres of a bus route or rail station. For the ten percent of households not serviced by regular route services or areas without sufficient patronage to sustain 60-minute frequencies, flexible alternatives may be considered.

Target: 90 per cent of residences within 400 metres of a bus route

Local Accessibility

Local accessibility can defined as a permeable network. An appropriate target for local accessibility is to aim for 85 percent of residents to live within an actual 400-metre walk distance of a public transport stop, rather than a 400-metre 'crow-fly' distance. It is recognised that people are prepared to walk further than 400 metres to a public transport services, but that they tend to dislike walking as far as 400 metres from a public transport stop.

Target: 90 per cent of residences within 400 metres of a bus route

Competitiveness of Public Transport

A review of the strategic modelling undertaken by Maunsell in support of the mode choice modelling in this study suggests that travel speeds for car journeys are likely to increase over the next ten years as congestion increases across the metropolitan area.

Target: Maintain bus journey times with priority measures

Mode Split Target

The existing mode split proportions of residential areas surrounding the site are a fair indication of the likely travel characteristics if a community were developed with no additional transport infrastructure.

The limitations of using a journey to work mode split target are appreciated and it is not the intention to suggest that other journeys during the day are not as important as the journey to work – it will be necessary to provide a sufficient level of public transport accessibility to the site, and publicise its availability, to ensure that people are able to undertake shopping, leisure, education and other trips by public transport, while also ensuring the area has a high level of pedestrian permeability.

However, journey to work mode split is a clear indicator from the Census that can be used to monitor progress towards this target. The journey to work is also a significant proportion of daily travel for a household and all progress towards reducing demand on transport networks at this time will benefit the movement of freight and other commercial needs.

Target: 5% mode shift from car (as driver).

Road Network Performance Targets

The capacity of an urban road network is controlled by the capacity of the intersections within that network. Average delay is commonly used to assess the actual performance of intersections, with Level of Service used as a simple index. A summary of the Level of Service index is shown in **Table 3.1**.

Table 3.1: Level of Service Criteria for Intersections

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

Source: Guide to Traffic Generating Developments, RTA 1993

Level of Service D is accepted by the RTA as an absolute minimum design criteria. However, the RTA also uses capacity constraint as a demand management technique. That is, additional capacity at intersections is not provided at certain intersections to dissuade drivers from that route.

Target: It is recommended that intersections in the range of influence around the precinct are ameliorated to the Level of Service prior to development, where the development decreases the Level of Service of C or below.

4.0 The Project

4.1 Overview

This section provides a brief description of the development proposal considered in this assessment.

Two sites have been identified as being suitable for development within the Bungarribee Precinct: Doonside, for residential uses and Huntingwood West, for commercial uses. Constraints have been investigated and the sites' masterplanners, Architectus, have calculated the following approximate developable areas:

- Doonside - 55 hectares
- Huntingwood West - 56 hectares

This TMAP considers a residential sub division for up to 730 lots at Doonside; the Huntingwood West industrial site is considered as a committed development.

The site will be accessed via existing intersections at Doonside Road/ Eastern Road, Doonside Road/ Bungarribee Road and Doonside Road/ Douglas Road. The access at Eastern Road provides connectivity to the station and shops and the access at Douglas Road provides a connection to employment areas to the south and the M4. The Bungarribee Road access provides the main entrance statement to the development and provides an opportunity for public transport routes from Blacktown to service the site.

Figure 4.1 illustrates the development footprint and indicative layout devised by Architectus. A detailed design road layout will be provided by the proponent with the Development Application.

Figure 4.1: Doonside Concept Plan Indicative Layout

Source: Architectus 2007

5.0 Initial Transport Assessment

5.1 Introduction

This section provides a more thorough review of existing transport conditions in the study area. It considers the analysis undertaken by Maunsell in 2005 which has been updated to include post M7 opening conditions.

5.2 Walking

Pedestrian facilities within the study area are limited due to the rural nature of the area, however facilities are provided throughout the surrounding outer areas. The majority of roads bordering the study area have paved footpaths on at least one side of the roadway suitable for all users, including Eastern Road (shown in **Figure 5.1)**, Knox Road, Doonside Road (north of Bungarribee Road only), Rooty Hill Road, Douglas Road and Bungarribee Road.

Figure 5.1: Existing pedestrian pathway in Doonside (Eastern Road looking west)

Source: Maunsell, 2005

Figure 5.2 illustrates a potential pedestrian route where a footpath is not provided, on the western side of Doonside Road south of Bungarribee Road.

Figure 5.2: Non-paved pedestrian pathway (Doonside Road looking north)

Source: Maunsell, 2005

The signalised intersections surrounding the study area provide pedestrian crossing facilities on the majority of the junction legs enabling safe crossing of the roadway.

The three roundabouts located north of the Doonside (residential) release area at Eastern Road/Knox Road; Eastern Road/Doonside Road; and Doonside Road/Bungarribee Road have limited pedestrian crossing facilities, besides the median(s) provided at each of the junction legs. The limited provision of pedestrian crossing facilities in this area is of some concern in providing (and promoting) a safe walking environment between the proposed development areas and the existing surrounding facilities (such as, Doonside Railway Station, Mountain View Advent (SDA) School and Church north of Eastern/Doonside Road and the Rainbow Shopping Centre north-west of Bungarribee Road).

5.3 Cycling

As shown in **Figure 5.3** there are an increasing number of cycle facilities in the Blacktown area, with a recent 50/50 funding agreement with the RTA. Blacktown City Council commissioned a review of the 1994 bike plan for the City of Blacktown in 2002 to determine cyclists needs and priorities for action. The Department of Planning are involved with cycle route development in the area, with the planning of a recreational trail within the Western Sydney Parklands.

Cycle paths leading towards the study area include:

Regional Routes:

- M4 Motorway
- M7 Motorway

Existing Recreational Route

- Nurragingy Recreation Area

Long Term Recreational Routes

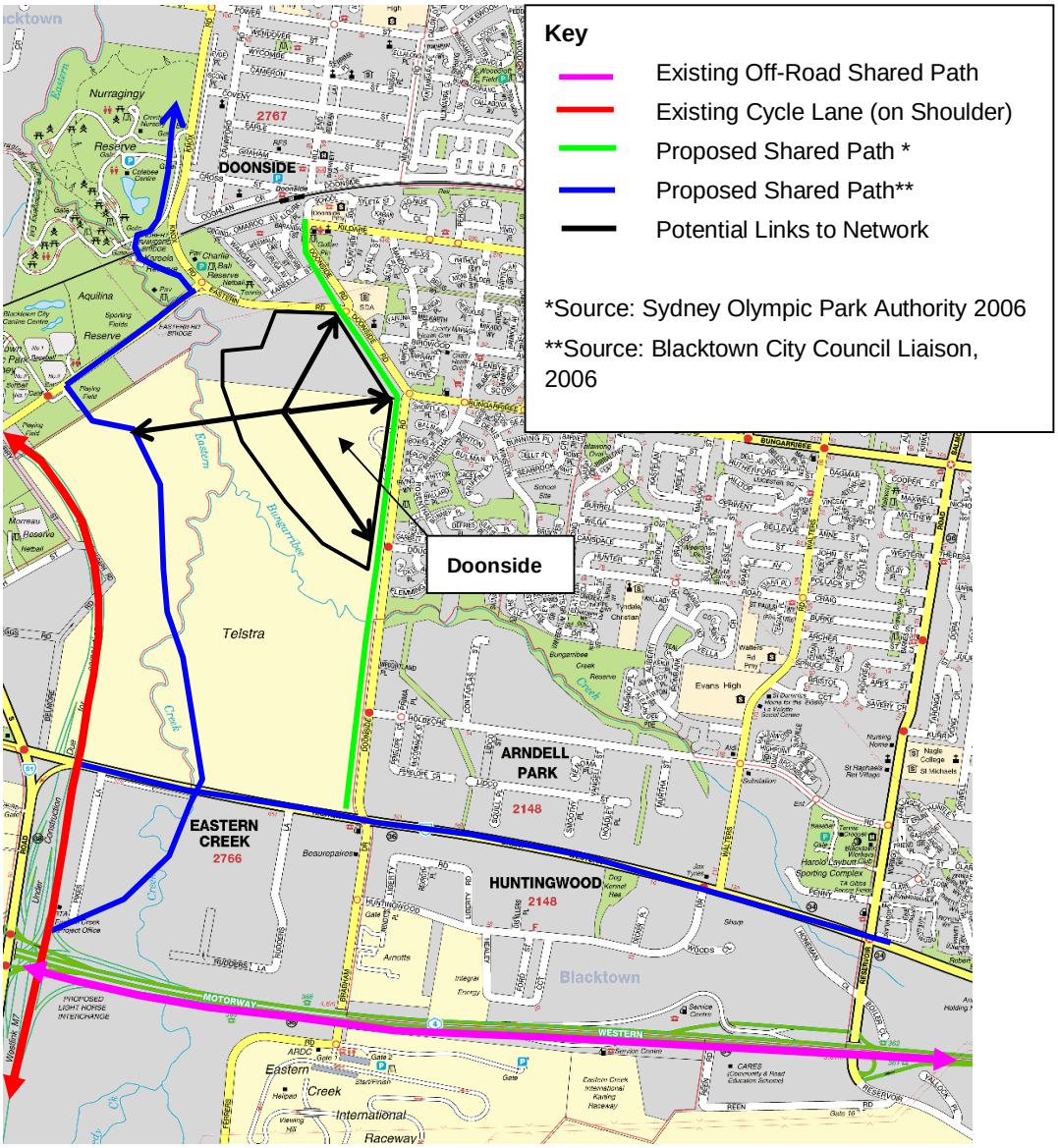
- Eastern Creek between Great Western Highway and Richmond Road. This route links to another cycle route which provides access to the Parklands north-east of Douglas/Doonside Road and Featherdale Wildlife Park.
- Western Sydney Parklands recreational trail

Other Proposed Routes

- Blacktown Council plans to implement a shared path running from Doonside rail station to the Huntingwood industrial areas.

The RTA has also developed a 10-year bicycle plan 'Action for Bikes – Bike Plan 2010, NSW[1]' to be completed in 2010. A proposed route that may provide a connection within the vicinity of the study area is the Penrith-CBD Rail Trail (proposed completion year 2010).

Figure 5.3: Cycleway Network



Source: Maunsell, 2007

Bike lockers are provided near the railway stations, similar to that shown in **Figure 5.4** at Doonside station. The number of lockers is limited, however their provision does promote and facilitate patrons who live within the area to cycle to the train station.

[1] September 1999

Figure 5.4: Bike lockers at Doonside Railway Station

Source: Maunsell, 2005

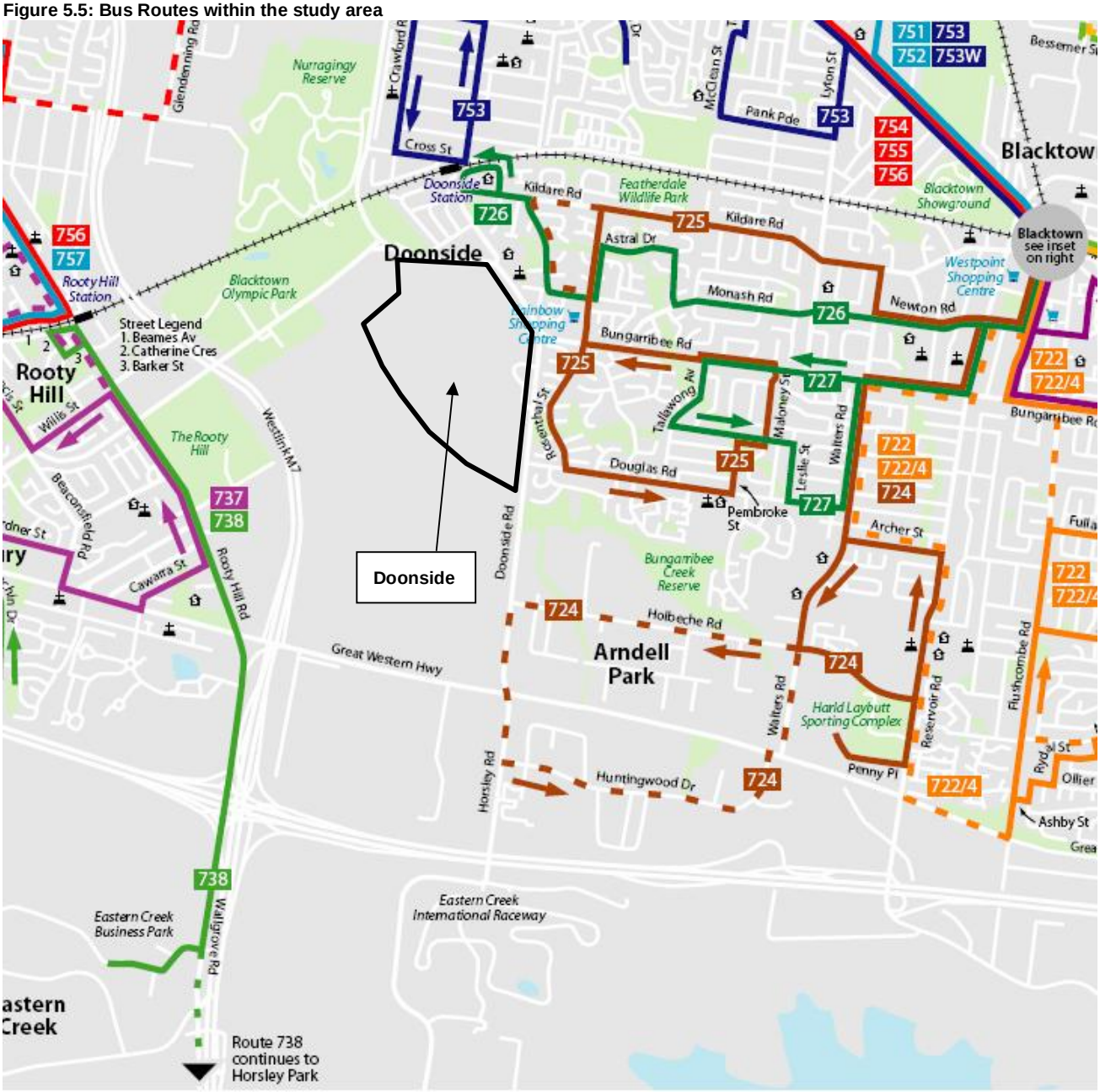
5.4 Bus Services

Bus services to the Bungarribee Precinct are currently limited to roads that either run along sections of the Parklands Boundary or the surrounding road network.

Buses form a very small proportion of travel within the surrounding study area at around 2% of total Journey to Work movements[2]. Services in the area are predominately provided by Busways. Several services are provided to the east of the study area within the Huntingwood and Blacktown suburbs and to the west within the Rooty Hill suburb as shown in **Figure 5.5**.

[2] 2001 Journey to Work Data, Blacktown South East and Blacktown South West SLA

Figure 5.5: Bus Routes within the study area



Source: Busways, 2006

Table 5.1 provides a summary of the bus services, including route peak and off-peak frequencies. Services terminating at stations are timed to meet respective train services. Weekend services are more limited. There are currently no bus priority measures along the road network surrounding the study area. Service 725, the closest route to the Doonside site, is highlighted.

Table 5.1: Bus Routes Servicing Western Sydney Parklands

Number	Route	Weekday Peak Frequency	Weekday Off-Peak Frequency	Sat / Sun Pub. Hol. Frequency
722	Blacktown to Prospect	16	30	30
724	Blacktown to Arndell Park	25 - 30	30	30

Number	Route	Weekday Peak Frequency	Weekday Off-Peak Frequency	Sat / Sun Pub. Hol. Frequency
725	**Blacktown to Doonside (Douglas Road)**	**15**	**30**	**30**
726	Blacktown to Doonside Station via Monash Road	30	60	60
737	Mt Druitt to Eastern Creek via Rooty Hill (loop)	30	30	60
738	Mt Druitt to Eastern Creek Industrial Park	Irregular Services		Nil

Source: Busways, April 2006

5.5 Rail Services

Two railway stations are located relatively close to the northern end of the study area, including Rooty Hill and Doonside stations. Rooty Hill station is located approximately 500 metres north-west of the Parklands near Rooty Hill Road and Eastern Road junction. Doonside station is located approximately 500 meters north-east of the Doonside residential area near the Doonside Road/ Eastern Road intersection. Blacktown station is accessed via feeder bus services serving neighbouring areas.

CityRail services to the study area are provided by the Western Line, which terminates at Emu Plains. A summary of currently timetabled CityRail services connecting Mount Druitt, Doonside and Blacktown stations to the city during the morning peak period is shown in **Table 5.2**, while the average frequency of rail service to each of these stations can be gauged from **Table 5.3**.

Table 5.2: AM Peak City-bound Rail Service Arrival Times (0700 to 0900 Hours)

→ Direction of Travel →			
Mount Druitt	**Doonside**	**Blacktown**	**Central**
7:01	7:07	7:12	7:53
7:13	-	7:21	7:56
7:27	-	7:35	8:11
7:12	7:18	7:23	8:14
7:31	7:37	7:43	8:23
7:44	-	7:52	8:26
7:53	-	8:01	8:41
7:42	7:48	7:53	8:44
8:02	8:08	8:13	8:56
8:14	-	8:22	9:00
8:11	8:17	8:23	9:14
8:33	8:39	8:44	9:26
8:42	8:48	8:53	9:44
9:16	9:22	9:28	10:13

Source: www.cityrail.info, April 2006

Table 5.3: Summary of AM Peak Period Rail Amenity

Station	Mount Druitt	Doonside	Blacktown	Central
Number of services 0700-0800	6.5	4	6.5	5.5
Average time between services	12 minutes	14 minutes	8 minutes	9 minutes

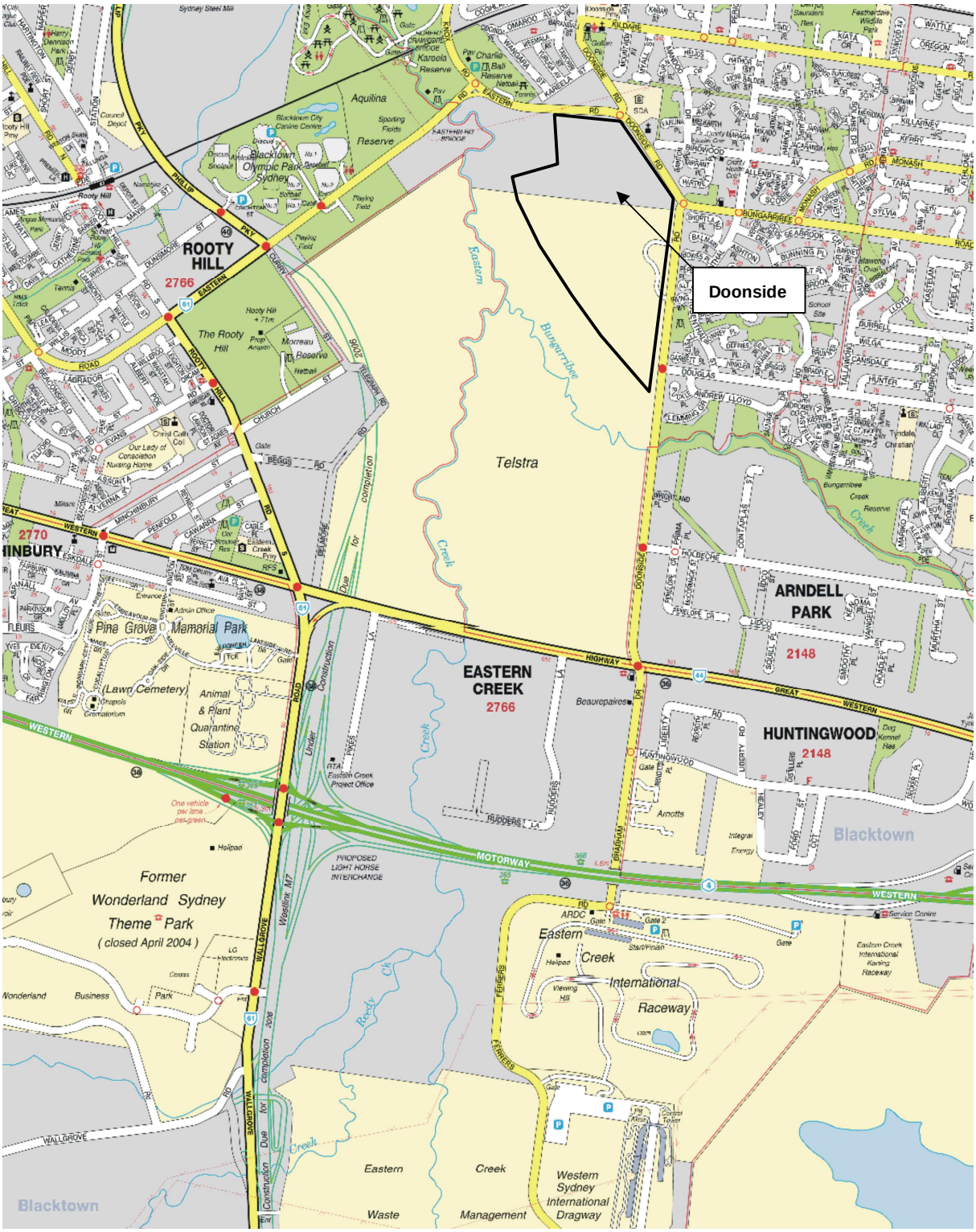
Source: www.cityrail.info, April 2006

5.6 Road System

5.6.1 Local Roads

The nearest public roads to the site include Doonside Road, Eastern Road to the north-west and Great Western Highway which runs south of the site. The proximity of the freeway is one of the key challenges. Sustainable travel modes need to provide attractive travel options that are comparable to the ease of freeway travel in a private car. The surrounding road network is shown in **Figure 5.6**.

Figure 5.6: Road Network



Source: Sydway

5.6.2 Motorways, Highways and Main Traffic Routes

The following classified roads are owned and maintained by the RTA.

M4 Motorway

The M4 Motorway connects Strathfield and Penrith, and is a key east-west link between suburbs in the east, including the Sydney CBD and suburbs in the west, including Penrith. The M4 is a classified State Road, with traffic volumes exceeding 70,000 Annual Average Daily Traffic (AADT). The speed limits along the route range from 90 to 100 kilometres per hour.

The M4 forms the southern boundary of the study area. The interchange at Wallgrove Road provides sufficient access to the Western Sydney Parklands.

M7 Motorway

The M7 Motorway provides a link between the M2 Motorway in the north and the M5 Motorway in the south, completing Sydney's orbital road network. The M7 runs parallel with Wallgrove Road, forming western boundary of Western Sydney Parklands.

The M7 intersects with the M4 and the Great Western Highway, providing access from the northern and southern suburbs.

Great Western Highway

The Great Western Highway is the key east-west link between the Sydney CBD and the western suburbs. A number of regional and local roads are accessed by the Great Western Highway including Rooty Hill Road South, Doonside Road to the north, Wallgrove Road and Brabham Drive to the south. The Great Western Highway is a classified State Road, with traffic volumes exceeding 30,000 AADT. The speed limits along the route range from 60 to 80 kilometres per hour.

Wallgrove Road

Wallgrove Road connects Rooty Hill in the north to Cecil Park in the south. Wallgrove Road is a classified State Road, consisting of four lanes and a speed limit of 80 kilometres per hour. Traffic volumes along the route range from 20,000 AADT north of the Great Western Highway and 40,000 AADT north of the M4 Motorway.

Between the M4 and the Great Western Highway, Wallgrove Road runs adjacent to the western edge of the Western Sydney Parklands. Its intersection with the Great Western Highway consists of an at-grade signalised intersection. The M4 / Wallgrove Road intersection is grade-separated.

Rooty Hill Road

Rooty Hill Road connects Rooty Hill in the south to Oakhurst in the north. Rooty Hill Road is a classified State Road, consisting of four lanes and a speed limit of 70 kilometres per hour. Traffic volumes on Rooty Hill Road are around 20,000 AADT.

Between Eastern Road and the Great Western Highway, Rooty Hill Road runs parallel to the western edge of the Western Sydney Parklands. Its intersections with the Great Western Highway and Eastern Road intersections are both at-grade, signalised intersections.

5.6.3 Regional Roads

The following classified roads are owned and maintained by Blacktown Council, with funding assistance from the RTA.

Eastern Road

Eastern Road runs between Rooty Hill Road and Doonside Road. Eastern Road is a classified Regional Road, consisting of four lanes and a speed limit of 70 kilometres per hour. Traffic volumes range between 24,500 AADT north of Rooty Hill Road and 19,600 AADT south of Knox Road.

Eastern Road lies north of the Western Sydney Parklands and the Doonside residential release area. Eastern Road's intersections with Knox Road and Doonside Road consist of two-lane roundabouts, and its intersection with Rooty Hill Road is an at-grade, signalised intersection.

Doonside Road

Doonside Road runs between Bungarribee Road and the Great Western Highway, east of the Western Sydney Parklands and Doonside residential release area. Doonside Road is a classified Regional Road, consisting of four lanes and a speed limit ranging between 60 and 70 kilometres per hour. Traffic volumes on Doonside Road are approximately 24,000 AADT.

Doonside's intersection with the Great Western Highway is an at-grade, signalised intersection. The intersection with Bungarribee Road consists of a two-lane roundabout.

Brabham Drive

Brabham Drive runs between the Great Western Highway and the M4. Brabham Drive lies east of Huntingwood West employment release area. The route is a classified Regional Road consisting of four lanes, with a speed limit of 70 kilometres per hour. Traffic volumes along Brabham Drive are around 18,000 AADT. The intersection with the Great Western Highway is an at-grade, signalised intersection.

5.6.4 Existing Intersection Performance

Following is a summary of intersection controls at the key intersections surrounding the study area. Traffic flows recorded at these intersections in 2006 are documented at **Appendix B**.

Signalised Intersections

- Great Western Highway and Doonside Road (Node 1);
- Great Western Highway and Rooty Hill Road South (Node 2);
- Rooty Hill Road South and Eastern Road (Node 3); and
- Doonside Road and Douglas Road (Node 6).

Roundabouts

- Eastern Road and Knox Road (Node 4);
- Doonside Road and Bungarribee Road (Node 5);
- Brabham Drive and Huntingwood Drive (Node 8);
- Knox Road and Power Street (Node 9); and
- Doonside Road and Eastern Road (Node 11).

Tables 5.4 and **5.5** summarise the results from the intersection analyses using aaSIDRA 3.1 for the 2006 AM and PM peak hours respectively. The intersections highlighted yellow in the tables indicate the intersections that have inadequate levels of service, that is, lower than Level of Service C.

Table 5.4: 2006 Weekday Morning Peak Period Intersection Performances

Intersection	Degree of Saturation	Average Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road	1.0	61.0	E
2: Great Western Highway / Rooty Hill Road	0.7	27.3	B
3: Rooty Hill Road South / Eastern Road	0.7	30.3	C
4: Eastern Road / Knox Road	0.7	9.7	A
5: Doonside Road / Bungarribee Road	0.7	12.7	B
6: Doonside Road / Douglas Road	0.7	14.1	B
8: Brabham Drive / Huntingwood Drive	0.5	8.2	A
9: Knox Road / Power Street	>1.2	145.5	F

Source: Maunsell, 2007

The roundabout at Knox Road/ Power Street is already failing during the morning peak due to unbalanced flows on entry arms. This could be the result of changes in traffic patterns following the opening of the M7 Motorway and associated interchanges. The subsequent review of traffic associated with the proposed development has found that it contributes less than one per cent of traffic to the total at the Knox Road/ Power Street intersection. As a sensitivity test, the proportion of traffic using the Knox Road intersection was increased to 25 per cent of all trips, but was still found to account for less than four per cent of trips. Therefore, as the impact of this development would be negligible it has been excluded from further assessment.

The Great Western Highway / Doonside Road intersection is also reporting a Level of Service that is operating near capacity. The M7 Motorway opened to traffic in December 2007 and may still be in a 'ramp up' period, so traffic patterns may be subject to further change.

Table 5.5: 2006 Weekday Evening Peak Period Intersection Performances

Intersection	Degree of Saturation	Average Delay (sec/veh)	Level of Service
1: Great Western Highway / Doonside Road	0.8	41.0	C
2: Great Western Highway / Rooty Hill Road	0.8	31.8	C
3: Rooty Hill Road South / Eastern Road	0.7	31.4	C
4: Eastern Road / Knox Road	0.7	9.7	A
5: Doonside Road / Bungarribee Road	0.6	10.1	B
6: Doonside Road / Douglas Road	0.6	12.5	B
8: Brabham Drive / Huntingwood Drive	0.6	9.5	A
9: Knox Road / Power Street	0.9	21.2	C

Source: Maunsell, 2007

No significant problems are experienced with the intersections during the evening peak period.

Table 5.6 illustrates a spreadsheet analysis of the link flow capacities by direction on the road network in the vicinity of the site in the existing situation and following the addition of developments already committed to the area. The committed developments will be completed over a number of years, but for this analysis they are added to the estimated 2016 flows to assess the residual capacity on the links. The table indicates that capacity remains on all links within the network with the exception of the Great Western Highway, which would already appear to be operating above capacity in 2006.

The committed developments included within the table are:

- Eastern Creek
- Esrkine Park
- Investa/ Raceway
- East Huntingwood
- Huntingwood West Industrial Development

Further details and assumptions relating to the traffic generated by these sites are included in **Section 7**.

Table 5.6: Local Road Network Link Flows: AM Peak Period

Link	2006		2016*		2016 plus Committed Developments **	
	Veh	V/C	Veh	V/C	Veh	V/C
Doonside Road (N of Douglas Road) Northbound	570	0.30	630	0.33	671	0.35
Doonside Road (N of Douglas Road) Southbound	1,120	0.59	1,240	0.65	1,492	0.79
Eastern Road (West of Knox Road) Eastbound	960	0.50	1,060	0.56	1,101	0.58
Eastern Road (West of Knox Road) Westbound	580	0.31	640	0.34	788	0.41
Rooty Hill Road South (N of GWH) Northbound	520	0.29	580	0.32	682	0.38
Rooty Hill Road South (N of GWH) Southbound	840	0.46	920	0.51	1,507	0.84
Great Western Highway (E of Brabham Drive) Eastbound	2,070	1.09	2,280	1.20	2,149	1.13
Great Western Highway (E of Brabham Drive) Westbound	670	0.35	750	0.39	891	0.47
Brabham Drive (N of Huntingwood Drive) Northbound	410	0.21	450	0.24	592	0.31
Brabham Drive (N of Huntingwood Drive) Southbound	1,130	0.59	1,250	0.66	1,496	0.79

Veh = vehicles

V/C = Volume to Capacity Ratio

Notes: Capacities based on Austroads Part 2: Roadway Capacity

* Estimated based on historical growth rates

** Please refer to Section 7.

5.7 Summary

The key strengths of the existing transport networks in the vicinity of the site include:

- The proximity of the motorway network which removes trips from local roads including Doonside Road.
- The opening of the M7 motorway has resulted in a decrease in traffic flow on certain links within the local network.
- The site is adjacent to an extensive cycle way network, both existing and proposed.
- The site is within walking distance of Doonside rail station.

This review of existing transport conditions has noted a number of weaknesses in the local area, including:

- The proximity of the freeway network to the site means that travel by private car is likely to be more attractive to certain destinations than travel by other modes of transport.
- The opening of the M7 motorway has resulted in an increase in traffic flow on certain links within the local network including Rooty Hill Road South and Eastern Road.
- Certain intersections are close to or at capacity, including the roundabout at Knox Road and Power Street.
- Bus routes are beyond a five minute walk trip for the majority of future residents on the site.

These strengths and weaknesses will provide ample opportunity for leverage towards a package of measures through this TMAP process.

6.0 Travel Demand

6.1 Introduction

Trip generation depends on many variables. This section provides a summary of the forecasting approach used to determine the number of trips travelling by each mode of transport. This review has considered both the morning and evening peak periods.

6.2 Existing Travel Behaviour

A review of the Census 2001 Journey to Work data for Blacktown South East SLA indicates that:

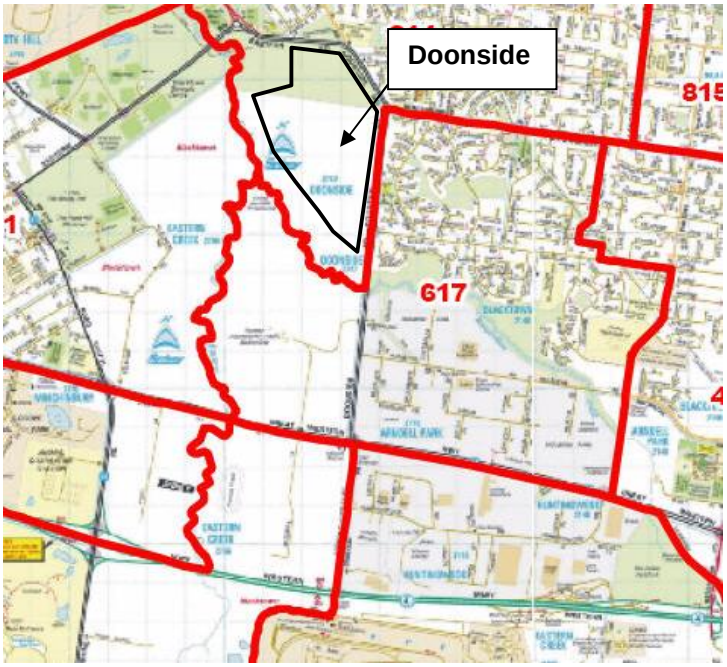
- 72 per cent of trips from the SLA are made by car
- 18 per cent of trips from the SLA are made by train
- 2 per cent of trips from the SLA are made by bus
- 8 per cent of trips from the SLA are made by other modes (e.g. walking and cycling)

At a more detailed level, a review of the Census 2001 Journey to Work data for travel zone 617 adjacent to the site indicates that:

- 76 per cent of trips from the zone are made by car
- 17 per cent of trips from the zone are made by train
- 1 per cent of trips from the zone are made by bus
- 6 per cent of trips from the zone are made by other modes (e.g. walking and cycling)

An analysis of the trip distribution from the 2001 journey to work database was undertaken based on Travel Zone 617 (tz617), for residential uses (using trips from tz617). This zone, located immediately east of the site, includes residential uses and is therefore considered likely to display similar trip making characteristics to the development site.

Figure 6.1: Surrounding TPDC Travel Zones



This information highlights the high dependence on car travel to work in the study area and it is a challenge to this TMAP to offer practical alternatives to the car to inspire mode shift. Reasons for the high car dependence could be due to a perception of low public transport provision or an unwillingness to interchange. It is likely that for destinations outside of Blacktown centre, a resident would be required to make at least a two leg public transport trip to reach their place of work.

6.3 Travel Demand

Maunsell has adopted a first principles method of travel demand forecasting using supporting information from Elton Consulting (household occupancy) and the Transport and Population Data Centre (TPDC) 2003 Household Travel Survey (mode by trip purpose).

The steps taken in the first principles method are as follows:

1	Establish lot type yield	Detached = 730
2	Multiply by lot type occupancy to establish site population[3]	730 x 3.2 = 2,336
3	Apply average trips per person to establish site trips[4]	2,336 x 3.78 = 8,830
4	Apply percentage of trips in the AM period[5]	20.5% x 8,830 = 1,810
5	Apply percentage of trips in the AM Peak Hour[6]	40% x 1,810 = 724
6	Split trips into purposes and mode share[7]	

The vehicle trip rate per household calculated by following this method is 0.68 and therefore comparable with the trip rate for medium density dwellings in the Guide to Traffic Generating Developments (RTA, 2002).

The number of trips by each mode is summarised in **Table 6.1**. After a mode shift from car to sustainable modes of five per cent, the number of residents travelling by car decreases and the number travelling by other modes, including as a car passenger, increases.

Table 6.1: AM Peak Doonside Trip Generation: All Modes

Mode	Without Mode Shift		With Mode Shift	
	Mode Share	Trips	Mode Share	Trips
Car driver	69%	495	64%	461
Car passenger	8%	61	9%	65
Train	10%	73	11%	79
Bus	1%	6	2%	14
Cycle	6%*	42	8%*	50
Walk	6%*	43	6%*	51
Total	100%	720	100%	720

Source: Maunsell 2006

* Assumed split of 'other modes'

[3] Elton Consulting 2006: Detached dwelling 3.2 persons; attached dwelling 2.7 persons.

[4] TPDC Household Travel Survey 2003

[5] TPDC Household Travel Survey 2003

[6] Percentage calculated from Maunsell 2006 traffic surveys

[7] TPDC Household Travel Survey 2003, except commuting trips – Census 2001 Journey to Work Data

It was assumed that 85 per cent of trips would be travelling away from the site and 15 percent to the site in the morning peak hour.

6.4 Mode Choice

The determinates used to assess mode choice within a mode choice model are travel time, travel cost and amenity (comfort, reliability and security). As an example: rail provides a more competitive choice to destinations such as the city where parking congestion makes car trips unattractive.

Maunsell has constructed mode choice models for previous TMAPs, using 2001 Journey to Work data to develop a generalised cost mode choice logit model that replicates observed journey to work mode splits (generally to within 5-10%) to major destinations in the Sydney metropolitan area from south east Blacktown. In all cases, the effect of increasing congestion on the road network has the effect of causing a minor mode shift of a few per cent since car journey times increase over train trips.

The mode choice model can be used to test measures within a TMAP that will decrease the generalised cost of public transport in comparison to car trips. Measures would include increasing bus or train frequency, or reducing walk time to the route. Policy measures or improvements to the quality of walking or cycling trips cannot be tested in the model.

To determine the likely mode choice shift as a result of other measures within a TMAP, it is possible to examine the success rates of previous projects. Projects to bring travel behaviour change using individualised marketing in Western Australia have resulted in differing success rates, ranging from four per cent reduction in car trips to 14 per cent. However, when the details of the study areas are compared, an outer suburb with poor public transport links, records a four percent reduction in car trips. The high mode shift results are recorded in inner city areas with good public transport provision.

To achieve a mode shift of between five and ten percent, it would be necessary to implement a range of measures, including those that improve the perception of public transport and that cannot be measured in a simple mode choice model. A comprehensive package of measures has been identified in **Section 8** to ensure the targets specified in this TMAP are met.

6.5 Trip Distribution

Trip distributions reflect the range of external origins of employees of a development site. Trip distribution patterns are influenced by wealth, employment patterns, the accessibility of regional employment zones and the cost and amenity of surrounding transport networks. Distribution patterns change relative to these variables over time.

The trip distribution undertaken to places of work by residents in tz617 is summarised in **Table 6.2.** These proportions have been used as a proxy to distribute trips to the local road networks for the residential development.

Table 6.2: 2001 Journey to Work Destinations

Location	Total	Proportion
Blacktown – South East	378	21.5%
Parramatta	227	12.9%
Fairfield	100	5.7%
Holroyd	96	5.5%

Location	Total	Proportion
Blacktown – North	86	4.9%
Auburn	78	4.4%
Baulkham Hills	78	4.4%
Blacktown – South West	64	3.6%
Penrith	63	3.6%
Ryde	56	3.2%
Bankstown	52	3.0%
South Sydney	39	2.2%
Willoughby	27	1.5%
Hornsby	26	1.5%
Hawkesbury	24	1.4%
Strathfield	21	1.2%
Other	313	17.8%

Source: Journey to Work data, 2001

In order to apply the distribution to the network, it is necessary to make assumptions about the route that the employees would take through the study area. This is conducted using gravity model principles, where the driver would take the shortest route. Where route length is similar, trips have been divided between the routes.

The Journey to Work trip origins for the purposes of this study can be translated into the road on which the trip by the resident leaves the study road network. These are based on the assumptions of route choice given in the previous paragraph and are summarised in **Table 6.3**.

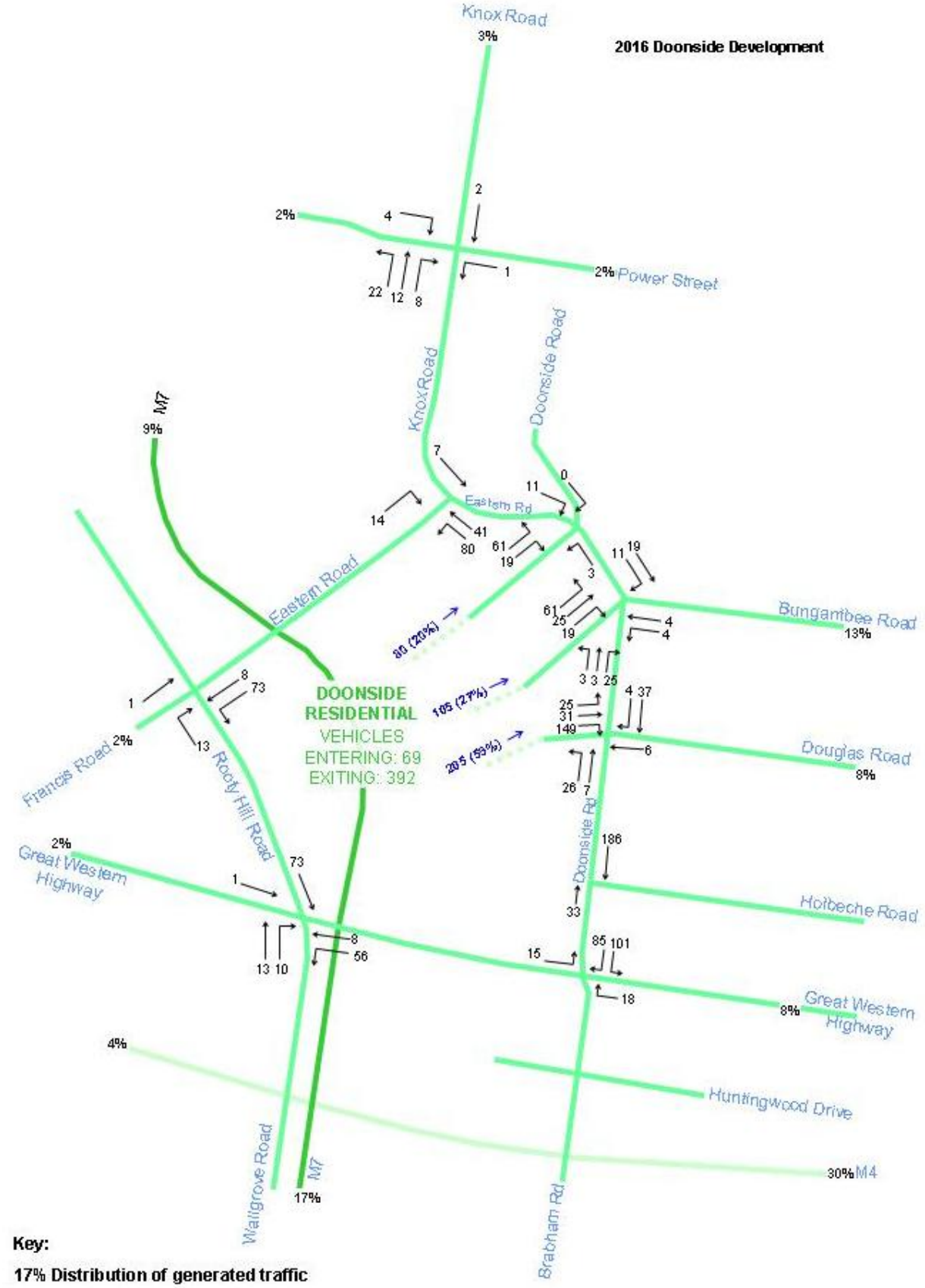
Table 6.3: Journey to Work Origins at Extent of Study Road Network

Trip Origin	Percentage of Trips	Number of Vehicle Trips
M4 East	30%	138
M4 West	4%	18
M7 North	9%	41
M7 South	17%	78
Great Western Highway East	8%	37
Great Western Highway West	2%	9
Francis Road	2%	9
Knox Road	3%	14
Power Road East	2%	9
Power Road West	2%	9
Bungarribee Rd	13%	60
Douglas Rd	8%	37
Total	**100%**	**461**

Source: Journey to Work data, 2001

Figure 6.2 illustrates the development traffic flows from the site.

Figure 6.2: Development Traffic Flow



Source: Maunsell, 2007

7.0 Impact Assessment

7.1 Introduction

This Section discusses the future traffic and transport scenarios, considers the impact of the Doonside development on the local network and assesses potential improvements that may ameliorate the impact, particularly in relation to local intersections.

The main purpose of this section is to compare the 2016 Base Scenarios to the 2016 Design Scenarios (with development) to determine the particular impacts of the development on the surrounding traffic and transport networks.

The Western Sydney Employment Hub includes ten key employment sites which may create around 36,000 jobs for residents in Western Sydney including residents of the Doonside site. These developments will have a significant impact on the road and public transport networks in the vicinity of the site and therefore those developments in the vicinity of the Doonside site are included in the Base Scenario impact assessment.

7.2 Local Developments

The following paragraphs summarise the details of the committed local developments in the vicinity of the Doonside site. This information has been used to estimate a number of generated trips and the distribution of these trips through the study network. These trips, when added to the background traffic, form Base Scenario 1 for the impact assessment.

Eastern Creek Precinct

The Eastern Creek Precinct is expected to develop some 700 hectares, generating 8,700 vehicle trips in the AM peak hour and 10,000 vehicle trips in the PM peak hour. Traffic modelling undertaken as part of the Eastern Creek Precinct Local Traffic Study[8] assumed that development would be complete by 2016.

Examination of the model output and report reveals that the impact of the generated traffic is expected to be distributed beyond the limits of the recommended network improvements. The model network included the Rooty Hill South Road/ Wallgrove Road/ Great Western Highway intersection that also falls within the Huntingwood West study network. **Table 7.1** reproduces data regarding the performance of this intersection from the Eastern Creek Precinct Local Traffic Study.

Table 7.1: Hill South Road/ Wallgrove Road/ Great Western Highway Intersection Performance

	AM Peak		PM Peak	
Performance Measure	**2002**	**2016***	**2002**	**2016***
Level of Service	E	F	E	F
Average Delay	60 seconds	230 seconds	56 seconds	189 seconds

Source: Eastern Creek Precinct Local Traffic Study (Arup, 2005)

*including development and recommended network improvements

[8] ARUP, July 2005

The performance of the Rooty Hill South Road/ Wallgrove Road/ Great Western Highway intersection is expected to deteriorate dramatically by 2016. However, improvements to ameliorate it have not yet been proposed.

Erskine Park Employment Area

The Erskine Park Employment Area has 276 hectares of developable land. Using the traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 4,140 vehicle trips. It is assumed that the development will be complete by 2016.

It has been assumed that the majority of the generated traffic will travel via the motorway network in a similar fashion to the Eastern Creek Precinct traffic. A minor proportion of traffic will impact the Huntingwood West study network as it travels via Wallgrove Road.

East Huntingwood Precinct

This precinct consists of 76 hectares of development. Using the traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 1,140 vehicle trips.

An examination of the Census 2001 Journey to Work data for the existing Huntingwood site would suggest that only a minor proportion of trips to the site will originate from the west and travel in the vicinity of the Huntingwood West site.

Investa Raceway Site

This site consists of 26 hectares of development. Using a typical RTA traffic generation rate of 15 vehicles per hectare of development during the weekday peak period, this site would generate approximately 350 vehicle trips.

The majority of the developable land on the site is to the east, suggesting that the majority of generated traffic will enter the road network via Reservoir Road rather than Brabham Drive. However, a minor proportion of the traffic is expected to be distributed along Brabham Drive and therefore past the access to the Huntingwood West site. An examination of the Census 2001 Journey to Work data for the existing Huntingwood site, which is suitable for application to the Raceway site, would suggest that only a minor proportion of trips to the site will originate from the west and travel in the vicinity of the Huntingwood West site.

Bungarribee Precinct Land Uses, Western Sydney Parklands

Concept planning of the Bungarribee Precinct of the Western Sydney Parklands is progressing, to the stage that certain land uses for the site are being discussed. It is likely that a leisure or educational facility may be developed.

The impact on the AM peak hour flows on the surrounding network of these types of facility will be minor. Leisure uses are not likely to experience peak demand at this time and educational visitors are likely to arrive by coaches after the AM Peak. Staff may arrive during the morning peak, but these volumes are not expected to be significant when distributed through the network.

Huntingwood West Industrial Development

Following discussions with Blacktown Council in May 2005, an AM peak hour trip rate of 15 vehicle trips per developable hectare has been adopted. Thus, for a development of 56 developable hectares, 840 peak hour trips would be generated.

This trip rate is expected to be high since the industrial estate is likely to operate with shift work patterns or early start times so that employees may not need to travel in the usual morning and evening peak hours. However, since the uses of the site are not confirmed, the trip rate is adopted as a worst case scenario.

The 2001 Census Journey to Work data mode splits have been applied to the data to obtain trips by other modes as well as the car, as shown in **Table 7.2**. After a mode shift from car to sustainable modes of ten per cent, the number of employees travelling by car decreases and the number travelling by other modes, including as a car passenger, increases.

Table 7.2: AM Peak Huntingwood West Trip Generation: All Modes

Mode	Without Mode Shift		With Mode Shift	
	Mode Share	Employee Trips	Mode Share	Employee Trips
Car driver	83%	840	73%	739
Car passenger	7%	71	14%	162
Train	2%	20	2%	20
Bus	1%	10	1%	10
Cycle	3%*	30	4%*	50
Walk	4%*	40	4%*	50
Total	100%	1012	100%	1012

Source: Maunsell 2006

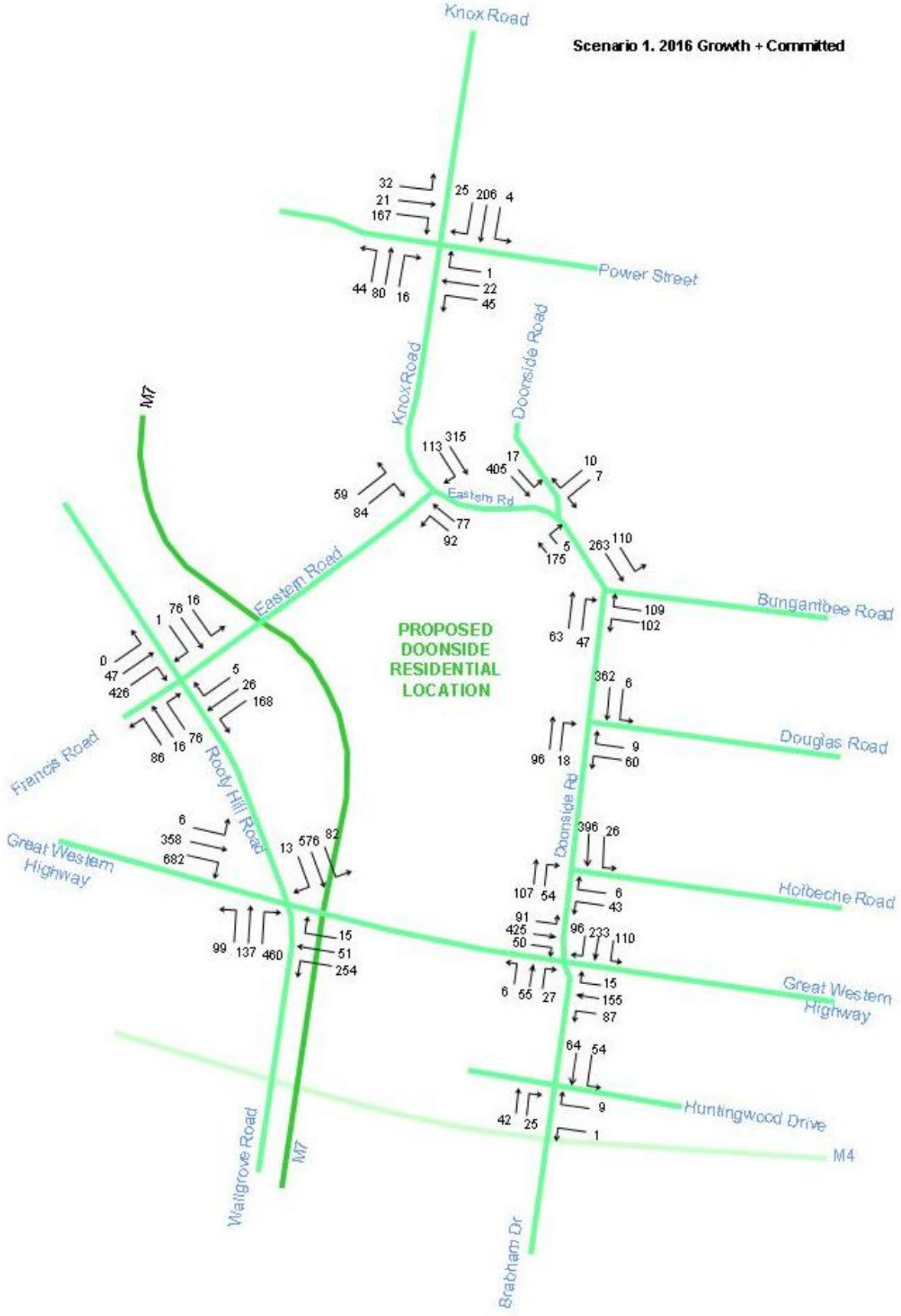
* Assumed split of 'other modes'

On the basis of rate of 15 vehicles trips per developable hectare and the mode shares exhibited by employees at a neighbouring site, total employees at the site are estimated at 1,102. Landcom expects 800 employees to be accommodated on the site, so this assessment tests a worse case.

In the AM peak it is assumed that there will be some counterflow to the large numbers of employees entering the site as visitors or service vehicles leave the site, so a split of 85 per cent / 15 per cent has been applied to the generated traffic.

Figure 7.1 illustrates the increases in traffic flow in the vicinity of the Doonside site as a result of committed developments and assumed background growth of one percent per annum.

Figure 7.1: Committed Development Traffic Flow



Source: Maunsell, 2007

7.3 Traffic Impacts and Opportunities

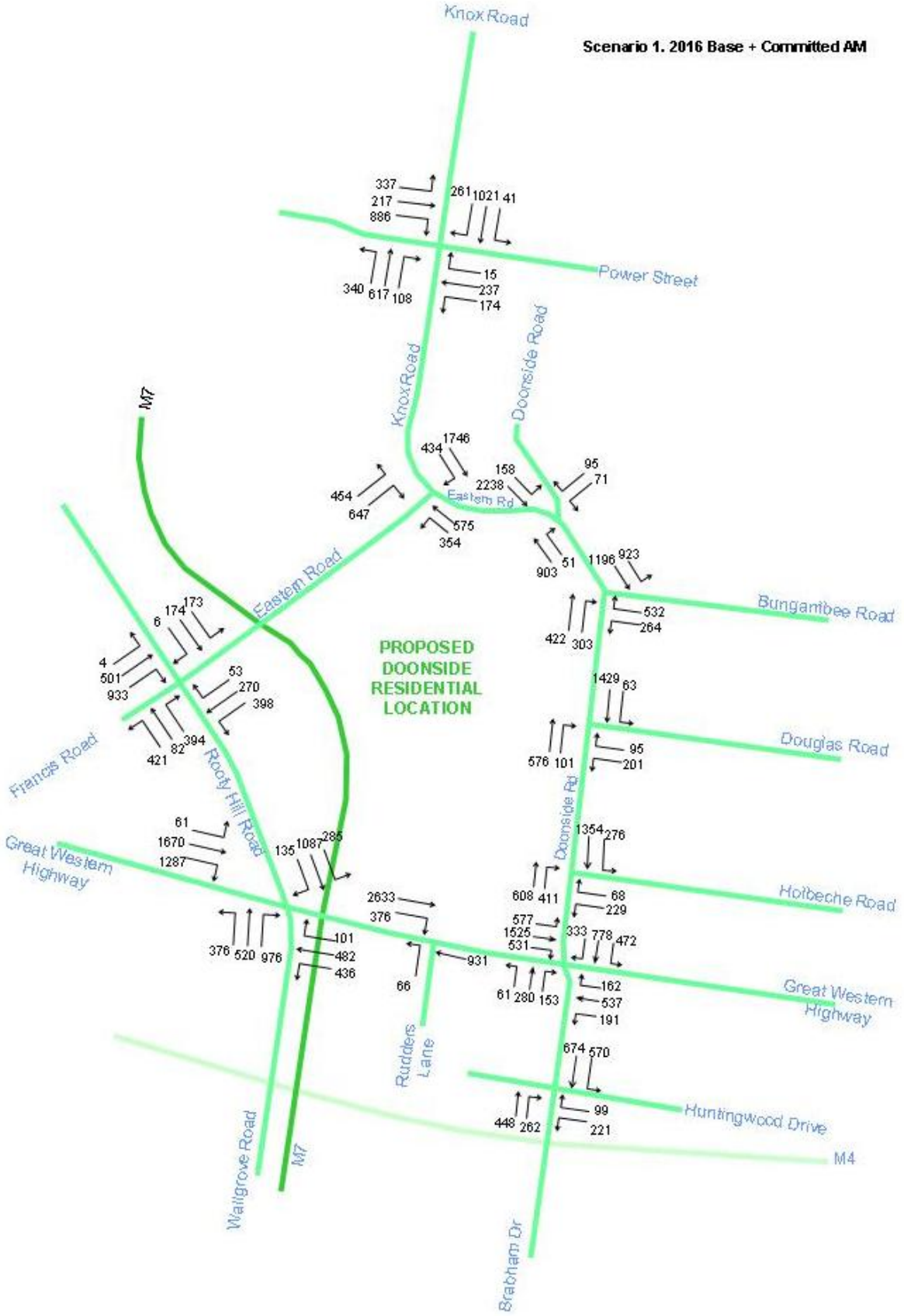
A review of the 2006 traffic count data has established that the peak loading on the road network in the vicinity of the Doonside site occurs during the AM peak between 7.30am and 8.30am. Therefore, this traffic assessment focuses on the AM Peak and considers the impact of employees trips to work.

Peak levels of traffic demand have been estimated using a strategic spreadsheet model. Four scenarios have been developed within the model:

- Base Scenario 1 – existing traffic counts factored to likely 2016 flows (at an assumed rate of one percent per year) plus estimates of all committed development trips as described previously;
- Base Scenario 2 – existing traffic counts factored to likely 2016 flows (at a rate of one percent per year) plus committed development traffic relating to the proposed Doonside residential development only;
- Design Scenario 1 – Base Scenario 1 plus Huntingwood West development trips; and
- Design Scenario 2 – Base Scenario 2 plus Huntingwood West development trips.

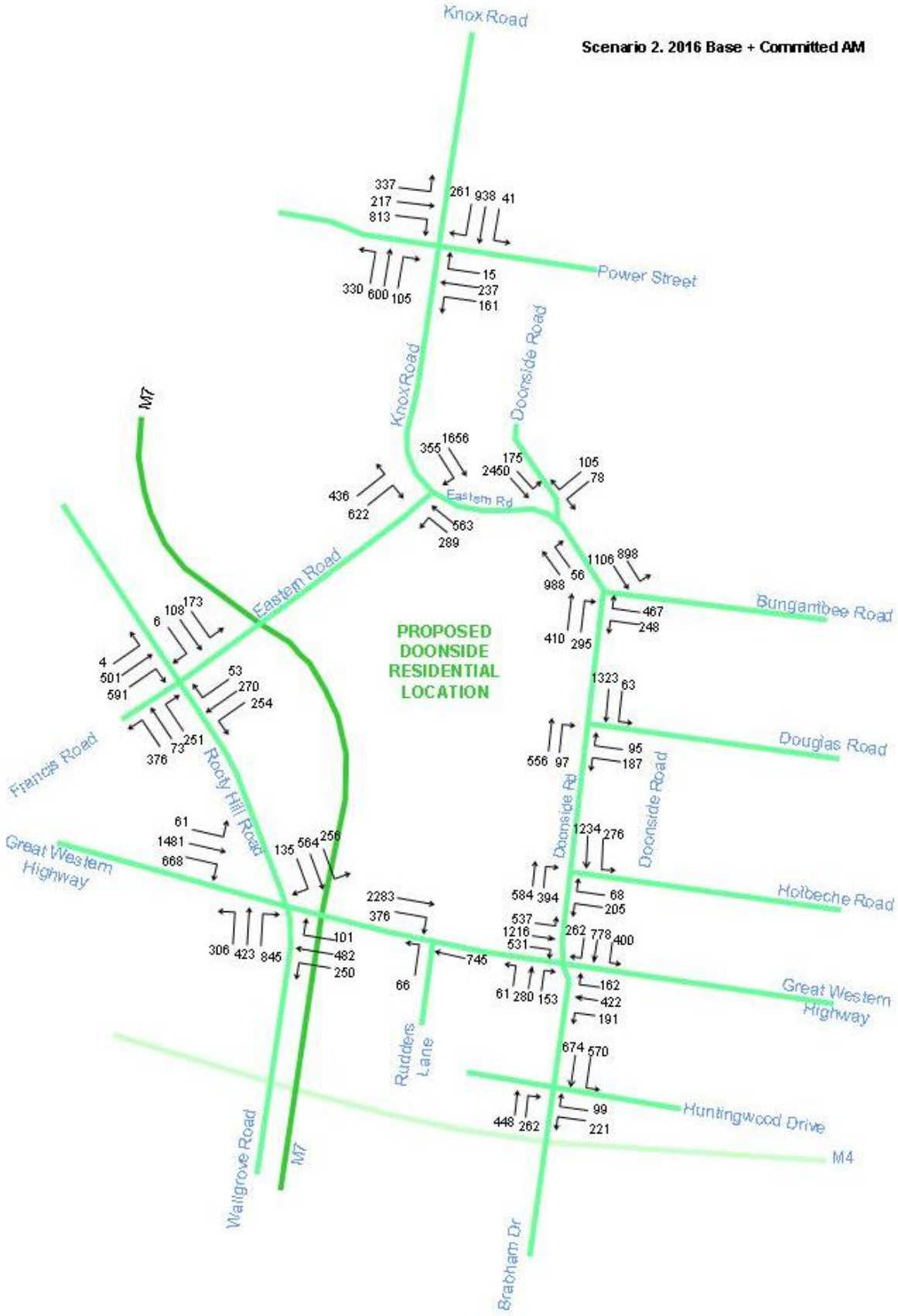
Figures 7.2 to **7.5** illustrate the estimated 2016 traffic flows with and without the Doonside site under Scenario 1 and 2. A full set of traffic flow diagrams is also included at **Appendix B**.

Figure 7.2: Base Scenario 1



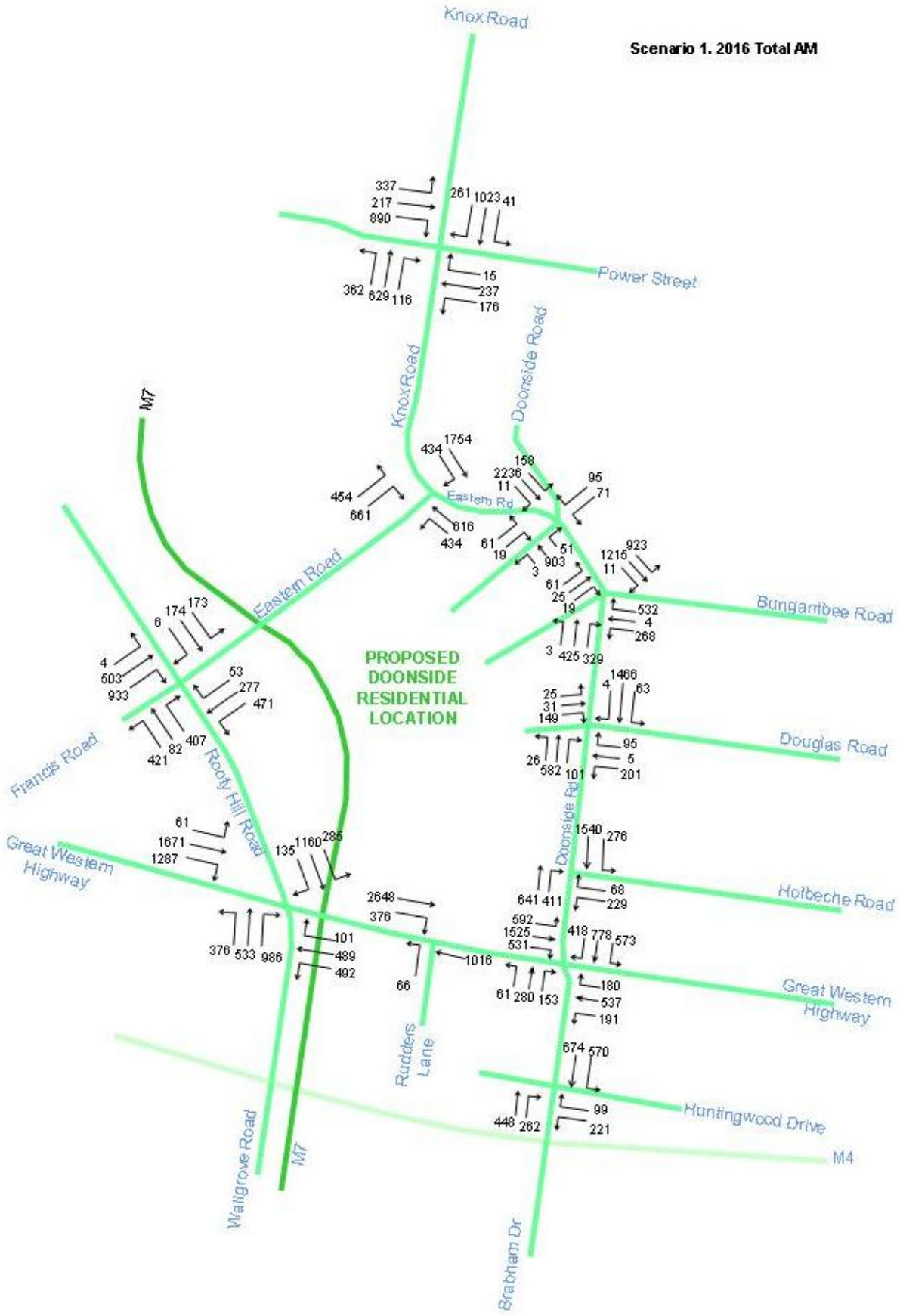
Source: Maunsell, 2007

Figure 7.3: Base Scenario 2



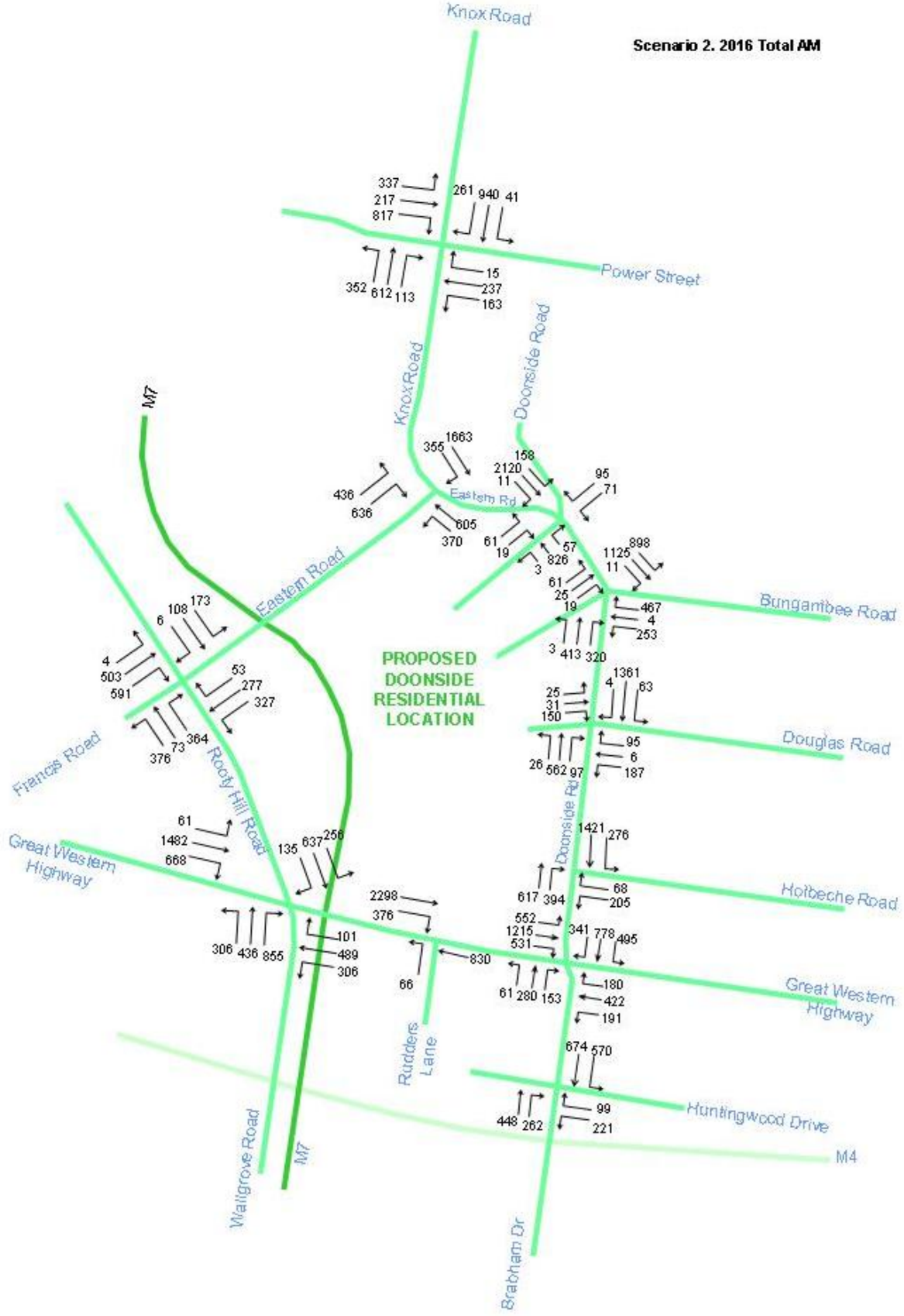
Source: Maunsell, 2007

Figure 7.4: Design Scenario 1



Source: Maunsell, 2007

Figure 7.5: Design Scenario 2



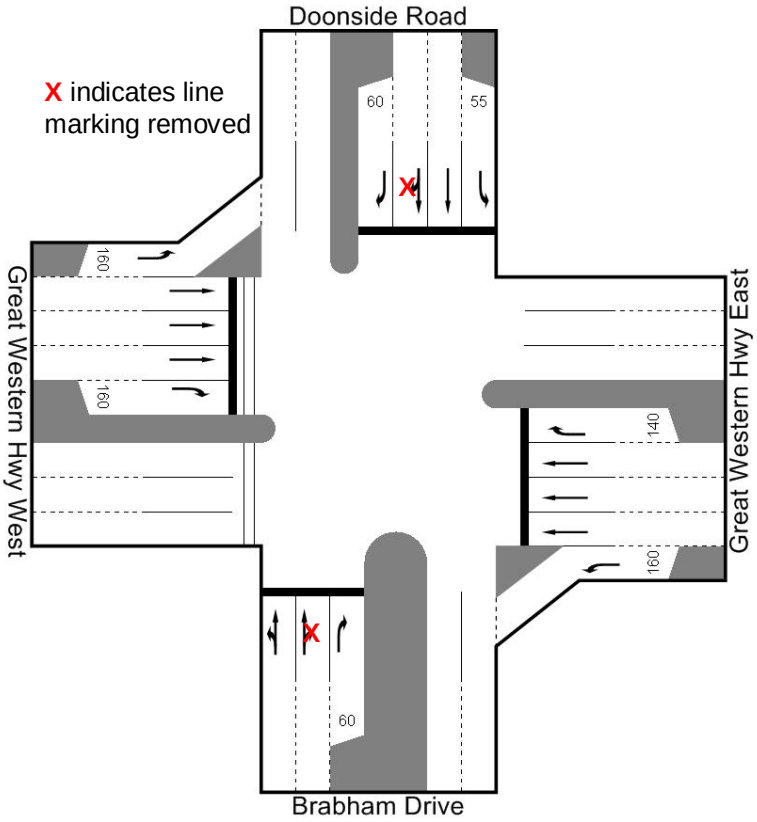
Source: Maunsell, 2007

Since the capacity of a network is limited by the delays caused by intersections in the network, this traffic assessment considers improvements to intersections only and does not consider mid-block improvements.

At the current time there are no published plans to improve the intersections in the surrounding area to accommodate the impacts of the Western Sydney Employment Hub, with the exception of measures recommended within the Huntingwood West TMAP developed by Maunsell. Therefore, the impact assessment applies the 2016 flows from each of the four Scenarios to the existing 2006 layout, with the exception of the Doonside Road/ Great Western Highway intersection.

The proposed layout for this intersection is illustrated by **Figure 7.6**.

Figure 7.6: Great Western Highway/ Doonside Road: With proposed changes to line markings



Source: Maunsell 2006

A number of assumptions have been made both in the total trips generated by these developments and the distribution of the trips through the network. In addition, this analysis does not take into account re-routing by vehicles to alternative less congested routes.

Intersection assessments were conducted using aaSIDRA v3.1. **Tables 7.3** to **7.6** summarise the results of the analysis for each Scenario in turn. Full SIDRA output is included at **Appendix C**.

Table 7.3: 2016 Base Scenario 1 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,597	1.0	101.3	F
2: Great Western Highway / Rooty Hill Road	7,414	1.1	77.9	F
3: Rooty Hill Road South / Eastern Road	3,409	1.0	77.3	F
4: Eastern Road / Knox Road	4,211	0.9	10.0	A
5: Doonside Road / Bungarribee Road	3,638	1.1	>120	F
6: Doonside Road / Douglas Road	2,464	0.5	10.5	A
11. Doonside Road/ Eastern Road	3,651	0.8	9.7	A

Source: Maunsell, 2007

With reference to the existing performance shown in **Table 5.4, Table 7.3** illustrates that the impact of other committed developments, and natural traffic growth, in the vicinity of the Doonside site, would significantly reduce the Level of Service at several local intersections, causing many to fail. Level of Service F is recorded at four of the seven intersections, with the worst performing being Rooty Hill Road South/ Eastern Road.

Intersection 'failures' are generally recorded due to the poor performance of individual approaches or single movements at the intersection. This can be due to a number of factors, including lack of capacity, minimal green time at traffic signals and / or high traffic demand from an opposing movement, therefore limiting exit opportunities. Experience has shown that often a right turn with high traffic demand is the key movement that will determine the failure of an intersection.

A number of the intersections fail significantly in the Scenario shown in **Table 7.3**. Analysis of the results identifies the following movements that perform worst at each of these intersections:

1. Through movements on Great Western Highway from the west, the through movement from Doonside Road and the right turn from Brabham Drive.

2. Through and right turn movements from Great Western Highway (west), the right turn from Wallgrove Road and the through movement from Rooty Hill Road South.

5. Both movements from Bungarribee Road.

Following this initial analysis, the performance of each intersection was tested where only base 2016 flows (i.e. factored from 2006) and Huntingwood West flows are added and these are reported in **Table 7.4**. Full SIDRA output is included at **Appendix D**.

Table 7.4: 2016 Base Scenario 2 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	4,990	1.0	78.8	F
2: Great Western Highway / Rooty Hill Road	5,568	0.7	46.2	D
3: Rooty Hill Road South / Eastern Road	2,760	0.7	45.7	D
4: Eastern Road / Knox Road	3,922	0.8	9.7	A
5: Doonside Road / Bungarribee Road	3,420	1.2	65.1	E
6: Doonside Road / Douglas Road	2,319	0.5	10.6	A
11. Doonside Road/ Eastern Road	3,454	0.8	9.6	A

Source: Maunsell, 2007

2016 Design Scenario 1 applies the Doonside trips to the potential flows from all other developments. This level of flow defines a worst case scenario for future traffic demand and consequently a number of intersections are again likely to fail. The results from this Scenario are given in **Table 7.5.** Full SIDRA output is included at **Appendix C**.

Table 7.5: 2016 Design Scenario 1 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,816	1.1	124.9	F
2: Great Western Highway / Rooty Hill Road	7,574	1.1	69.7	E
3: Rooty Hill Road South / Eastern Road	3,502	1.0	70.9	F
4: Eastern Road / Knox Road	4,354	0.9	10.2	A
5: Doonside Road / Bungarribee Road	3,813	1.0	28.8	C
6: Doonside Road / Douglas Road	2,761	1.0	25.8	B
11. Doonside Road/ Eastern Road	3,808	0.9	6.7	A

Source: Maunsell, 2007

Two intersections fail under the design scenario, but the impact due to the Doonside development appears to be marginal. In order to establish a better understanding of the likely impacts of the Doonside development on its own, expected flows generated from this site were applied to the 2016 base data and the committed development at Huntingwood West only. These results are presented in **Table 7.6**. Full SIDRA output is included at **Appendix D**.

Table 7.6: 2016 Design Scenario 2 Weekday Morning Peak Period Intersection Performances

Intersection	Vehicles (veh / hour)	Degree of Saturation	Average Delay (sec / veh)	Level of Service
1: Great Western Highway / Doonside Road	5,209	1.0	90.7	F
2: Great Western Highway / Rooty Hill Road	5,728	0.8	46.7	D
3: Rooty Hill Road South / Eastern Road	2,853	0.7	47.5	D
4: Eastern Road / Knox Road	4,067	0.9	9.9	A
5: Doonside Road / Bungarribee Road	3,598	0.9	15.8	B
6: Doonside Road / Douglas Road	2,606	0.9	25.1	B
11. Doonside Road/ Eastern Road	3,607	0.8	6.4	A

Source: Maunsell, 2007

Comparison between **Tables 7.4 and 7.6** illustrates that the Doonside development will have a marginal impact on local intersections. The operation of the Doonside Road/ Bungarribee Road intersection improves following the addition of a fourth arm to the roundabout. The improvement is a result of improved balance of flow, since the access road traffic interrupts the flow of traffic from the Doonside Road North, allowing traffic on the Bungarribee Road approach to enter the roundabout. The failure of intersection 1 was to be expected following the poor result in the base scenario.

The impact assessment concludes that there is no requirement to upgrade local intersections to accommodate the Doonside residential development.

7.4 Pedestrian Impacts and Opportunities

The site will generate walking demands both within the site and to and from the site. This would include trips to:

- Schools;
- Local shops;
- Rail stations;
- Bus stops; and/or
- Home.

In the morning peak hour, it is anticipated that approximately 160 walk trips will be generated by the site, if the beginning of all train and bus trips is made on foot. Outside of the peak, it is expected that the number of walk trips will also be significant. Pedestrian desire lines outside of the peak hour include:

- Bungarribee Road to the Rainbow Shopping Centre or the service station (for residents to purchase daily items);
- Doonside station to the Parklands for visitors arriving by rail;
- Existing residential areas to the Parklands; and
- Existing residential areas to the heritage site adjacent to Douglas Road. Potential uses for the site may include a community facility.

The Doonside development is between two and three kilometres of the Huntingwood and Arndell Park industrial sites and approximately four kilometres from Blacktown City Centre, so there is some potential for employees to walk to local places of work. These opportunities will be improved by provision of direct and secure walking routes.

It is essential to provide high quality, direct and secure connections from the site to the surrounding areas along these desire lines to:

- reduce dependency on the car;
- encourage incidental activity for improved health; and
- provide equity in transport for those without independent means of travel (especially teenagers and older people).

These objectives are consistent with the Social Sustainability Plan for the site.

To estimate pedestrian demand at the site accesses, pedestrians travelling in the peak hour have been apportioned on the basis of the location of attractors within walking distance of the site, as reported by **Table 7.7**.

Table 7.7: Peak hour walk trip destinations

Access Point	Train	Bus	School	Shops	Other	Total
Doonside Road/ Eastern Road	73	-	10	-	16	99
Doonside Road/ Bungarribee Road	-	6	-	18	16	39
Doonside Road/ Douglas Road	-	-	10	-	16	26
Total						**164**

Source: Maunsell, 2007

The peak hour volumes of pedestrian trips at the Eastern Road/ Doonside Road intersection combined with the location adjacent to a school warrant provision of formal crossing facilities.[9] Since the access is located directly adjacent to a school, it is not considered appropriate to provide a roundabout without explicit crossing guidance measures.

Peak hour estimates at Bungarribee Road do not meet the warrant, although it would be advisable to provide a pedestrian crossing because:

- a critical desire line exists at this location;
- the population of the site will include many families with children who would be vulnerable crossing Doonside Road using refuges at a roundabout; and because
- trips on foot should be encouraged not discouraged.

Three options to provide pedestrian crossings at these two locations have been considered:

a) Provide roundabout with adjacent mid block signalised pedestrian crossing.
b) Provide roundabout and footbridge.
c) Signalised intersections with pedestrian crossings.

Roundabout and footbridge

Provision of a footbridge also creates increased travel distance for pedestrians and may cause incidences of crossing at ground level. Significant median barriers would need to be installed, leading to aesthetic implications as well as the high cost of the bridge. Therefore, this option was discounted early in the analysis.

Signalised intersection

The operation of the Doonside Road/ Eastern Road access as a signalised intersection was modelled using SIDRA Intersection 3.1. The model reported a Level of Service C, a degree of saturation of 0.88 and an average delay 28.5 seconds, suggesting that a signalised intersection in this form would operate satisfactorily but at a lower Level of Service than as a roundabout.

The Doonside Road/ Bungarribee Road access was also tested as a signalised intersection and reported a Level of Service D, a degree of saturation of 0.89 and an average delay 46.5 seconds. A Level of Service D indicates a significant increase in delay to users when compared to a Level of Service B that can be achieved when operating as a roundabout.

Full output from the intersection models is included at **Appendix E**.

Roundabout and mid-block crossings

Intersection models were constructed to represent mid-block pedestrian crossings. The model tests a standard signal arrangement with full red during the pedestrian phase. However, it should be noted that provision of pelican crossings would reduce delay experienced by drivers and therefore may be a more suitable arrangement at this location.

For a crossing location between Eastern Road and Bungarribee Road the model indicated that queue lengths for eastbound traffic may be up to 100 metres in length and that a crossing should be located at least 100 metres to the south east of the Doonside Road/ Eastern Road intersection. An ideal site for a crossing would be in the vicinity of Birdwood Avenue so that a visual connection could be provided between this street and a road internal to the site. By providing a crossing in this location residents living at the very north of the site would experience slightly longer walk trips to the station

[9] Austroads Guide to Traffic Engineering Part 13: Pedestrians

and schools but this is offset by shorter trips to the Rainbow Shopping Centre. Therefore, a midblock location is judged to be suitable.

At the Bungarribee Road intersection, the same model test indicated that a mid-block pedestrian crossing should be located at least 125 metres to the south of the roundabout. A visual connection can be provided to an internal road within the site by locating the crossing in the vicinity of Bowes Place. Pedestrians will travel to the Rainbow Shopping Centre along Doonside Road and Bungarribee Road; currently there is no footpath provision for this length. Council has noted safety concerns for pedestrians using pathways into Bowes Place and this is acknowledged by providing a footpath along Doonside Road and Bungarribee Road.

A third pedestrian crossing has been proposed by Landcom to connect the Parklands to Doonside station without creating a pedestrian route through the residential development. It will also allow pedestrians to connect to the existing footpath network north of Eastern Road, providing access to Nurragingy Recreational area.

The location of the mid-block crossings described above is illustrated by **Figure 7.7.**

During consultation, the RTA noted that there are safety concerns associated with mid-block crossings, in that drivers have been observed to drive through a red light without stopping at other locations in Blacktown. This concern can be addressed by adequate lighting at the crossing and signage prior to the crossing to alert drivers to its location.

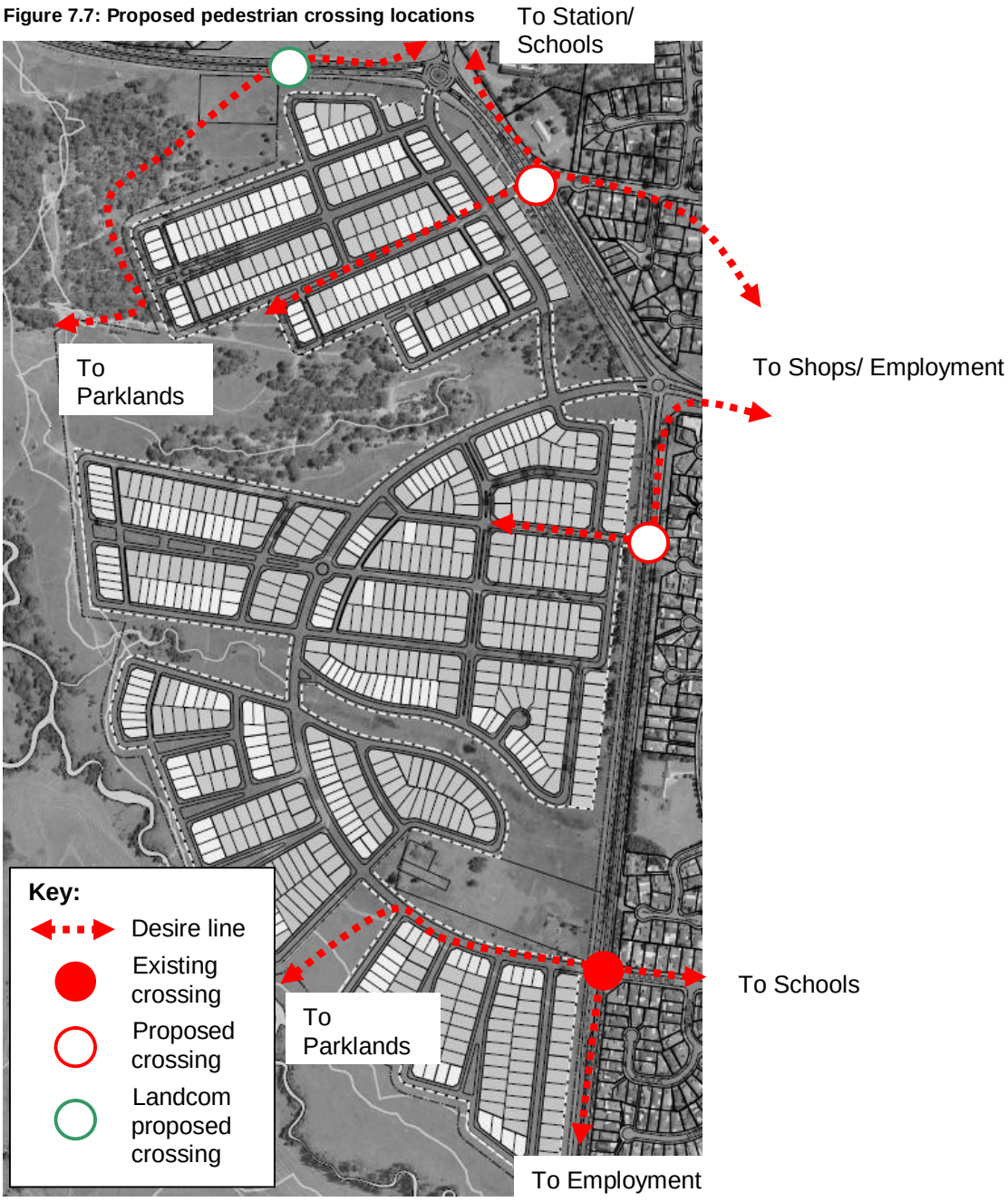
The pedestrian crossings play a key role in enhancing connectivity with residential areas and surrounding community facilities to meet social sustainability objectives. It is noted that Council has raised concerns of promoting pedestrian connections through the existing residential area to the east Doonside Road reach the shopping centre but it is considered that the improved amenity through the connectivity is greater than a loss than could be incurred by increased pedestrian activity on a residential street. Increased pedestrian activity can increase amenity since passive surveillance of an area is increased.

Council also expressed concern during consultation that additional walk distances would encourage some pedestrians to cross the road at locations other than the crossings. However, the crossings have been located so that the majority of residents would not incur longer walk distances. In addition, the preferred pedestrian routes will be encouraged through elements of the detailed landscape design, including lighting and signing, and proposed acoustic barriers along Doonside Road.

In summary, pedestrian impacts and opportunities to encourage increased trips by foot have been assessed and the preferred option is to provide two mid block pelican crossings at the following locations:

- Doonside Road (in the vicinity of Birdwood Avenue); and
- Doonside Road (in the vicinity of Bowes Place).

Figure 7.7: Proposed pedestrian crossing locations



Source: Maunsell 2007, on Architectus 2007 base

7.5 Cycling Impacts and Opportunities

Cycling mode splits are expected to remain low for journey to work trips from the Doonside site. However, improvements to cycle facilities and networks around the site offer opportunities to increase the mode share. The site is within cycle commuting distance for a number of places of work within Blacktown.

It is likely that between one and four per cent of trips will be made by bicycle. At the upper end, this could create 30 cycle trips from the site during the AM peak hour.

Planned improvements to the cycle network will accommodate these cyclists, and any mode shift to cycling, but it should be ensured that the connection is provided from the site to the cycle network and

that trip end facilities are offered, for example, sufficient secure cycle parking and lockers should be provided to cater for cyclists at rail stations.

7.6 Bus Impacts and Opportunities

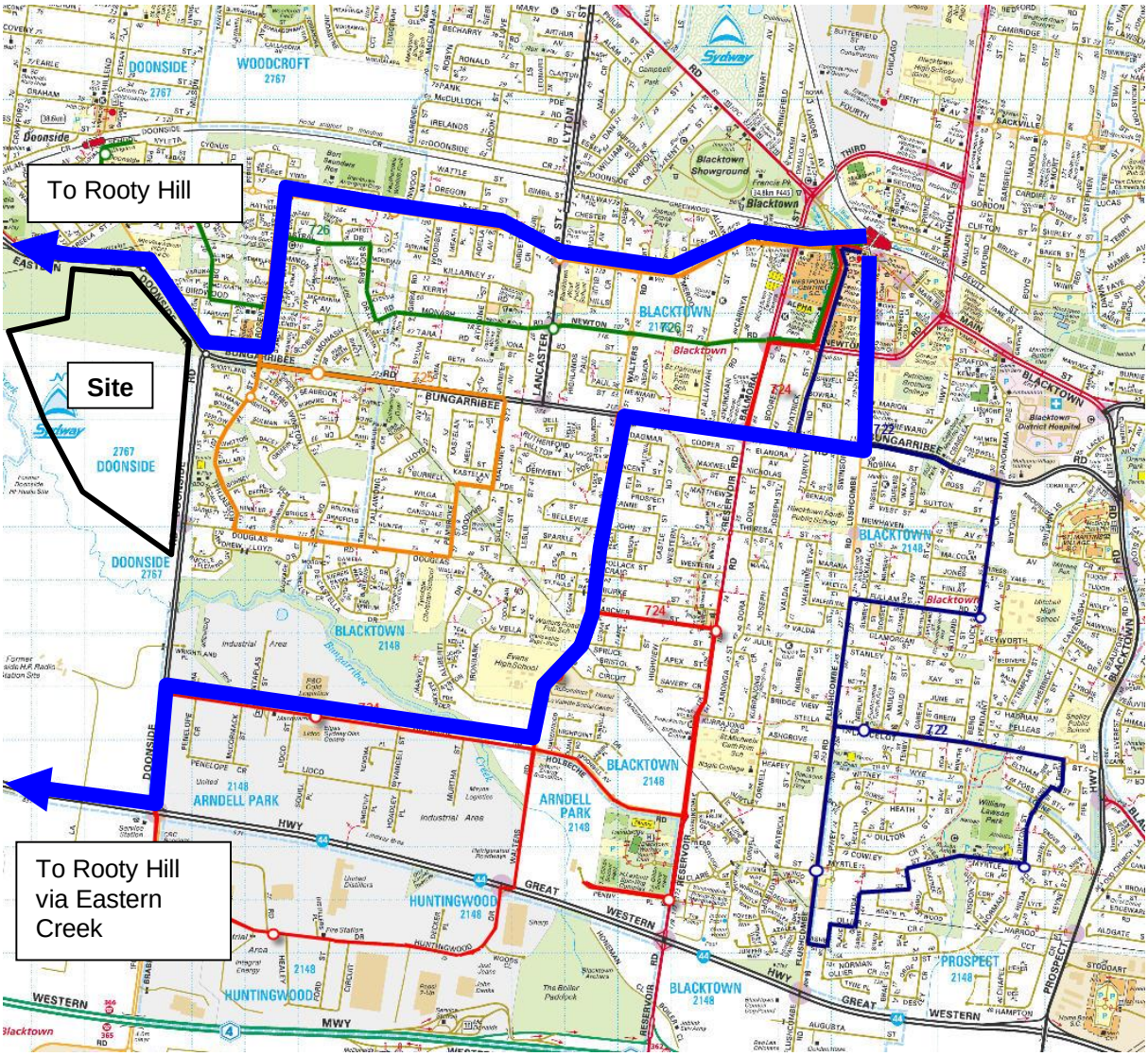
Consultation with the Ministry of Transport has revealed that new bus routes to meet growing demand in the Western Sydney Employment Hub area are in the planning stages. These have not been evolved to the stage of consultation with operators and the community but they can be used as an indication of future provision.

Upon full development and with double the current mode share of the adjacent neighbourhoods following mode shift from car, the Doonside site is expected to generate around 14 bus trips during the morning peak hour.

This level of patronage is not sufficient to support a new bus service for the site. However, the opportunity exists to divert an existing route to serve the site. Route 725 currently serves the existing residential estates east of Doonside Road and could potentially be diverted to travel either through the site or along Doonside Road. The site collector road should be constructed to accommodate buses and potential bus stop locations should be identified. By providing accesses at Bungarribee Road and Douglas Road, the collector road can be positioned in a way that facilitates provision of a bus route. Public transport measures are explored in further detail in **Section 8**.

Figure 7.8 illustrates future bus routes in the vicinity of the site being considered by the Ministry of Transport to meet future demand.

Figure 7.8: Future Bus Routes in the Vicinity of the Doonside Site



Source: MOT, 2006

7.7 Rail Impacts

Upon full development, the Doonside site is expected to generate approximately 75 rail trips during the morning peak hour. These would be accommodated across the four peak hour train services that call at Doonside station or the eight peak hour services that call at Blacktown station.

These rail trips include a walk and/or bus trip to the station. For the purposes of this assessment, it is assumed that the rail users will use the closest station (Doonside). These trips are included within the walking impacts in earlier paragraphs.

7.8 Conclusion

The findings of the impact assessment indicate that infrastructure works to mitigate traffic impacts of the Doonside development are not required. To accommodate and encourage trips by other modes, the following measures are proposed:

- two signalised pedestrian crossings across Doonside Road to provide safe and equitable access to schools, transport and community facilities;
- connections to the cycle network; and
- a high quality network of footpaths to/ from and around the site.

A range of measures will be required to supplement these infrastructure improvements in order to meet the sustainability objectives of this TMAP. The comprehensive package of measures is detailed in **Section 8**.

8.0 Package of Measures

8.1 Introduction

This section discusses the package of measures recommended for implementation in the vicinity of the site. The driving force behind the package will be the implementation of personalised travel plans for Doonside residents to encourage mode shift. This mode shift will be enabled by supporting initiatives, addressing:

- Infrastructure needs – including measures to improve walking, cycling and public transport opportunities, while maintaining private vehicle access; and
- Service needs – providing sufficient services to promote a higher public transport mode split.

Planning principles that would guide the provision of high quality infrastructure are also included. At this stage of the TMAP, the approach is independent and holistic so that the most appropriate package of measures is developed.

8.2 Travel Behaviour Change

Personalised Travel Planning

Personalised travel planning has been proven in Western Australia, South Australia and Europe to be an effective tool in effecting a mode shift to sustainable modes of transport. A pilot project conducted in Woy Woy successfully reduced vehicle kilometres travelled by residents.

Personalised travel planning has not been adopted as a standard planning tool in NSW. This development offers the opportunity to use a measure that is innovative in NSW but one that has been proven to work elsewhere.

Each household would be provided with a free mountain bike to encourage use of both the recreational routes in the area and routes to schools, shops and places of work. A welcome pack (commonly called 'travel kits') would also be provided to each new household. A typical pack would include:

- Welcome letter (including direction to the 131500 travel information line and website);
- Bus map;
- Train network map;
- Blacktown Council cycle map;
- Site cycle and footpath map, including cycle parking locations in the surrounding area;
- Leaflet: Using the bus for the first time;
- Leaflet: Fares/Travel passes;
- Leaflet: How to use cycle lockers;
- Bus timetables for Service 724 and 725 to Blacktown;
- Train timetables for Doonside and Blacktown Station;
- Cycle store discounts; and
- Four free weekly travel passes per household.

8.3 Infrastructure

This section discusses the infrastructure that is required to underpin the service and policy initiatives. The infrastructure package has been tailored to improve sustainable transport, while maintaining satisfactory levels of private car performance.

Walking Infrastructure

Internal roads within Doonside will connect to the existing street and footpath network so that footpaths are connected without creating diversions. This will provide a direct route for residents to local shops and school and bus stops, as well as the Parklands.

Roundabouts are not recommended within the development site. The site access will connect to the existing roundabouts at the Doonside Road/ Eastern Road and Doonside Road/ Bungarribee Road and the signalised intersection at Douglas Road, at which a pedestrian crossing is already provided.

Two pelican crossings will be provided across Doonside Road, in the vicinity of Birdwood Avenue and Bowes Place. Pedestrians will be able to cross without significant diversion from desire lines and drivers will experience minimal additional delay.

A third pedestrian crossing has been proposed by Landcom to connect the Parklands to Doonside station without creating a pedestrian route through the residential development. It will also allow pedestrians to connect to the existing footpath network north of Eastern Road, providing access to Nurragingy Recreational area.

To accommodate pedestrians that choose to reach the crossings by walking along Doonside Road instead of travelling through the site, a footpath should be provided. This would be provided as part of a shared path proposed by Blacktown Council to link the station to the Huntingwood commercial areas. A footpath would also be required on the eastern side of Doonside Road between Bowes Place and Bungarribee Road and on the southern side of Bungarribee Road as far as Rosenthal Street.

Cycling Infrastructure

Connections to cycle paths, such as those adjacent to the M7 and M4 and the proposed Parklands cycle path, will be provided where appropriate. There is the opportunity for the developer to provide a contribution to the construction of the shared path proposed by Blacktown Council connecting Huntingwood to Doonside station. This could enable construction of the path prior to the site opening.

Cyclists will be able to avoid using the Doonside Road/ Bungarribee Road if a shared path is provided on Doonside Road. Holding rails should be included in the design of the Doonside Road/ Eastern Road intersection.

Trip end facilities for cyclists should be available at rail stations, schools, shops and community centres. Cycle racks should be installed at all of these locations in highly visible locations, both to increase security and to encourage the awareness of cycling as a viable mode choice.

Rail Infrastructure

The Clearways programme is a project that will upgrades the Sydney rail network that will benefit rail users from increases in reliability and capacity. A specific project that may benefit passengers travelling on the Western Line and catching a train from Blacktown, Doonside or Rooty Hill is the Quakers Hill to Schofields duplication. The Western Line Richmond branch is a single track route and therefore suffers congestion. A double track will be constructed by 2010 to improve reliability and reducing passenger crowding.

An improvement to rail infrastructure in the local area is in progress at Blacktown Station. The customer lift facilities are being improved at the station and bus interchange to improve reliability, increasing the attractiveness of a trip by rail for passengers with restricted mobility or families with pushchairs. Works are programmed for completion by the end of June 2006.

Bus Infrastructure

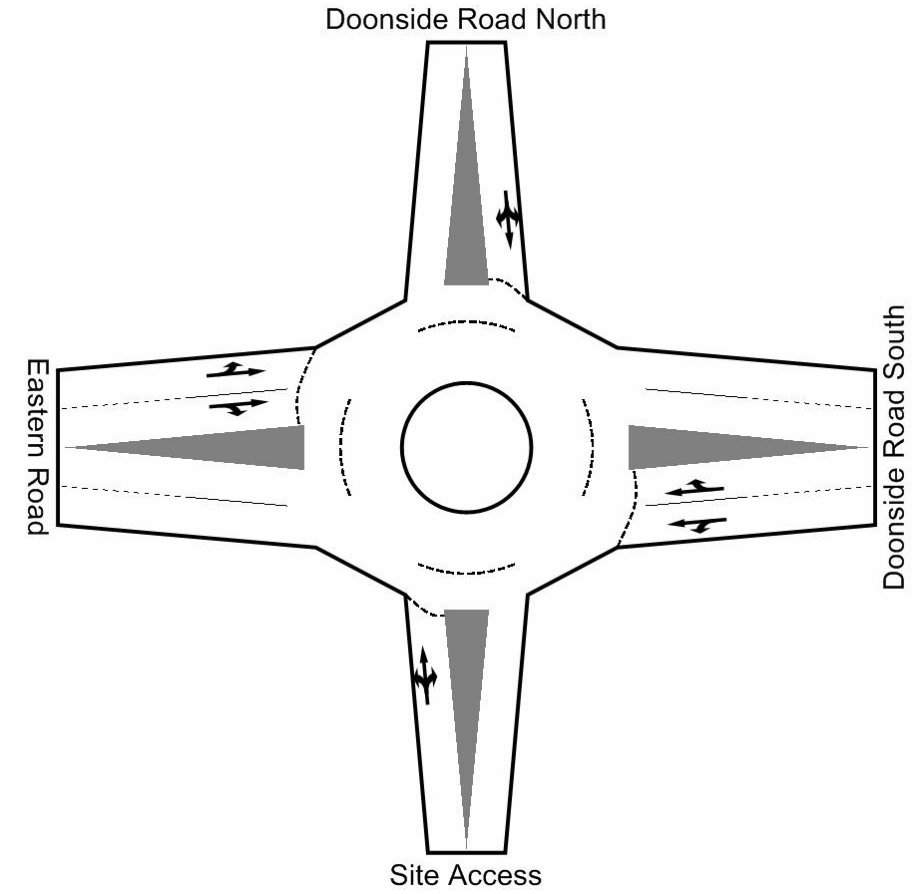
Bus stops would be provided on bus routes serving the site as required.

Road Network Infrastructure

Major upgrade works will be required to accommodate traffic volumes generated by the Western Sydney Employment Hub. However, the measures within this TMAP address only the traffic volumes generated by the Doonside site so as not to attempt to redesign the Western Sydney road network, which is not within the scope of this TMAP.

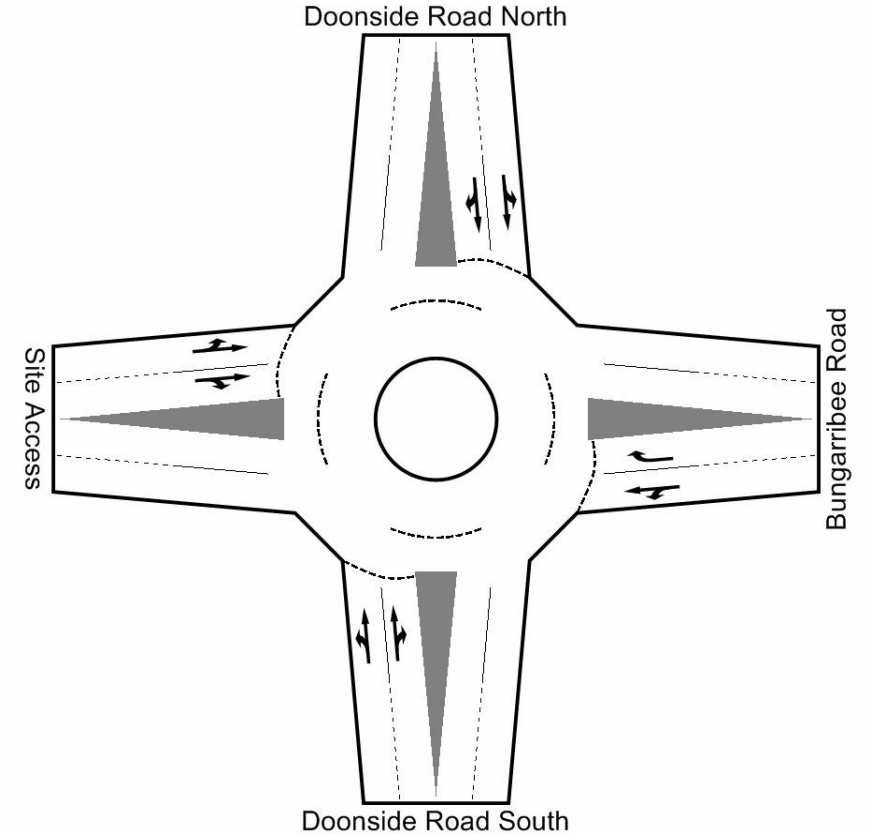
Site accesses will be provided at the existing intersections of Doonside Road/ Eastern Road, Doonside Road/ Bungarribee Road and Doonside Road/ Douglas Road. The suggested intersection arrangement is illustrated by **Figures 8.1** to **8.3**.

Figure 8.1: Proposed Access at Doonside Road/ Eastern Road



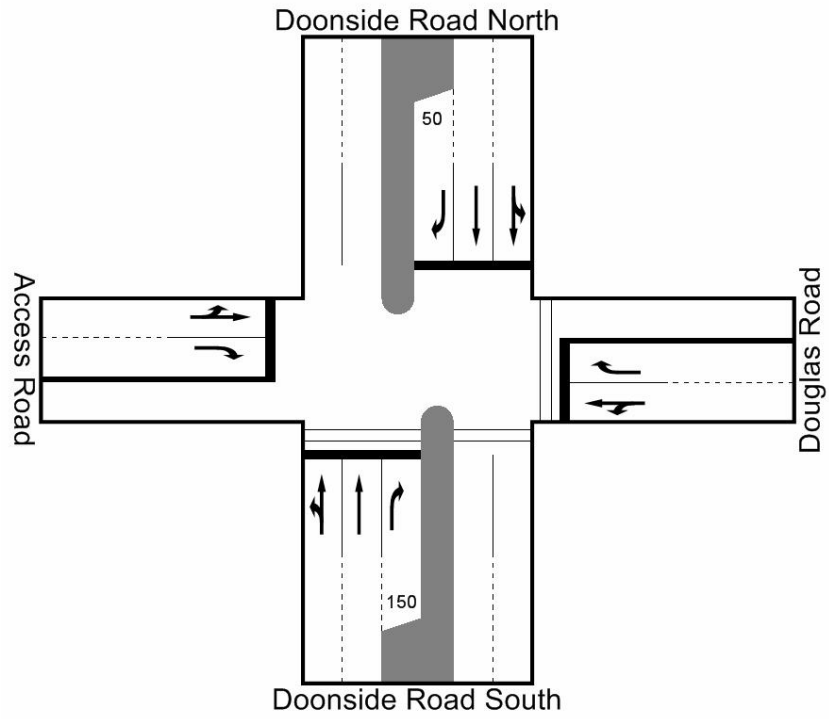
Source: Maunsell 2007

Figure 8.2: Proposed Access at Doonside Road/ Bungarribee Road



Source: Maunsell 2007

Figure 8.3: Proposed Access at Doonside Road/ Douglas Road



Source: Maunsell 2007

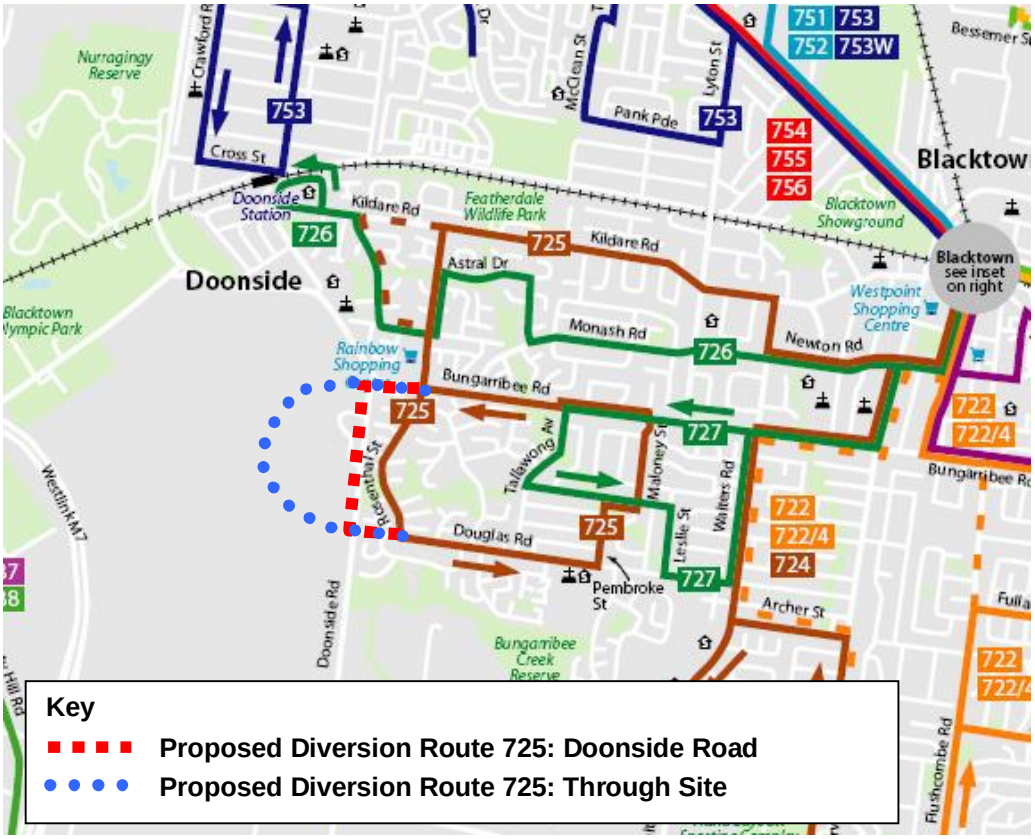
8.4 Service Responses

Bus Services

The study area falls within Contract Area 1, scheduled for review by the Ministry of Transport under NSW Bus Reform in 2007/2008. Therefore, improvements to bus services to serve the site are considered to be medium term measures.

The opportunity exists to divert the existing service 725 along Doonside Road adjacent to the site, an additional distance of 1.3 kilometres, or through the site, a distance of approximately 1.6 kilometres. A bus route through the site is dependent on provision of vehicular access at both Douglas Road and Bungarribee Road.

Figure 8.4: Bus Service Measures



Source: Maunsell 2007

Negotiations between the operator and the Ministry of Transport will take place to determine the best way to serve the Doonside site. New services drafted by the MoT but not yet negotiated with operators or put to community consultation are shown in **Figure 7.8**.

Rail Services

There are no scheduled changes to rail services that may benefit the site and encourage mode shift.

8.5 Planning Principles

In order to create high quality pedestrian and cycling environments there are a number of general principles that should be considered and applied when planning and designing facilities. These include:

- ***Permeability*** – pedestrians and cyclists should be able to move conveniently through the study area by ensuring that all key origins and destinations are well connected. Large sites, developments and buildings should not present unacceptable barriers to movement.
- ***Priority*** – high priority should be given to pedestrian and cycle movements on key routes, through measures such as short wait times at signalised crossing points.
- ***Continuous*** – pedestrian and cycle routes should be continuous, with connected foot/cycle paths, crossing facilities and entry points.
- ***High quality*** – pedestrian and cycle facilities should at least meet design standards. Footpaths should include provision for people with disabilities. Designs should at least meet the standards expressed in Austroads Guide to Traffic Engineering, Part 13: Pedestrians and Part 14: Bicycles.
- ***Integration*** – walking and cycling should be integrated with other modes (particularly bus and train services) through the provision of obvious, safe and convenient pedestrian/cycle access paths to interchange areas, as well as secure cycle storage facilities.
- ***Legibility*** – the local environment should be easy for pedestrians and cyclists to 'read' so that they can easily find their way – street names should be clearly visible and clear signage should be provided including key destinations and distances.
- ***Capacity*** – pedestrian and cycle paths should be designed to provide ample space for both travelling and waiting pedestrians and cyclists.
- ***Pleasant*** – streetscapes should be designed to high urban design standards that provide interesting pedestrian and cycle routes, free of litter and fear of crime. Appropriate lighting should be provided on all routes. Greater levels of pedestrian and cyclist activity will assist in these regards.

The following principles relate well to the design of pedestrian facilities and should be incorporated into the design of the plan:

- ***Comfortable*** – pedestrian paths should be comfortable to walk on. Walking surfaces should be free of obstructions and provide a smooth surface (with no broken paving).
- ***Crossing facilities*** – appropriate at-grade pedestrian crossing facilities should be provided on desire lines. Consideration should be given to reducing the road width at these locations. Grade separated crossing facilities should be avoided where possible.
- ***Facilities*** – appropriate facilities should be provided within the footpath area, including regular seating, rubbish bins and maps. Design of facilities should be coordinated with the overall urban design theme and care should be taken when placing facilities to ensure that footpaths are not obstructed.
- ***Access to car parks*** – pedestrian access between car parks and local attractions should be considered to ensure that safe, convenient and obvious routes are provided, including pedestrian routes within car parks.

The following principles relate well to the design of cyclist facilities and should be incorporated into the design of the plan:

- ***Segregated facilities*** – cyclists should generally be provided with segregated on-road facilities, with clear cycle lanes, advance stop lines and other priority treatments. Particular care needs to be taken if cycle lanes and on-street parking are to be integrated.
- ***Storage Facilities*** – appropriate storage facilities should be provided at work. Storage facilities should provide for both long and short term storage of cycles and related equipment. Design should be such that storage is not only secure and provides weather protection, but also conveys a sense of high priority for the treatment of cycles and cyclists.

- ***Intersection Treatments*** – appropriate facilities should be provided for cyclists at intersections and at locations where cyclists have to move between on and off-street paths and vice versa to ensure safe and convenient access. These locations are typically the most difficult and confusing areas of the network for both cyclists and other road users.

The following principles relate well to the design of shared pedestrian / cyclist facilities and should be incorporated into the design of the plan:

- ***Separate*** - in general, facilities should be provided separately for pedestrians and cyclists, taking into account the different needs of these two groups.
- ***Consultation*** - where opportunities for shared off-road routes are identified (such as the Doonside Road facility), paths should be carefully planned with wide consultation at an early stage to ensure suitability of the route and the proposed facilities. Once implemented, use of the route should be monitored and changes made if problems arise.

8.6 Package of Measures

This chapter has described in some detail a proposed package of measures for implementation in and around the Western Parklands site. The package has been designed as an integrated package, requiring implementation of all measures if the objective of increasing public transport use, walking and cycling is to be achieved.

The analysis undertaken to supplement this TMAP in **Section 6.4** suggests that a mode shift of between five per cent could be achieved through the implementation of this integrated package of measures. **Table 8.1** provides a summary of the recommended measures developed as part of this TMAP.

Table 8.1: Summary of Package of Measures

Area	Measure	Detail
Travel Behaviour Change	Personalised Travel Plans	Welcome Pack and free bicycle for every household.
Infrastructure	Road Network	Site access to Doonside Road/ Eastern Road roundabout
		Site access to Doonside Road/ Bungarribee Road roundabout
		Site access to Doonside Road/ Douglas Road
	Bus	Bus stops on Doonside Road or Collector Road
	Pedestrian/ Cycle	Cycle parking facilities at rail stations, schools, shops and community centres.
		Pedestrian/ Cycle Connections
		Pedestrian crossing on Doonside Road (Birdwood Avenue)
		Pedestrian crossing on Doonside Road (Bowes Place)
		Pedestrian crossing on Eastern Road (Doonside station/Parklands connection)
		Doonside Road shared path
		Doonside Road footpath: Doonside Road: Bowes Place to Bungarribee Road Bungarribee Road: Doonside Road to Rosenthal Street
Transport Services	Bus	Potential to divert Service 725

Source: Maunsell, 2007

9.0 Cost and Timing

9.1 Introduction

For the travel behaviour, bus and cycle parking measures, Maunsell has formed an opinion of probable cost[10]. The probable cost is indicative at this preliminary stage and may have a confidence level of between +/-30 per cent and +/-50 per cent. YSCO Geomatics have provided costs for the civil works.

Upon agreement of the package and an associated scope of works for each measure, a more thorough scrutiny of likely costs can be undertaken if appropriate within the context of the planning process.

9.2 Cost Summary

The costs provided by YSCO Geomatics and details of the probable cost calculations are included at **Appendix A**.

Table 9.1 includes costs for items within the package of measures that are expected to be funded by the developer directly or via a Section 94 agreement.

Table 9.1: Summary of Probable Costs

Area	Measure	Probable Cost
Travel Behaviour Change	Welcome Pack and free bicycle for every household.	$431,000
Infrastructure	Site access to Doonside Road/ Eastern Road roundabout	$250,000
	Site access to Doonside Road/ Bungarribee Road roundabout	$3.5 million
	Site access to Doonside Road/ Douglas Road	$1 million
	Pedestrian crossing on Doonside Road (Birdwood Avenue)	$200,000
	Pedestrian crossing on Doonside Road (Bowes Place)	$200,000
	Pedestrian crossing on Eastern Road	$200,000
	*Bus stops on Doonside Road or Collector Road	$78,000
	Cycle parking facilities at rail stations, schools, shops and community centres.	$13,000
	*Doonside Road shared path	$300,000
	*Doonside Road footpath: Doonside Road: Bowes Place to Bungarribee Road Bungarribee Road: Doonside Road to Rosenthal Street	$41,000
Total		**$6.2million**

Source: Maunsell, 2007

* Section 94 item

[10] Opinion of probable costs are made on the basis of best judgment as an experienced and qualified engineering consultant, familiar with the construction industry As Maunsell is not a qualified Quantity Surveyor, nor does it employ quantity surveyors, Maunsell cannot and will not guarantee that any tenders or actual costs will not vary from this opinion of probable cost.

9.3 Timing

The likely timing for each of the elements of the package is shown in **Table 9.2.** The timing has been developed with consideration of the following factors:

- Residents are likely to begin to occupy the site in 2009.
- Certain measures need to be in place prior to occupation in an effort to encourage preferred travel habits.
- All required funding may not be available during one year and must be programmed.
- The study area falls within Contract Area 1, scheduled for review by the Ministry of Transport under NSW Bus Reform in 2007/2008.

Table 9.2: Suggested Timing

Area	Measure	Timing
Travel Behaviour Change	Welcome Pack and free bicycle for every household.	Provided to each household on occupation
Infrastructure	Site access to Doonside Road/ Eastern Road roundabout	Prior to first occupation of stages adjacent to the access
	Site access to Doonside Road/ Bungarribee Road roundabout	Prior to first occupation of stages adjacent to the access
	Site access to Doonside Road/ Douglas Road	Prior to first occupation of stages adjacent to the access
	Bus stops on Doonside Road or Collector Road	Following review of Bus Contract Area One
	Cycle parking facilities at rail stations, schools, shops and community centres.	Prior to first occupation
	Pedestrian crossings	Prior to first occupation of stages adjacent to the crossing
	Pedestrian/ Cycle Connections	Prior to first occupation
	Doonside Road shared path	Prior to first occupation
	Doonside Road footpath	Prior to first occupation
Transport Services	Diversion of Service 725	Following review of Bus Contract Area One

Source: Maunsell, 2007

10.0 Conclusions

10.1 Introduction

The site is well located in terms of the rail station and there are community facilities such as schools and the Western Sydney Parklands within walking distance. The development is also a superb opportunity for innovative promotion of alternatives to the car through personalised travel planning.

The Doonside site also provides challenges from the transport perspective since there are limited existing pedestrian facilities, such as crossings of Doonside Road, and certain intersections are close to or at capacity, especially the Doonside Road/ Great Western Highway intersection.

Building on the work completed in Stage 1 of this TMAP and an assessment of existing traffic conditions in the local area, the implications of the development traffic on the local transport networks has been reviewed to enable a package of measures to be identified that will go some way to achieving NSW Government sustainable planning guidance.

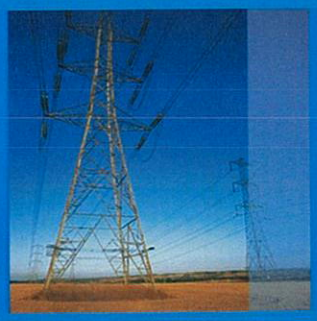
10.2 Key Recommendations

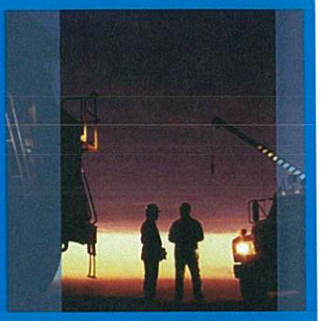
The recommendations of this study are reflected in the package of measures developed for the site discussed in **Section 8**, together with the finding and implementation strategy discussed in **Section 9**.

Key points of this package include:

- Personalised travel plans, to include measures such as provision of a bicycle to each household, marketing of public transport options, or free travel passes.
- Infrastructure improvements to provide easy pedestrian and cyclist access via pelican crossings, a shared path, a footpath and connections to existing paths such as the M7 cycleway.
- Public transport infrastructure, following consultation with the MoT during region planning.
- Transport service improvements, including potential to divert a bus route past or through the site.
- Access to the site via existing intersections at Douglas Road, Bungarribee Road and Eastern Road.

As a comprehensive package of measures, this will meet the needs of future residents of Doonside, while achieving a mode shift towards public transport.





Doonside Transport Management and Accessibility Plan Technical Appendices

Bungarribee Precinct, Western Sydney Parklands

Landcom

7 August 2007

MAUNSELL | AECOM

Technical Appendices

Prepared for

Landcom

Prepared by

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Date 7 August 2007

Prepared by Daniel Lee

Reviewed by Jane Tyler

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Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	10/04/2007	Supplementary Information Pack to accompany Doonside TMAP Revision C	Sigrid Sanderson Technical Director	Original signed
B	28/06/2007	Supplementary Information Pack to accompany Doonside TMAP Revision E	Sigrid Sanderson Technical Director	Original signed
F	07/08/2007	Supplementary Information Pack to accompany Doonside TMAP Revision F	Sigrid Sanderson Technical Director	7/8

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Appendix A: Cost Estimates

Appendix A: Cost Estimates

Cost Estimates

Table A1: Opinion of Probable Cost

Measure	Detail	Quantity	Unit Cost	Unit	Probable Cost	Cost plus Contingency	Total
Cycle facilities	Lockers (at rail station)	5	$1,000	Locker	$5,000	$6,500	
	Bike rack (at shops)	2	$1,000	Rack	$2,000	$2,600	
	Bike rack (at schools)	3	$1,000	Rack	$3,000	$3,900	$13,000
Bus Stops	Bus stops and shelter, Doonside Road or Collector Road	3	$20,000[1]	Stop and shelter	$60,000	$78,000	$78,000

[1] Draft Public Transport Funding Requirements for Planning Agreements (Ministry of Transport, July 2006)

Welcome Packs: $350 per bicycle, $220 for travel passes per household. 730 households = $416,100 plus $15,000 transport consultant fee for 2-3 weeks work (including negotiation of local cycle shop discounts).

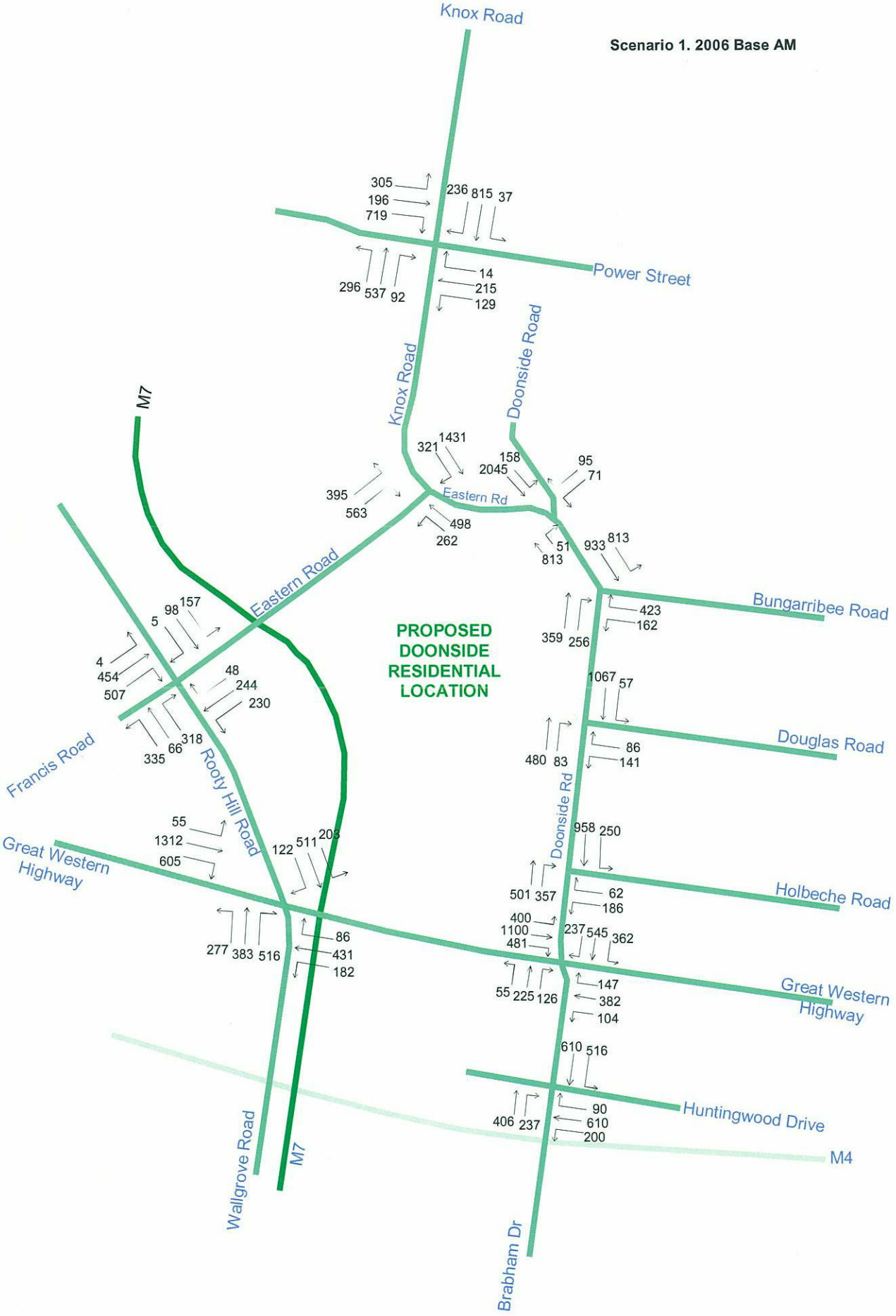
Welcome Packs total: $431,100

Table A2: Cost Estimates Provided by YSCO Geomatics

Measure	Detail	Total
Site Accesses	Doonside Road/ Eastern Road	$250,000
	Doonside Road/Bungarribee Road	$3.5 million
	Doonside Road/ Douglas Road	$1 million
Pedestrian Crossings	Doonside Road (Birdwood Avenue)	$200,000
	Doonside Road (Bowes Place)	$200,000
	Eastern Road	$200,000
Shared Path	Alongside Doonside Road	$300,000
Footpath	Doonside Road/Bungarribee Road	$40,800

[1] Ministry of Transport, July 2006, Draft Public Transport Funding Requirements For Planning Agreements

Appendix B: Traffic Flow Inputs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Knox Road
Power Street
Knox Road
Doonside Road
M7
Eastern Rd
Eastern Road
Bungarribee Road
Douglas Road
Holbeche Road
Great Western Highway
Huntingwood Drive
M4
Francis Road
Rooty Hill Road
Great Western Highway
Doonside Rd
Wallgrove Road
M7
Brabham Dr
PROPOSED DOONSIDE RESIDENTIAL LOCATION
305
196
719
236
815
37
296
537
92
14
215
129
321
1431
395
563
158
2045
95
71
498
262
51
813
933
813
423
162
359
256
1067
57
86
141
480
83
98
157
5
4
454
507
48
244
230
335
66
318
55
1312
605
122
511
208
277
383
516
86
431
182
958
250
62
186
501
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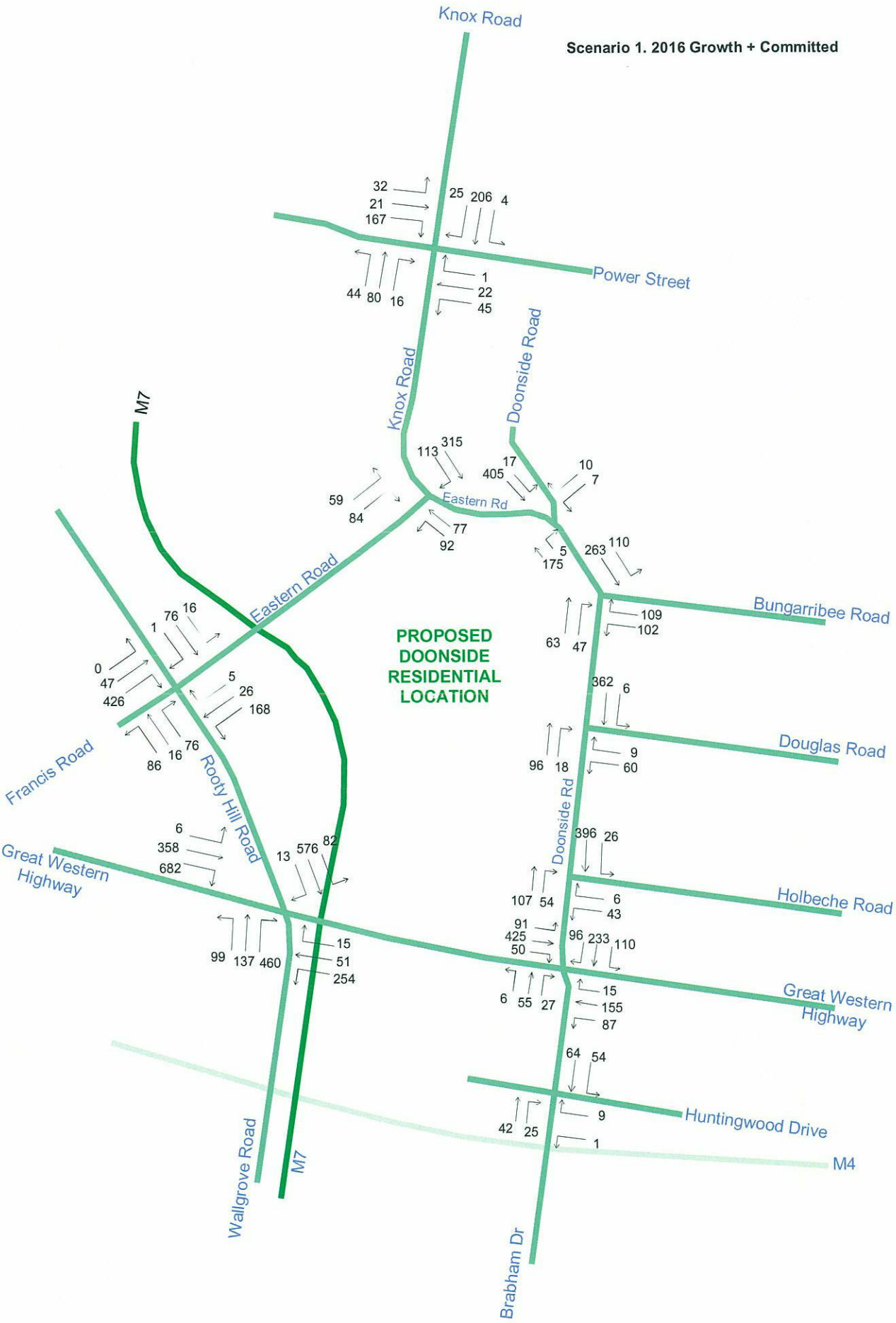
Scenario 1. 2016 Growth + Committed
Knox Road
Power Street
Knox Road
Doonside Road
Eastern Rd
Eastern Road
M7
PROPOSED
DOONSIDE
RESIDENTIAL
LOCATION
Bungarribee Road
Douglas Road
Doonside Rd
Holbeche Road
Great Western
Highway
Great Western
Highway
Francis Road
Rooty Hill Road
Wallgrove Road
M7
Huntingwood Drive
M4
Brabham Dr
32
21
167
25 206 4
1
22
45
44 80 16
59
84
113 315
405 17
10
7
77
92
5
175
263 110
109
102
63 47
362 6
9
60
96 18
396 26
6
43
107 54
91
425
50
96 233 110
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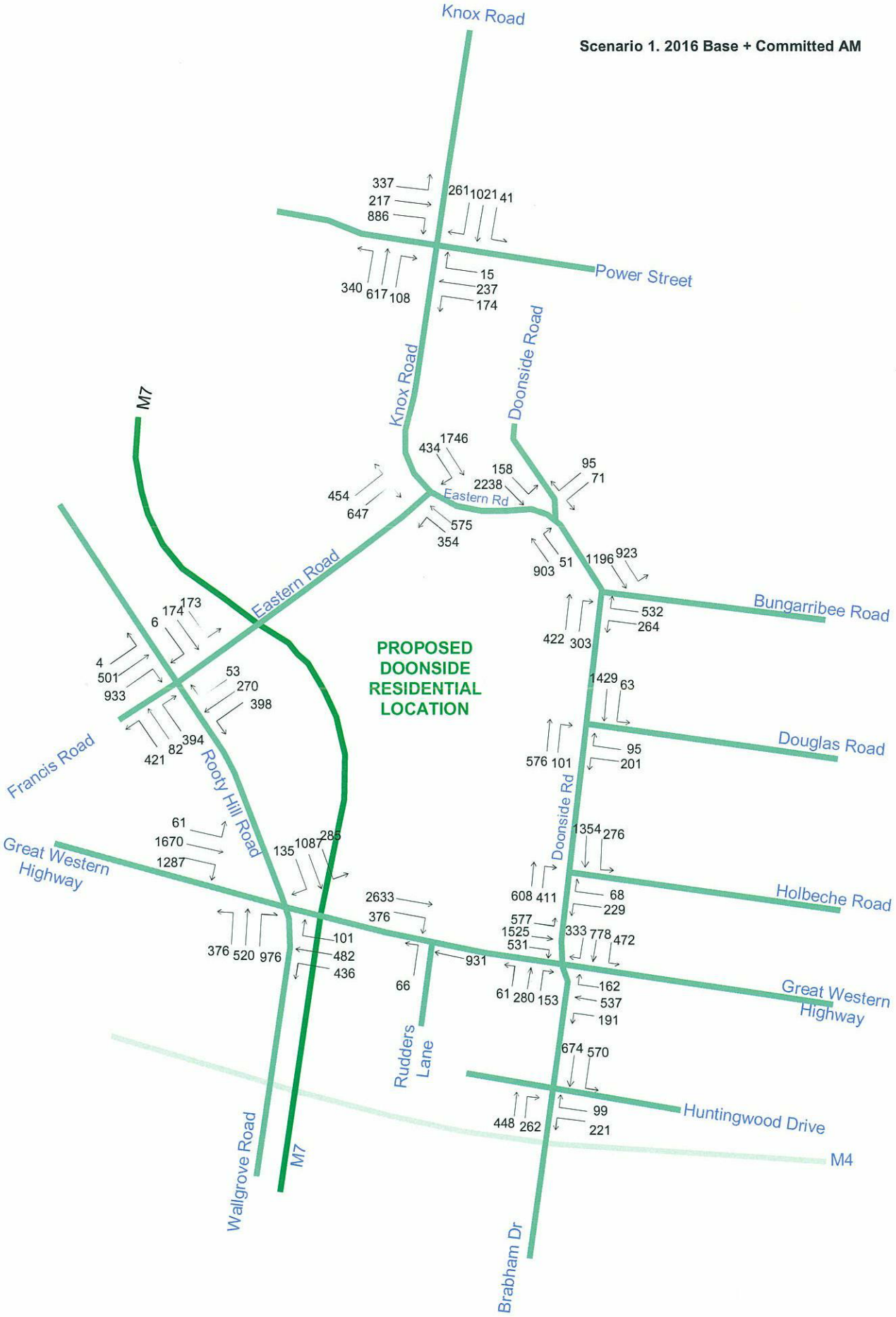
Scenario 1. 2016 Base + Committed AM
Knox Road
Power Street
Knox Road
Doonside Road
Eastern Road
Eastern Rd
Bungarribee Road
Douglas Road
Holbeche Road
Great Western Highway
Huntingwood Drive
M4
M7
Francis Road
Rooty Hill Road
Doonside Rd
Rudders Lane
Wallgrove Road
Brabham Dr
PROPOSED DOONSIDE RESIDENTIAL LOCATION
337
217
886
261
1021
41
340
617
108
15
237
174
434
1746
158
2238
95
71
454
647
575
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1196
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532
264
422
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576
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778
472
2633
376
931
66
61
280
153
162
537
191
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448
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4
501
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270
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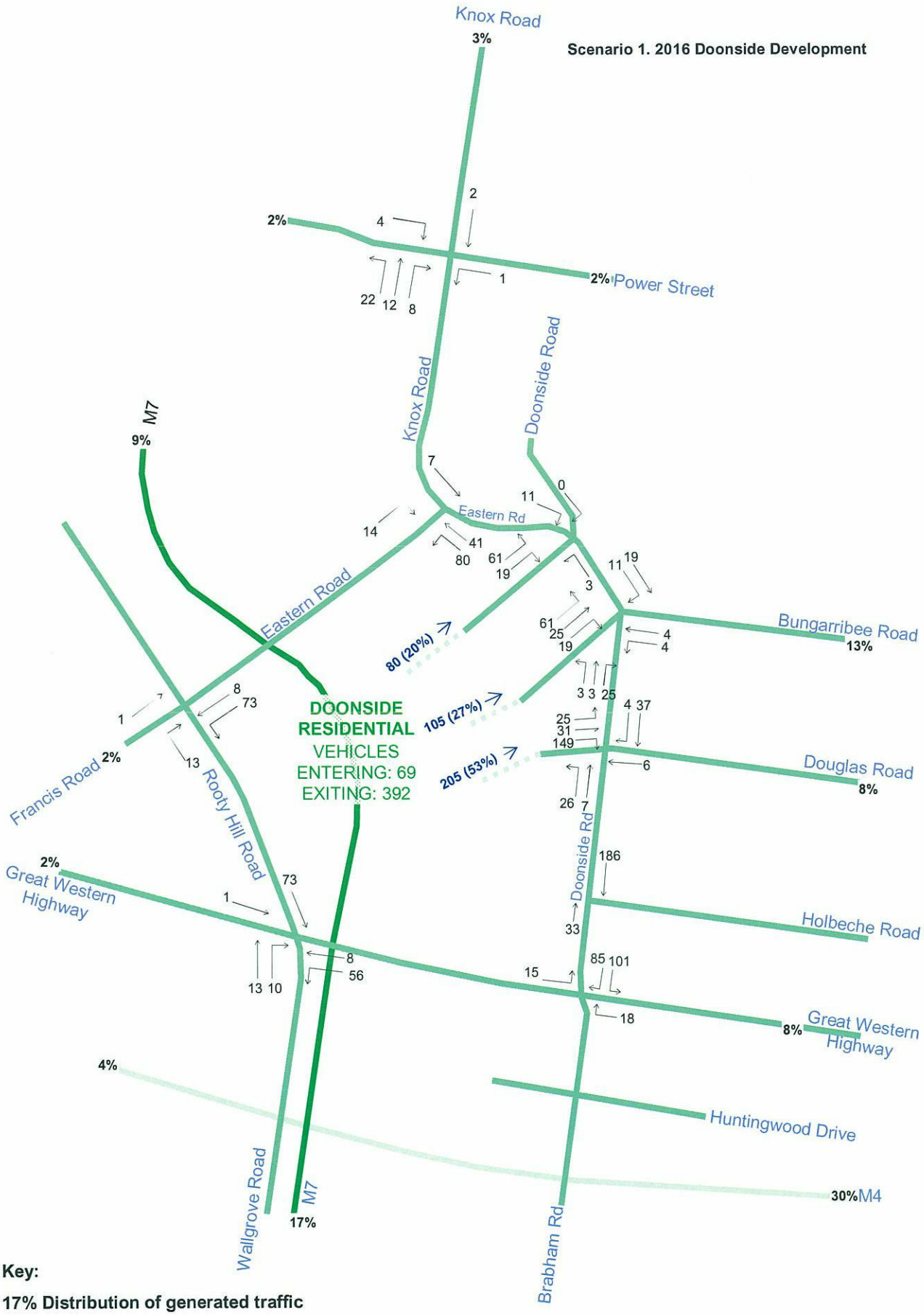
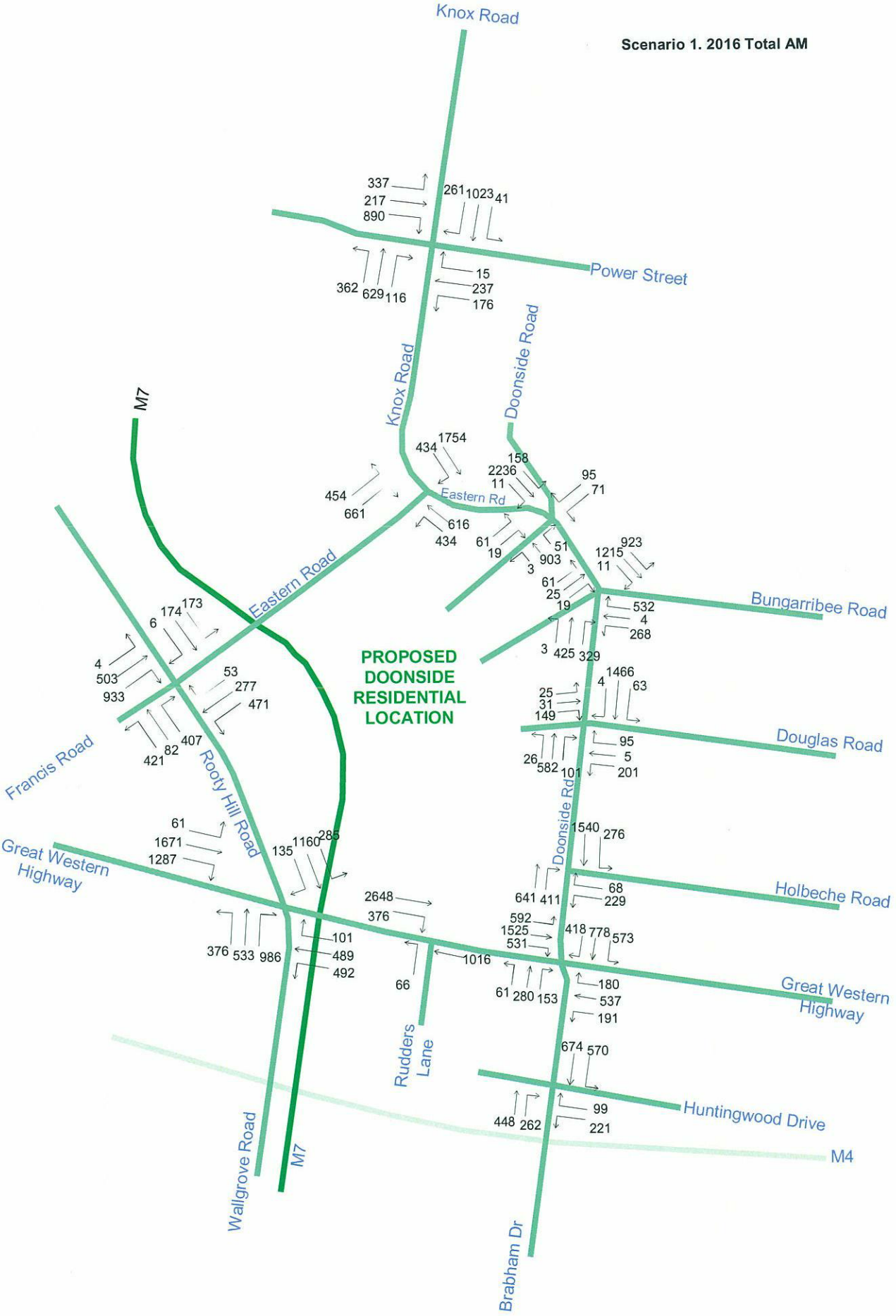
Scenario 1. 2016 Doonside Development



Key:

17% Distribution of generated traffic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Knox Road
Doonside Road
Eastern Road
Eastern Rd
Bungarribee Road
Douglas Road
Doonside Rd
Holbeche Road
Great Western Highway
Great Western Highway
Rudders Lane
Huntingwood Drive
M4
Brabham Dr
Wallgrove Road
M7
M7
Rooty Hill Road
Francis Road
PROPOSED DOONSIDE RESIDENTIAL LOCATION
337
217
890
261
1023
41
362
629
116
15
237
176
454
661
434
1754
158
2236
11
95
71
616
434
61
19
51
903
3
923
1215
11
61
25
19
532
4
268
3
425
329
4
503
933
174
173
6
53
277
471
421
82
407
25
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149
4
1466
63
95
5
201
26
582
101
61
1671
1287
135
1160
285
376
533
986
101
489
492
2648
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1016
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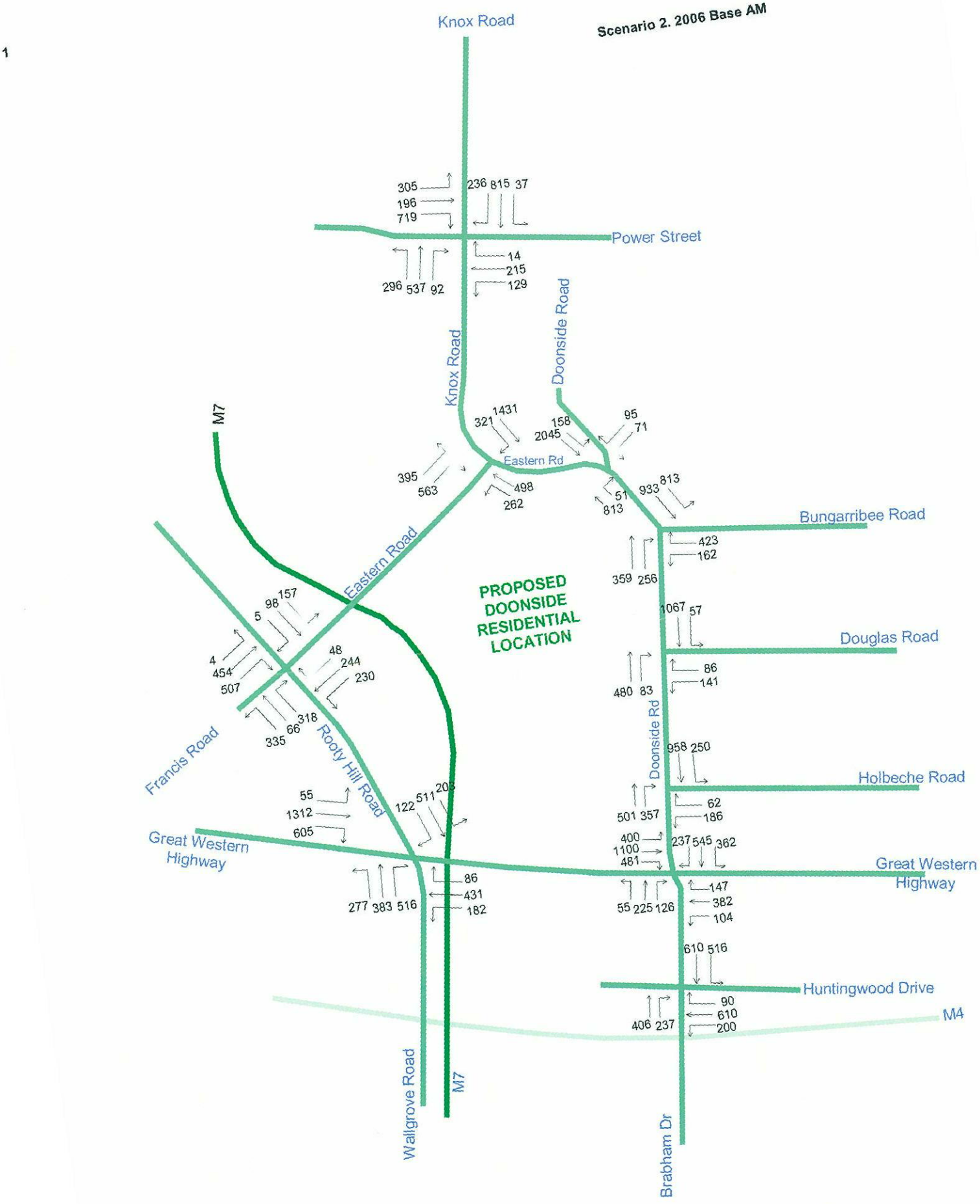
Scenario 2. 2006 Base AM
Knox Road
Power Street
Knox Road
Doonside Road
Eastern Rd
Eastern Road
M7
Bungarribee Road
Douglas Road
Doonside Rd
Holbeche Road
Great Western Highway
Great Western Highway
Huntingwood Drive
M4
Brabham Dr
Wallgrove Road
M7
Francis Road
Rooty Hill Road
PROPOSED DOONSIDE RESIDENTIAL LOCATION
305 196 719
236 815 37
14 215 129
296 537 92
321 1431
158 2045
95 71
395 563
498 262
51 813
933 813
423 162
359 256
1067 57
86 141
480 83
958 250
62 186
501 357
400 1100 481
237 545 362
147 382 104
55 225 126
610 516
90 610 200
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4 454 507
48 244 230
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335 66 318
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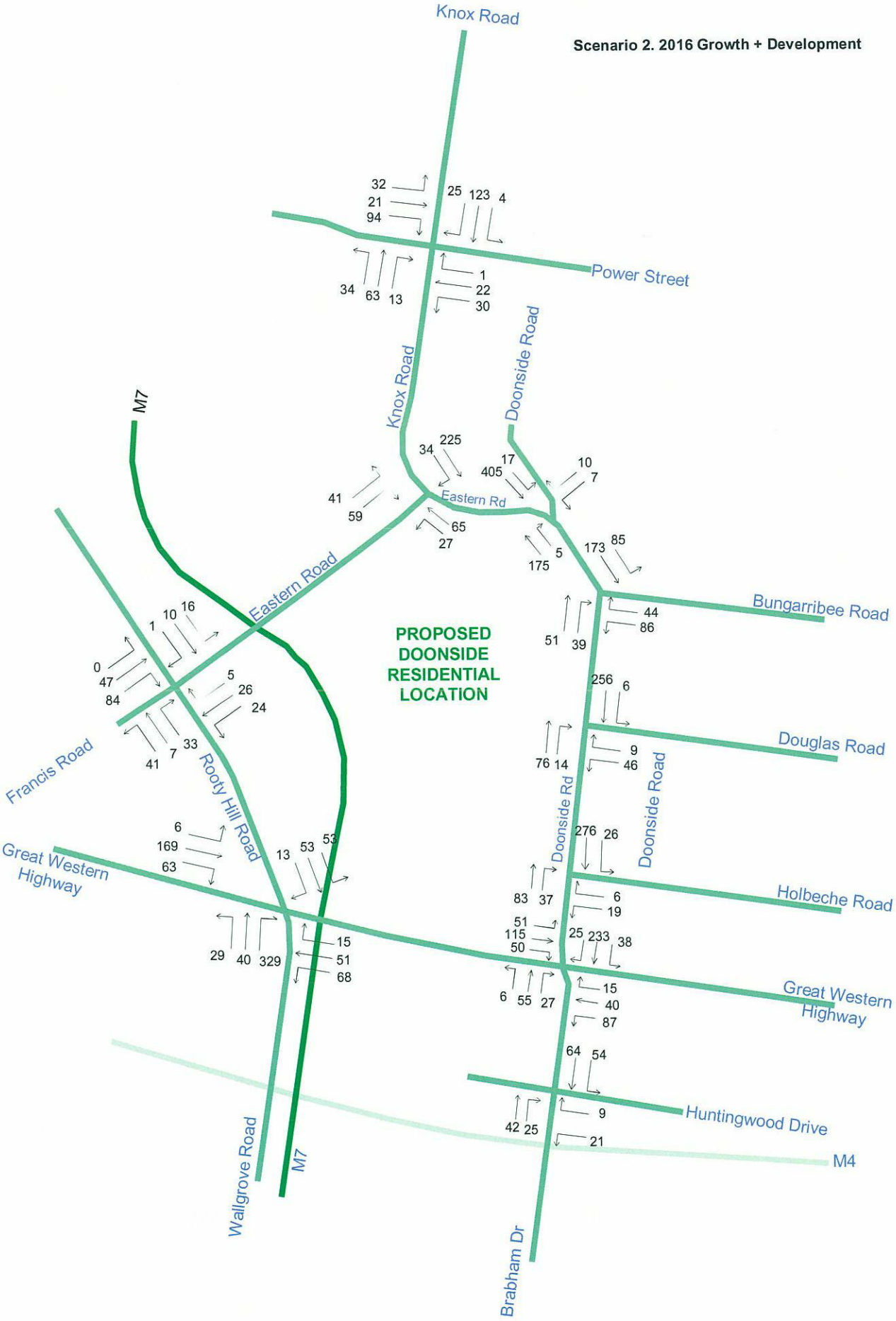
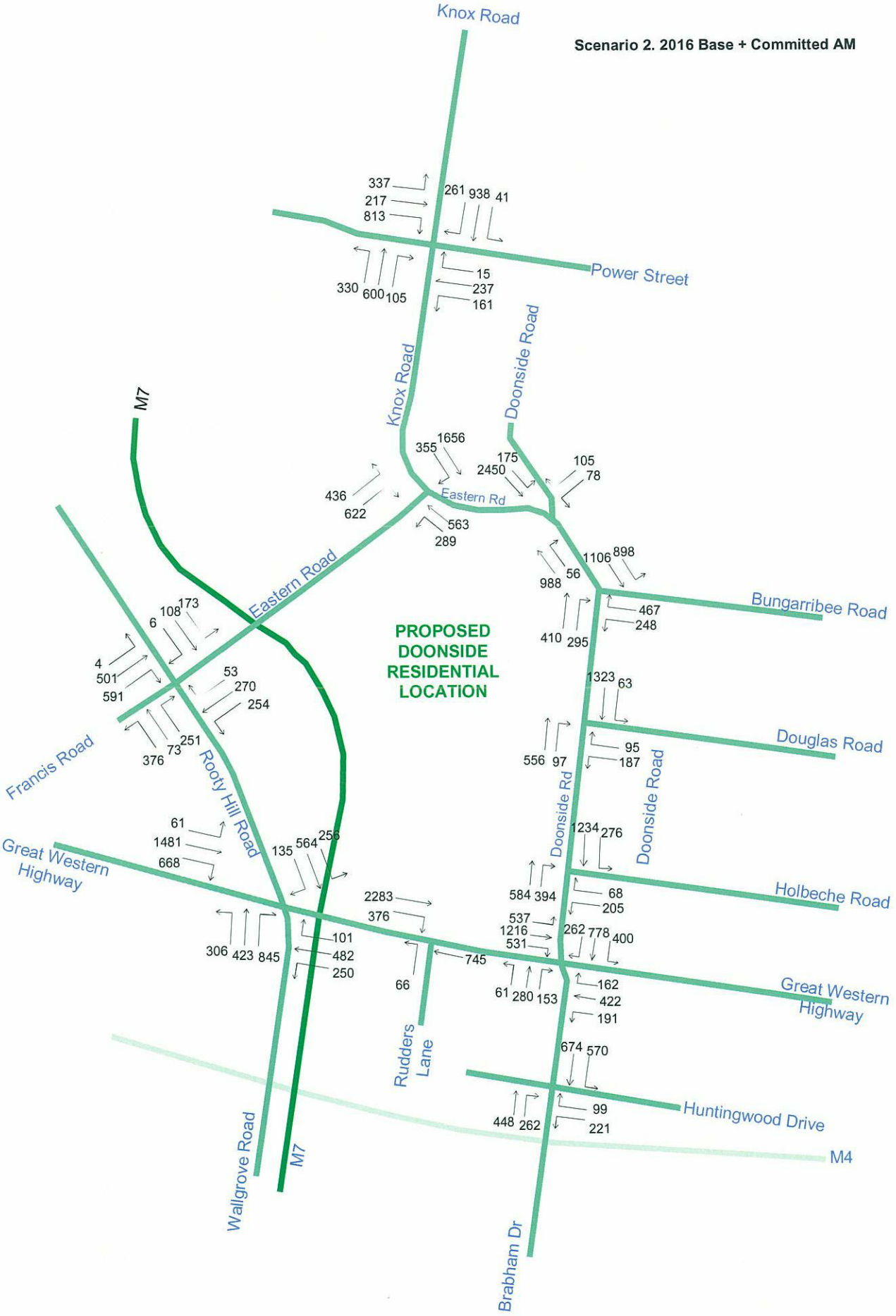
122 511 203
86 431 182
277 383 516

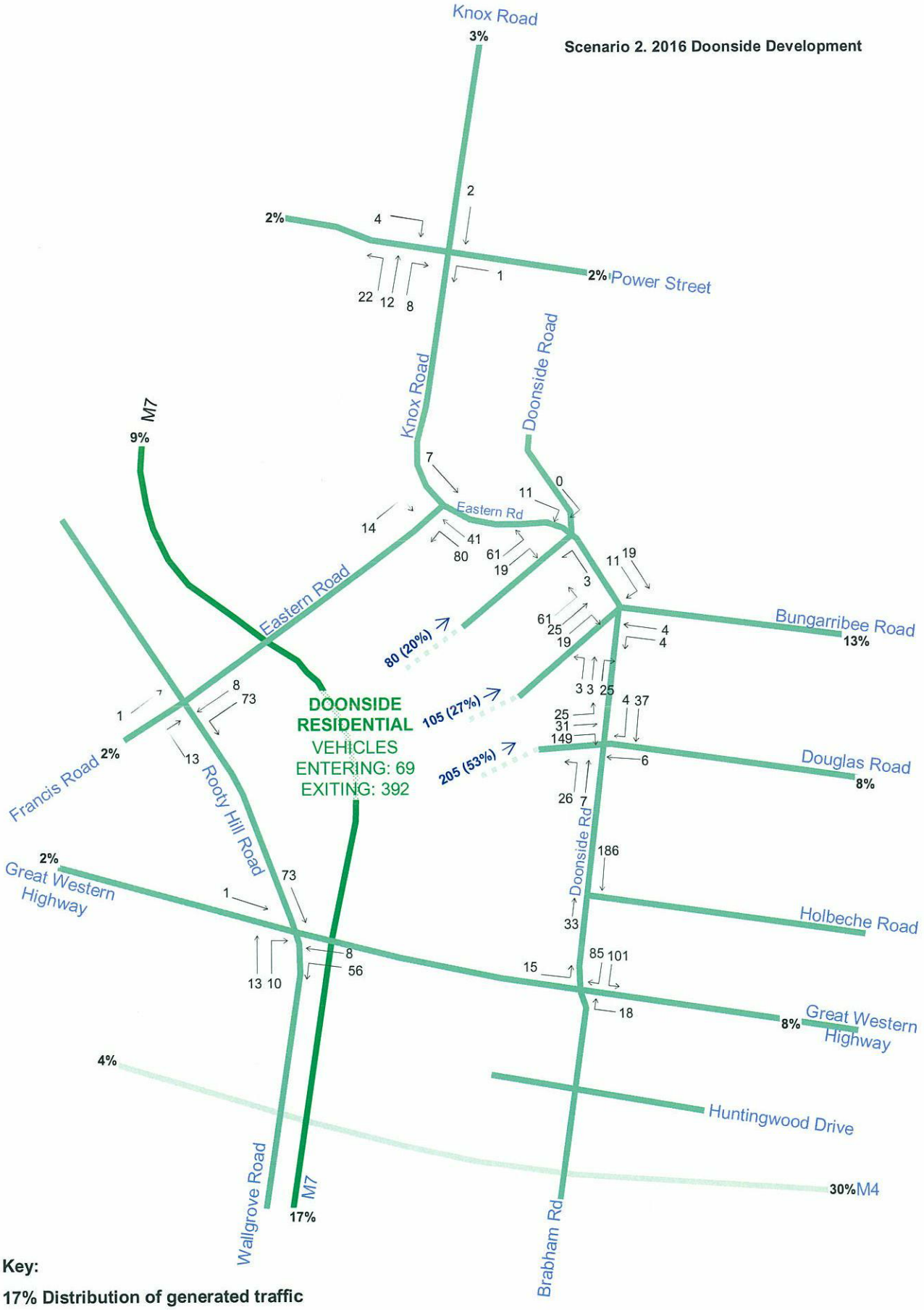
Scenario 2. 2016 Growth + Development



Scenario 2. 2016 Base + Committed AM



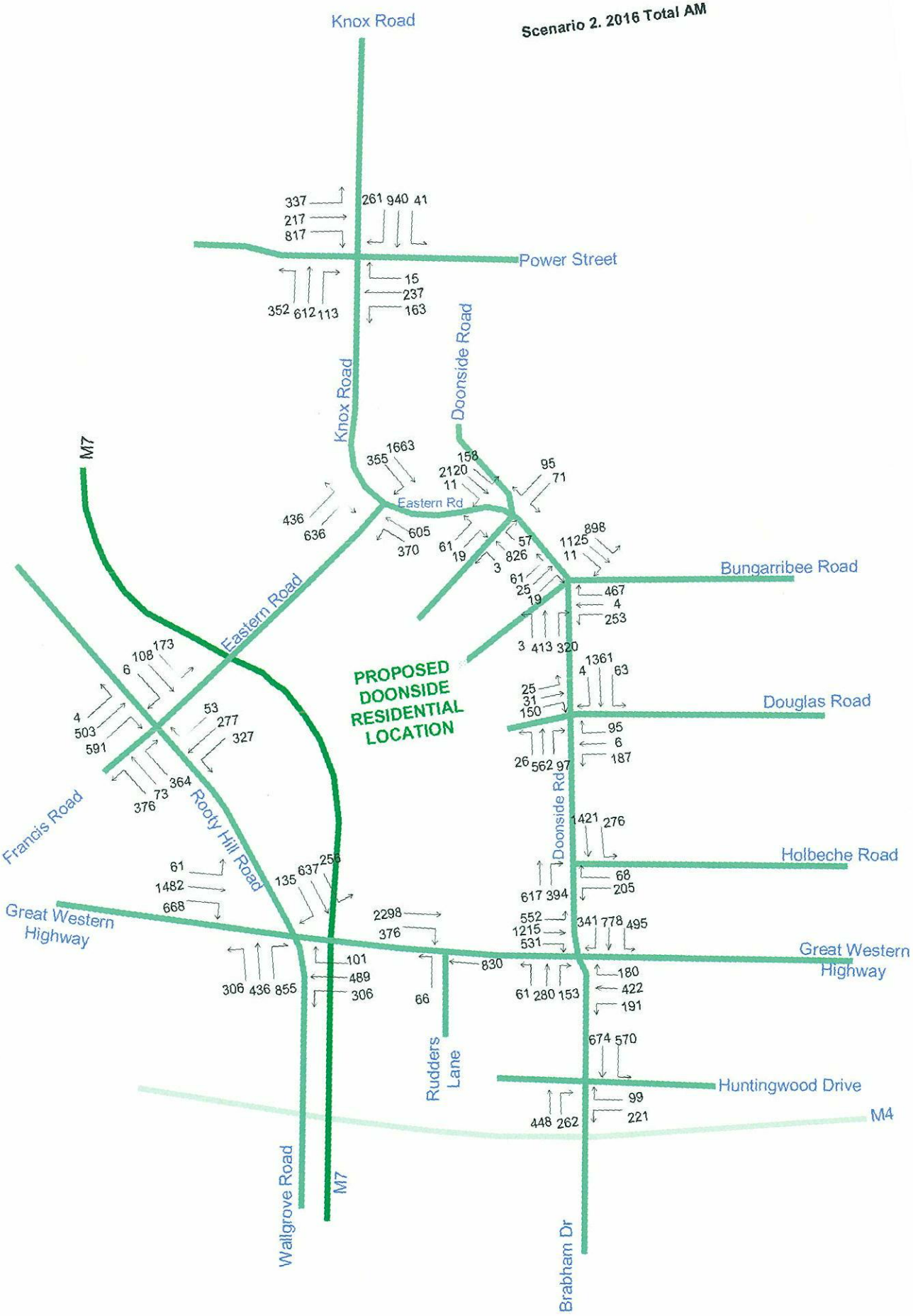
Scenario 2. 2016 Doonside Development



Key:

17% Distribution of generated traffic

Scenario 2. 2016 Total AM

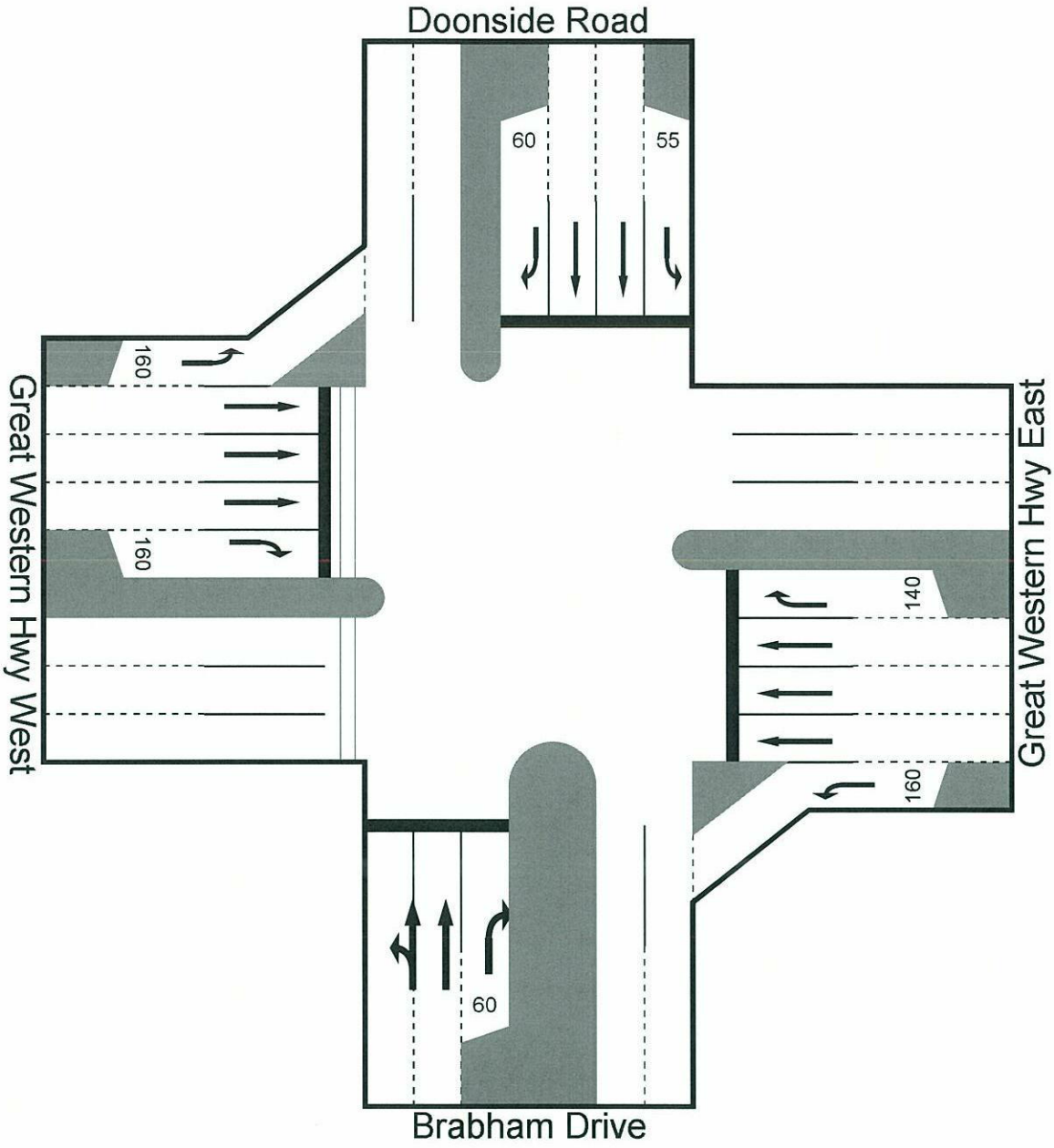


Appendix C: SIDRA Output Scenario 1

Intersection Summary

Node 1: Great Western Highway and Doonside Road - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 1: Great Western Highway and Doonside Road - Base

2016 Base Layout Without Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Brabham Drive										
1	L	60	21.7	0.311	51.0	LOS D	88	0.80	0.81	26.6
2	T	280	14.6	0.311	43.1	LOS D	87	0.81	0.69	29.1
3	R	152	29.6	0.922	79.4	LOS F	111	0.95	0.90	20.0
Approach		**492**	**20.1**	**0.923**	**55.3**	**LOS D**	**111**	**0.85**	**0.77**	**25.2**
Great Western Hwy East										
4	L	191	17.8	0.131	10.5	LOS A	6	0.06	0.67	57.1
5	T	537	11.5	1.002	123.2	LOS F	169	1.00	1.13	14.4
6	R	162	20.4	1.004	152.5	LOS F	154	1.00	1.24	12.3
Approach		**890**	**14.5**	**1.004**	**104.4**	**LOS F**	**169**	**0.80**	**1.05**	**16.6**
Doonside Road										
7	L	472	12.6	1.001#	51.8	LOS D	100	1.00	0.84	26.1
8	T	777	5.9	1.024	158.3	LOS F	531	1.00	1.52	11.5
9	R	333	16.7	1.000#	69.6	LOS E	108	0.97	0.82	21.9
Approach		**1223**	**8.4**	**1.024**	**168.8**	**LOS F**	**531**	**1.29**	**1.72**	**13.5**
Great Western Hwy West										
10	L	577	7.6	0.356	10.2	LOS A	18	0.09	0.67	56.9
11	T	1524	6.9	1.022	128.9	LOS F	528	0.99	1.29	13.9
12	R	532	12.8	1.000#	65.7	LOS E	258	1.00	0.88	23.6
Approach		**2577**	**8.1**	**1.022**	**93.4**	**LOS F**	**528**	**0.81**	**1.10**	**18.3**
All Vehicles		**5597**	**9.6**	**1.024**	**101.3**	**LOS F**	**531**	**0.86**	**1.12**	**16.8**

Pedestrian Movements

Mov ID	*Dem Flow* (ped/h)	Aver Delay (sec)	*Level of* Service	95% *Back of* Queue (m)	*Prop.* Queued	*Eff. Stop* Rate
P7	5	57.2	LOS E	0	0.87	0.87
All Peds	**5**	**57.2**	**LOS E**	**0**	**0.87**	**0.87**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node1Base
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SIDRA INTERSECTION

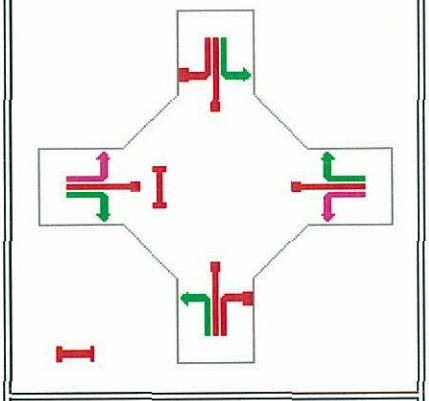
Phasing Summary

Node 1: Great Western Highway and Doonside Road - Base

2016 Base Layout Without Development - Scenario 1

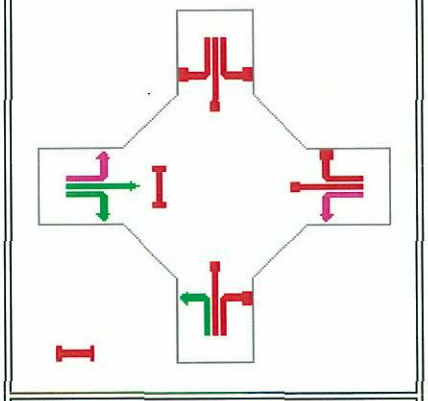
C = **150** seconds
Cycle Time Option: ***Program calculated cycle time***
Phase times determined by the program.

Phase B



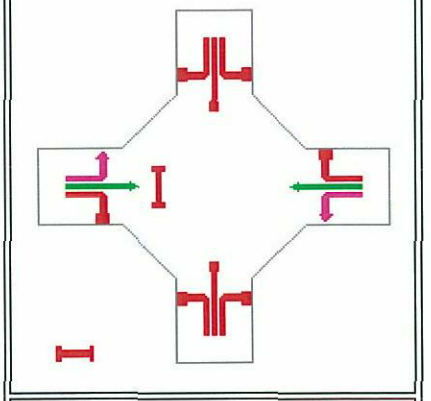
Green Time = **15** seconds
Phase Time = **19** seconds
Phase Split = **13** %

Phase D



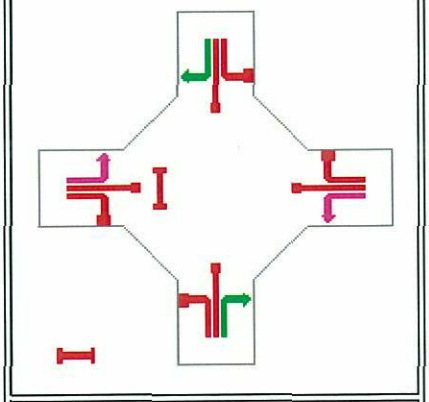
Green Time = **25** seconds
Phase Time = **29** seconds
Phase Split = **19** %

Phase F



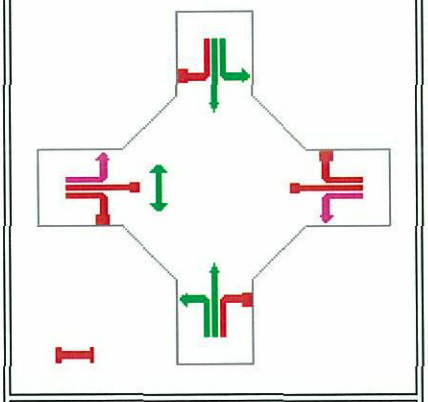
Green Time = **16** seconds
Phase Time = **20** seconds
Phase Split = **13** %

Phase E



Green Time = **28** seconds
Phase Time = **32** seconds
Phase Split = **21** %

Phase C



Green Time = **46** seconds
Phase Time = **50** seconds
Phase Split = **33** %

Normal Movement | Permitted/Opposed | Stopped Movement
Slip-Lane | Opposed Slip-Lane | Continuous
Turn On Red

SIDRA SOLUTIONS

Site: Node1Base
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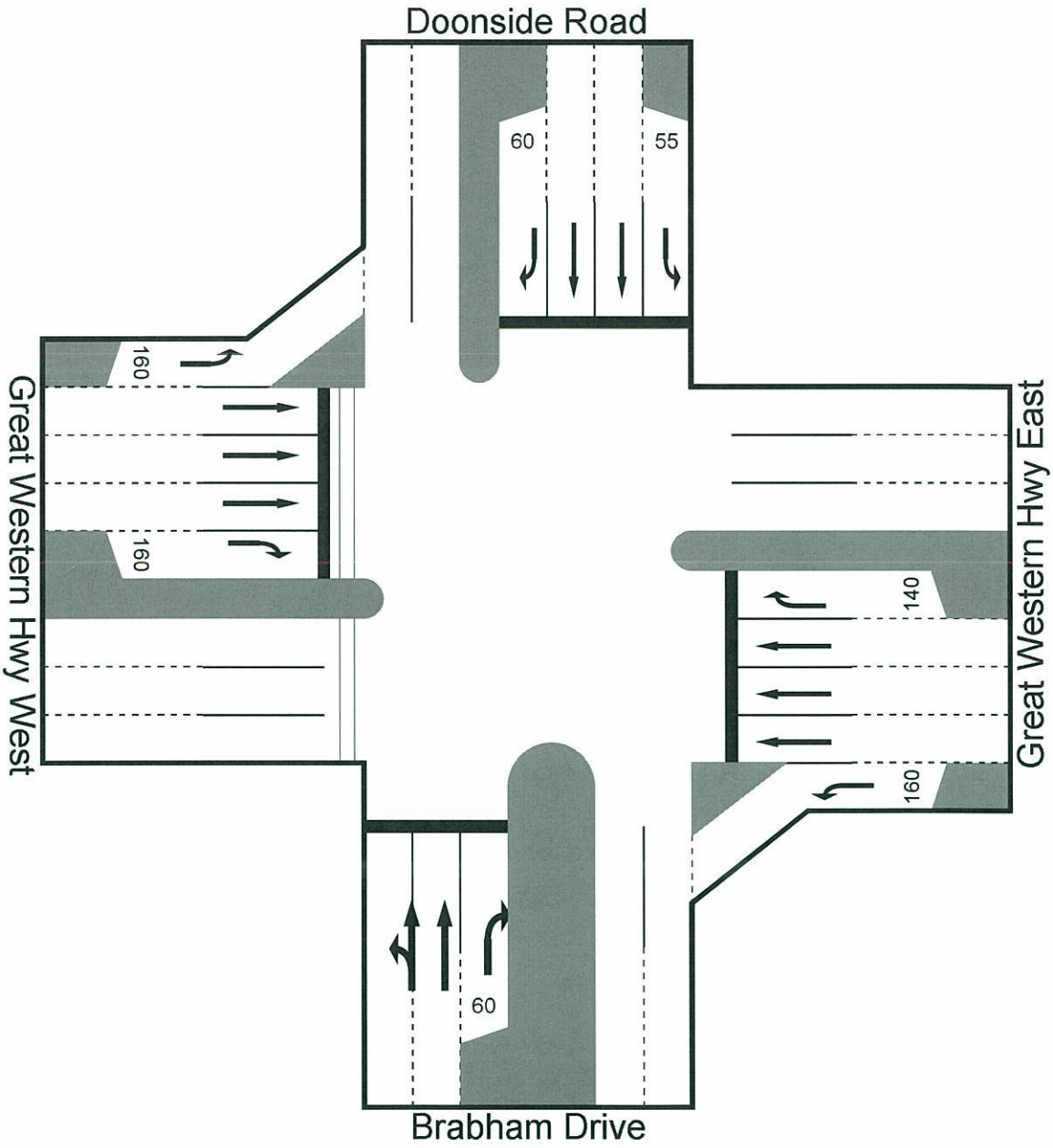
Intersection Summary

Node 1: Great Western Highway and Doonside Road - Development

2016 Base Layout With Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 1: Great Western Highway and Doonside Road - Development

2016 Base Layout With Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Brabham Drive										
1	L	60	21.7	0.281	46.9	LOS D	84	0.76	0.80	27.9
2	T	280	14.6	0.281	39.0	LOS C	83	0.77	0.67	30.8
3	R	152	29.6	0.956	80.0	LOS F	111	0.98	0.86	19.9
Approach		**492**	**20.1**	**0.955**	**52.7**	**LOS D**	**111**	**0.83**	**0.74**	**26.0**
Great Western Hwy East										
4	L	191	17.8	0.130	10.5	LOS A	5	0.06	0.67	57.1
5	T	537	11.5	0.943	93.1	LOS F	143	1.00	1.02	18.0
6	R	180	18.3	1.033	187.4	LOS F	186	1.00	1.33	10.3
Approach		**908**	**14.2**	**1.033**	**94.4**	**LOS F**	**186**	**0.80**	**1.01**	**17.9**
Doonside Road										
7	L	573	11.7	1.000#	48.8	LOS D	100	1.00	0.84	27.1
8	T	777	5.1	1.062	211.7	LOS F	707	1.00	1.79	9.0
9	R	418	17.1	1.000#	73.4	LOS F	108	0.99	0.82	21.1
Approach		**1239**	**7.8**	**1.063**	**245.0**	**LOS F**	**712**	**1.43**	**2.20**	**10.7**
Great Western Hwy West										
10	L	592	7.4	0.364	10.2	LOS A	19	0.09	0.67	56.9
11	T	1524	6.9	1.063	173.3	LOS F	619	1.00	1.46	10.8
12	R	532	12.6	1.000#	68.4	LOS E	271	1.00	0.89	22.9
Approach		**2602**	**8.0**	**1.063**	**119.7**	**LOS F**	**619**	**0.81**	**1.20**	**15.1**
All Vehicles		**5816**	**9.2**	**1.063**	**124.9**	**LOS F**	**707**	**0.86**	**1.22**	**14.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P7	5	52.9	LOS E	0	0.84	0.84
All Peds	**5**	**52.9**	**LOS D**	**0**	**0.84**	**0.84**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node1Design
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SIDRA INTERSECTION

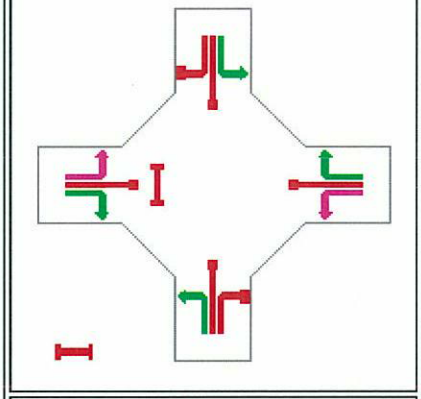
Phasing Summary

Node 1: Great Western Highway and Doonside Road - Development

2016 Base Layout With Development - Scenario 1

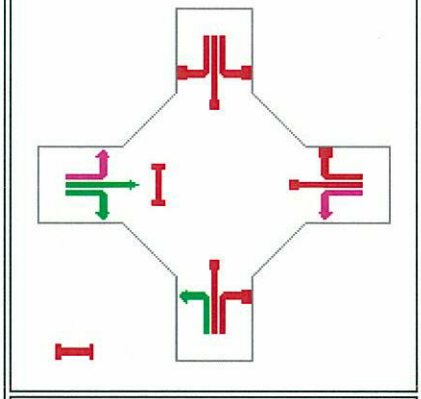
C = **150** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase B



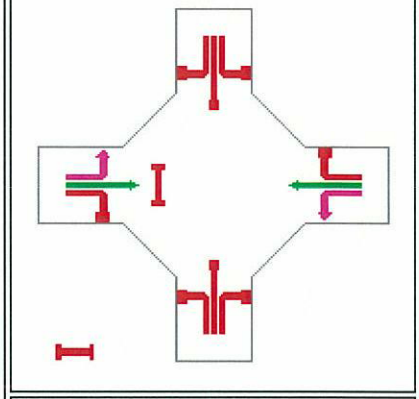
Green Time = **16** seconds
Phase Time = **20** seconds
Phase Split = **13** %

Phase D



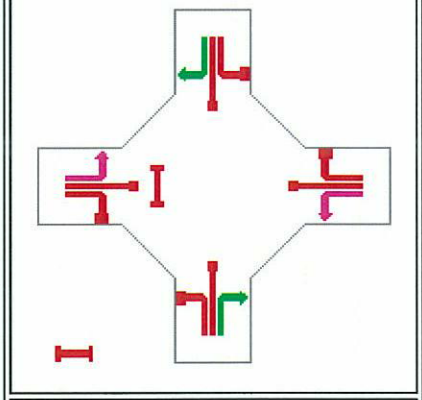
Green Time = **22** seconds
Phase Time = **26** seconds
Phase Split = **17** %

Phase F



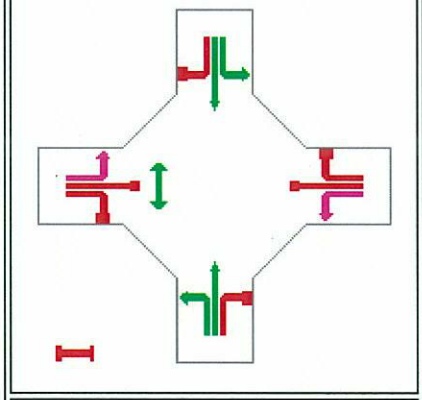
Green Time = **17** seconds
Phase Time = **21** seconds
Phase Split = **14** %

Phase E

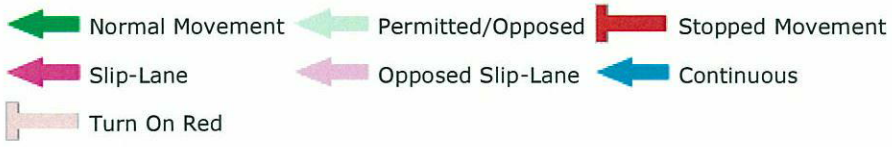


Green Time = **24** seconds
Phase Time = **28** seconds
Phase Split = **19** %

Phase C



Green Time = **51** seconds
Phase Time = **55** seconds
Phase Split = **37** %



SIDRA SOLUTIONS

Site: Node1Design
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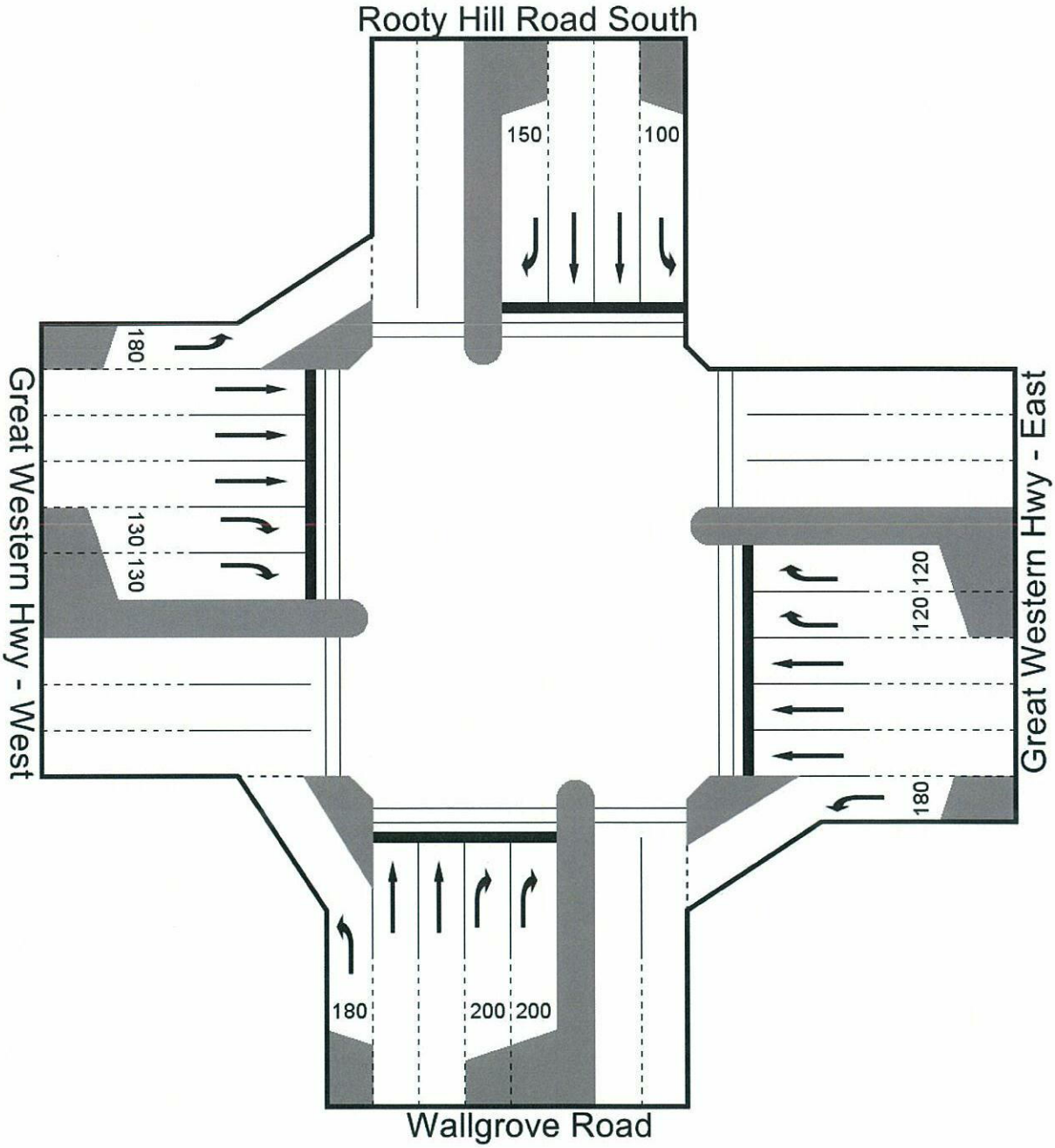
Intersection Summary

Node 2: Great Western Highway & Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 2: Great Western Highway Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Wallgrove Road										
1	L	376	5.9	0.217	10.1	LOS A	10	0.07	0.67	57.1
2	T	521	2.4	0.788	59.2	LOS E	199	0.97	0.87	25.0
3	R	976	13.7	1.059	196.6	LOS F	320	1.00	1.39	9.9
Approach		**1606**	**6.9**	**1.058**	**118.2**	**LOS F**	**320**	**0.93**	**1.20**	**17.0**
Great Western Hwy - East										
4	L	435	20.5	0.286	10.6	LOS A	14	0.07	0.67	57.0
5	T	481	11.4	0.570	67.0	LOS E	94	0.95	0.79	23.0
6	R	100	1.0	0.375	42.4	LOS C	21	0.90	0.76	31.1
Approach		**1016**	**14.3**	**0.570**	**40.4**	**LOS C**	**94**	**0.57**	**0.73**	**32.0**
Rooty Hill Road South										
7	L	285	4.2	0.695	49.4	LOS D	113	0.74	0.81	26.9
8	T	1088	2.6	1.053	190.4	LOS F	517	1.00	1.60	9.8
9	R	134	2.2	0.342	38.8	LOS C	53	0.87	0.79	31.2
Approach		**1507**	**2.9**	**1.053**	**150.2**	**LOS F**	**517**	**0.94**	**1.38**	**12.0**
Great Western Hwy - West										
10	L	61	1.6	0.035	9.9	LOS A	1	0.05	0.67	57.2
11	T	1670	8.2	0.809	39.0	LOS C	278	0.88	0.82	32.5
12	R	1287	6.0	1.000#	43.1	LOS D	212	0.98	0.89	30.9
Approach		**2801**	**7.5**	**1.000**	**42.9**	**LOS C**	**278**	**0.97**	**0.91**	**32.2**
All Vehicles		**7414**	**6.9**	**1.059**	**77.9**	**LOS F**	**517**	**0.84**	**0.98**	**20.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	57.2	LOS E	0	0.87	0.87
P5	5	35.4	LOS D	0	0.69	0.69

P7	5	59.0	LOS E	0	0.89	0.89
All Peds	**20**	**55.2**	**LOS D**	**0**	**0.85**	**0.85**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node2Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 2 GWH Rooty.aap
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SIDRA INTERSECTION

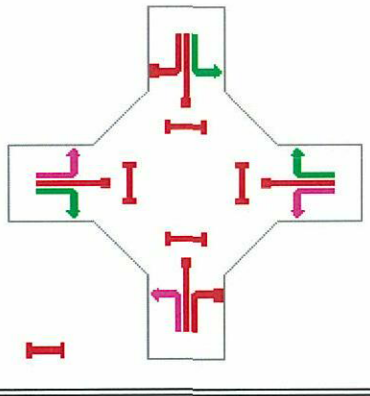
Phasing Summary

Node 2: Great Western Highway Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 1

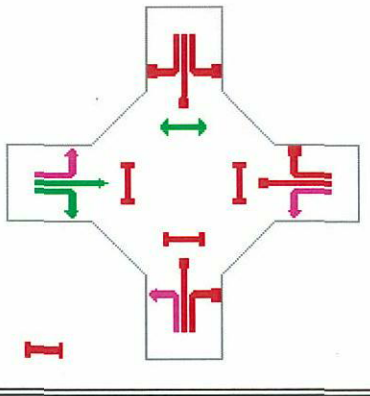
C = **150** seconds
Cycle Time Option: ***Program calculated cycle time***
Phase times determined by the program.

Phase C



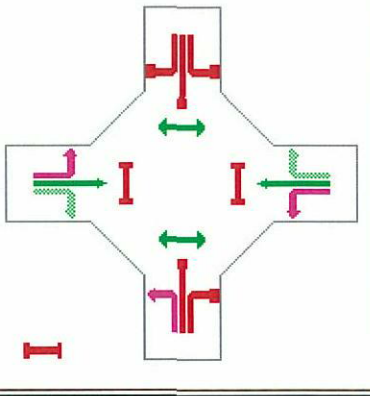
Green Time = **6** seconds
Phase Time = **10** seconds
Phase Split = **7** %

Phase G2



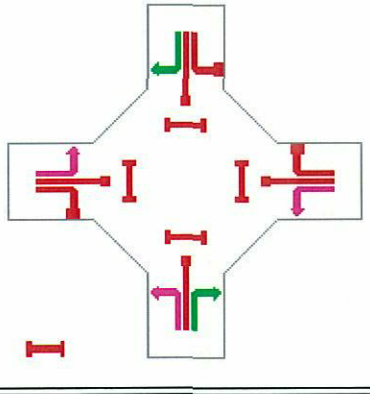
Green Time = **36** seconds
Phase Time = **40** seconds
Phase Split = **27** %

Phase A



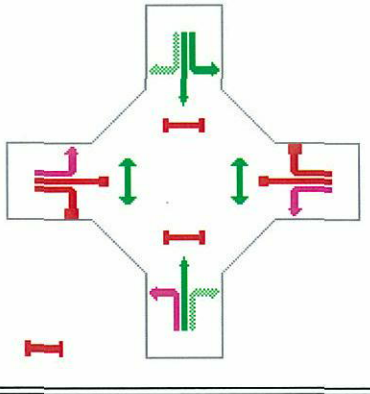
Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase E

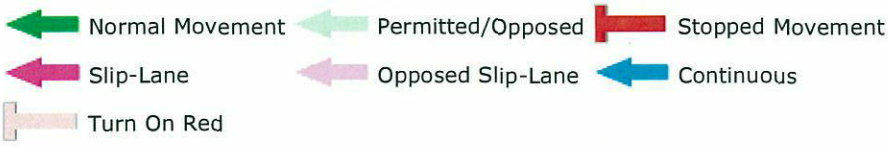


Green Time = **25** seconds
Phase Time = **29** seconds
Phase Split = **19** %

Phase D



Green Time = **40** seconds
Phase Time = **44** seconds
Phase Split = **29** %



SIDRA SOLUTIONS

Site: Node2Base
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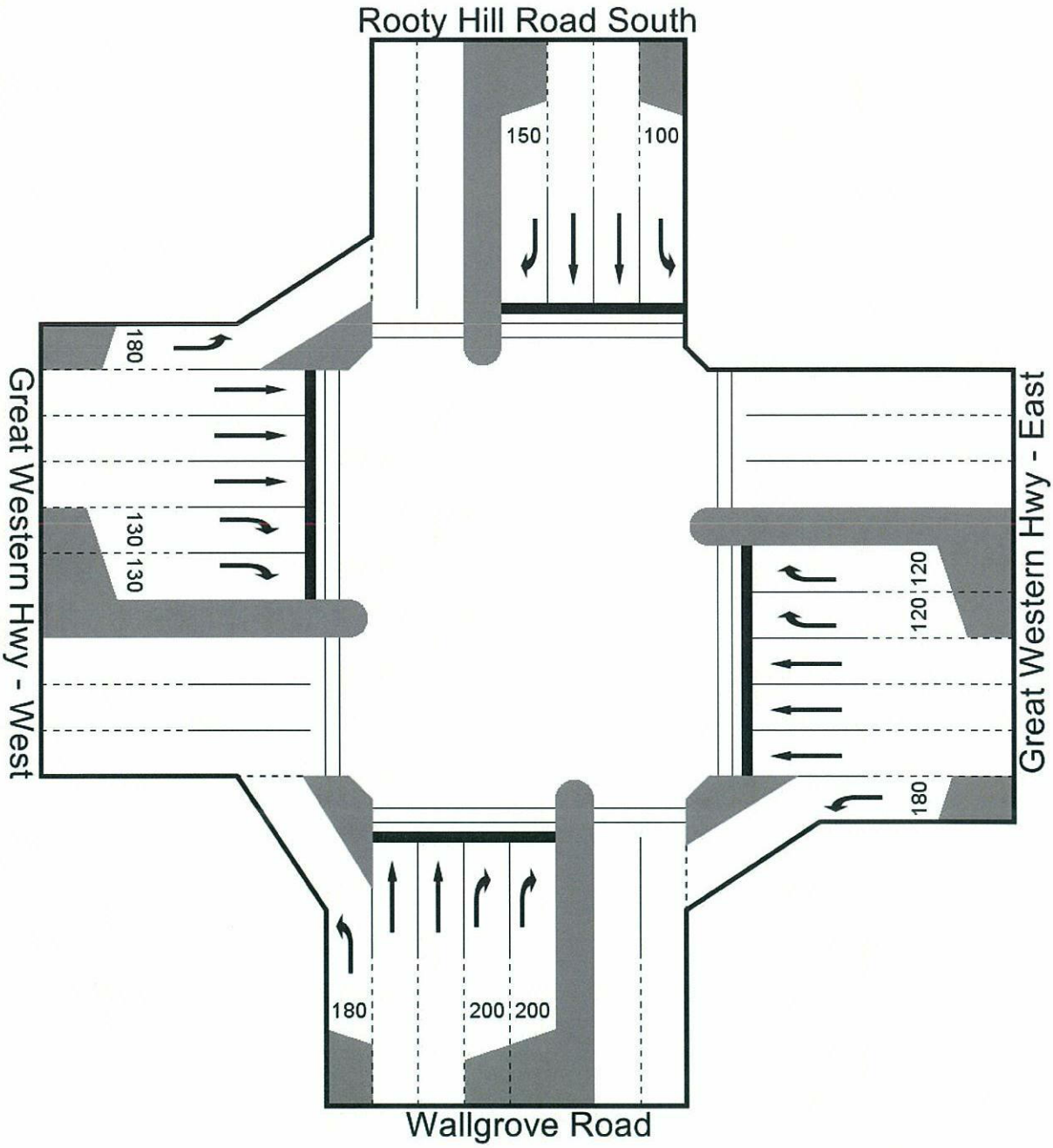
Intersection Summary

Node 2: Great Western Highway & Rooty Hill Rd South - Development

2016 Base Layout With Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 2: Great Western Highway and Rooty Hill Rd South - Development

2016 Layout With Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Wallgrove Road										
1	L	376	5.9	0.216	10.1	LOS A	10	0.07	0.67	57.1
2	T	533	2.2	0.754	53.2	LOS D	201	0.94	0.84	26.8
3	R	986	14.4	1.076	221.9	LOS F	321	1.00	1.42	8.9
Approach		**1581**	**6.8**	**1.076**	**125.2**	**LOS F**	**321**	**0.94**	**1.21**	**16.6**
Great Western Hwy - East										
4	L	491	18.1	0.318	10.5	LOS A	16	0.08	0.67	57.0
5	T	489	11.2	0.579	67.1	LOS E	96	0.95	0.79	22.9
6	R	100	1.0	0.383	45.5	LOS D	22	0.94	0.76	29.8
Approach		**1080**	**13.4**	**0.579**	**39.4**	**LOS C**	**96**	**0.55**	**0.73**	**32.5**
Rooty Hill Road South										
7	L	285	4.2	0.650	44.2	LOS D	106	0.68	0.80	28.7
8	T	1160	2.4	0.997	113.7	LOS F	431	1.00	1.29	15.0
9	R	134	2.2	0.349	37.3	LOS C	51	0.86	0.79	31.8
Approach		**1579**	**2.7**	**0.997**	**94.7**	**LOS F**	**431**	**0.93**	**1.16**	**17.3**
Great Western Hwy - West										
10	L	61	1.6	0.035	9.9	LOS A	1	0.05	0.67	57.2
11	T	1672	8.1	0.862	47.1	LOS D	318	0.94	0.91	29.0
12	R	1287	6.1	1.000#	45.1	LOS D	212	1.00	0.89	30.1
Approach		**2775**	**7.5**	**1.000**	**49.7**	**LOS D**	**318**	**1.03**	**0.97**	**29.7**
All Vehicles		**7574**	**6.6**	**1.076**	**69.7**	**LOS E**	**431**	**0.85**	**0.96**	**22.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	52.9	LOS E	0	0.84	0.84

P5	5	37.5	LOS D	0	0.71	0.71
P7	5	54.6	LOS E	0	0.85	0.85
All Peds	**20**	**53.5**	**LOS D**	**0**	**0.84**	**0.84**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node2Design
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SIDRA INTERSECTION

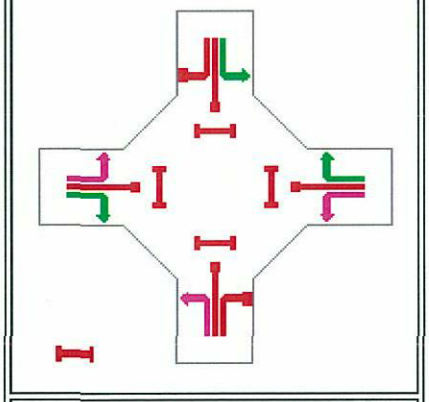
Phasing Summary

Node 2: Great Western Highway and Rooty Hill Rd South - Development

2016 Layout With Development - Scenario 1

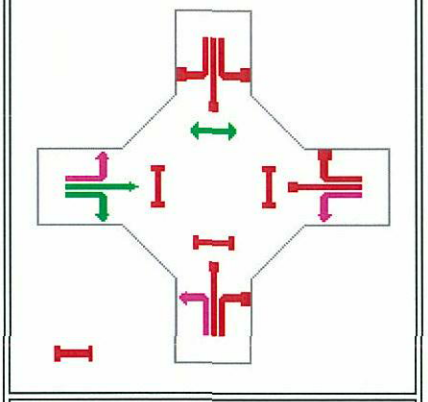
C = **150** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase C



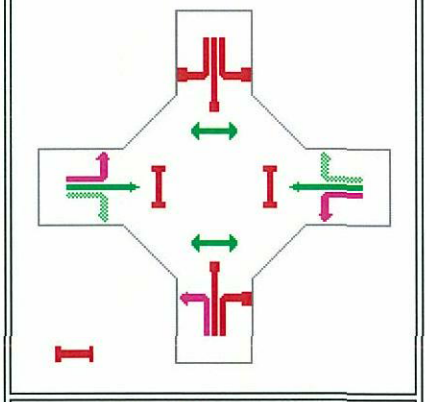
Green Time = **6** seconds
Phase Time = **10** seconds
Phase Split = **7** %

Phase G2



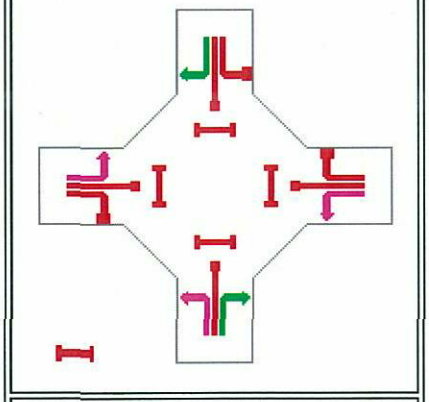
Green Time = **33** seconds
Phase Time = **37** seconds
Phase Split = **25** %

Phase A



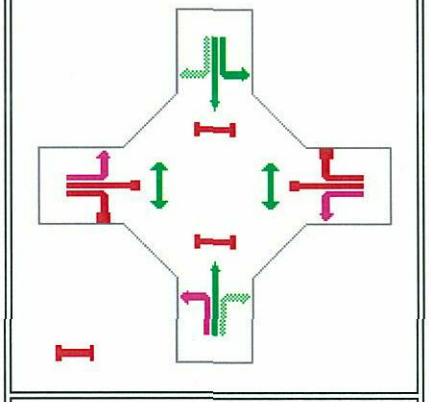
Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase E

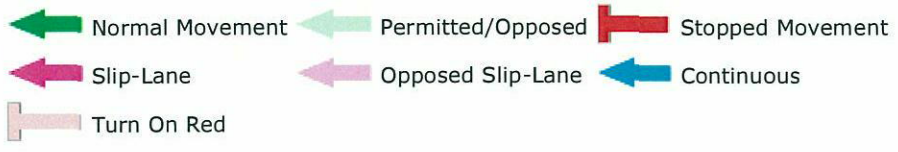


Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase D



Green Time = **45** seconds
Phase Time = **49** seconds
Phase Split = **33** %



SIDRA SOLUTIONS

Site: Node2Design
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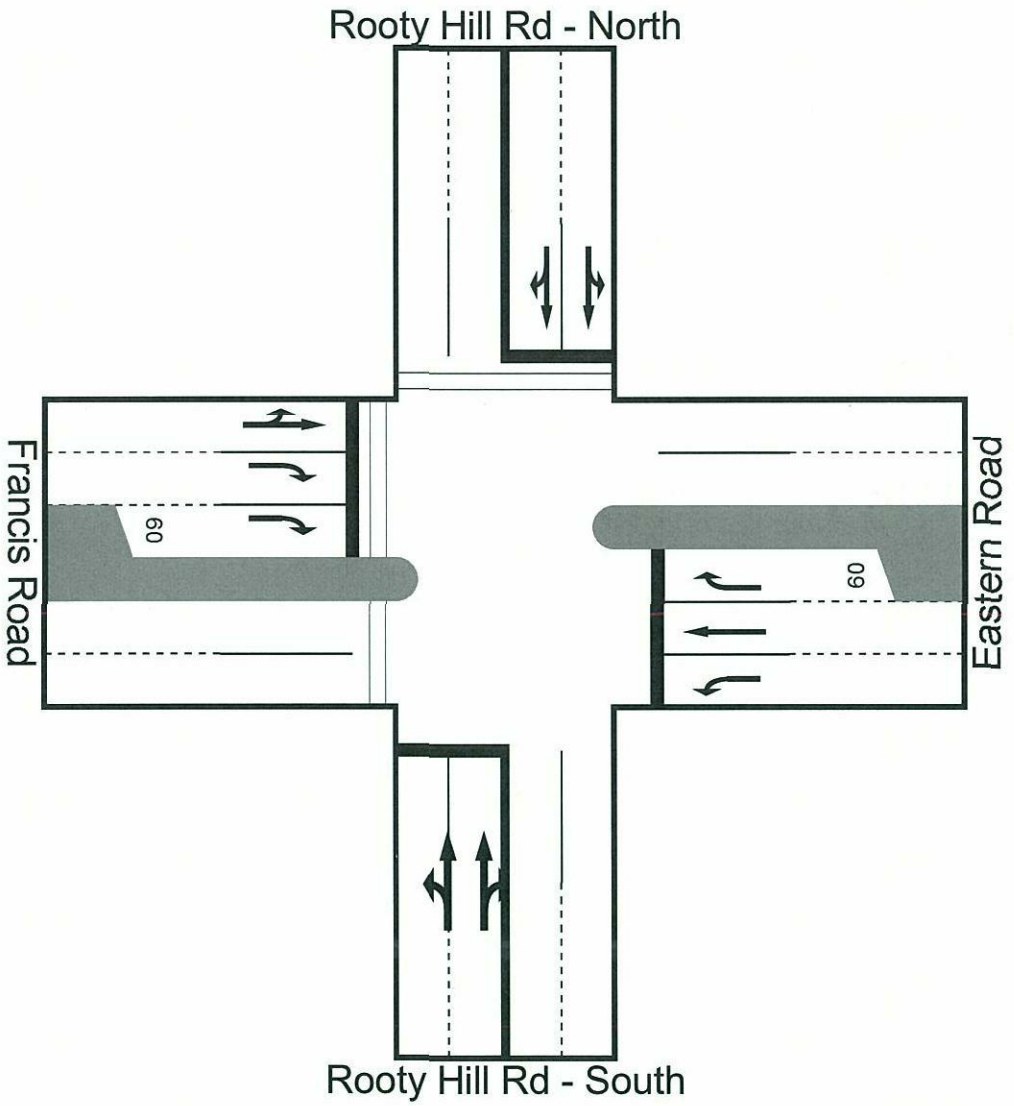
Intersection Summary

Node 3: Rooty Hill Rd and Eastern Rd - Development

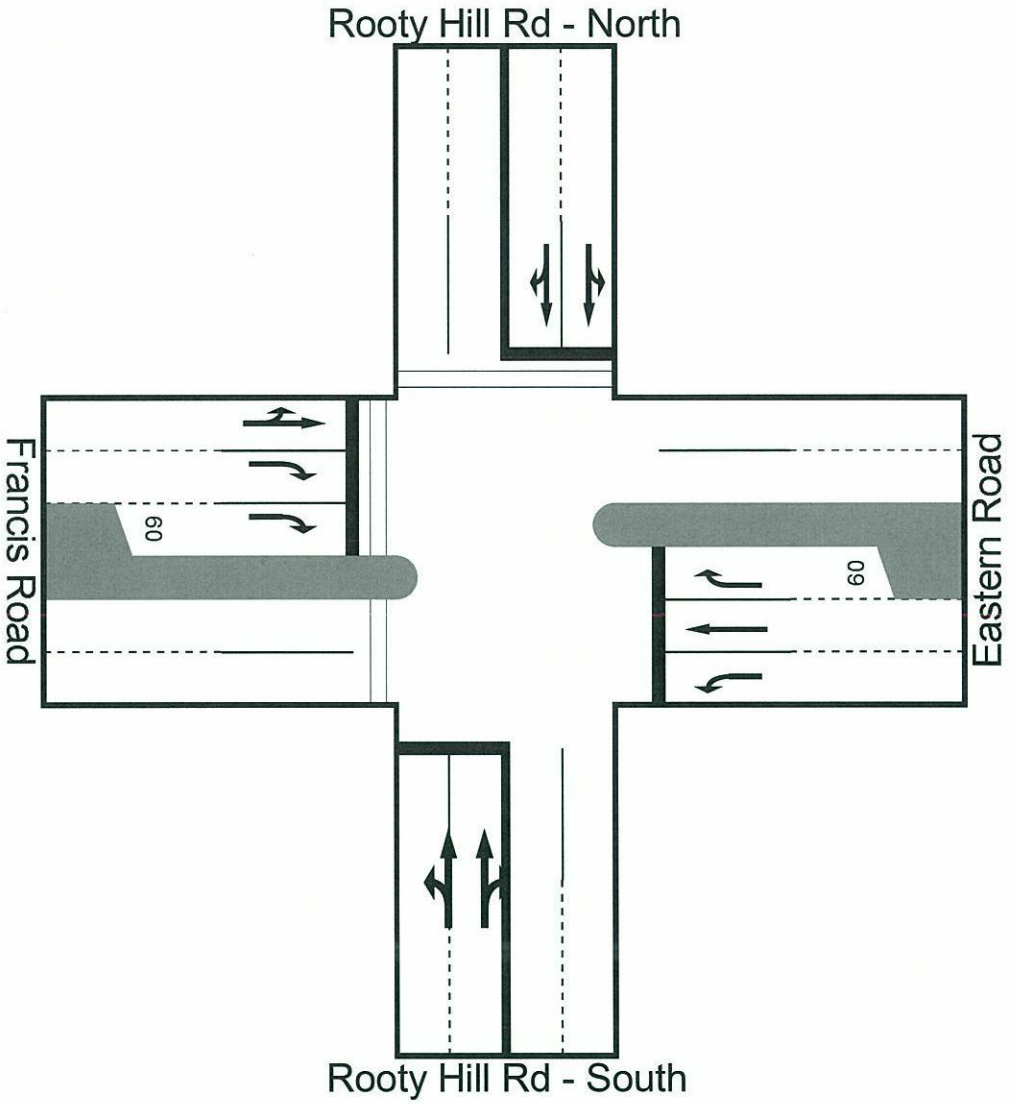
2016 Base Layout With Development - Scenario 1



Intersection Summary

Node 3: Rooty Hill Rd and Eastern Rd - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 3: Rooty Hill Rd and Eastern Rd - Base

2016 Base Layout Without Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Rooty Hill Rd - South										
1	L	421	1.9	0.833	61.1	LOS E	214	0.94	1.04	23.4
2	T	81	4.9	0.834	53.1	LOS D	214	0.94	1.01	25.7
3	R	394	2.3	0.929	92.6	LOS F	245	1.00	1.10	17.6
Approach		**896**	**2.3**	**0.929**	**74.2**	**LOS F**	**245**	**0.97**	**1.06**	**20.6**
Eastern Road										
4	L	398	3.5	0.954	96.9	LOS F	254	1.00	1.15	16.4
5	T	270	3.7	0.638	57.2	LOS E	131	0.92	0.78	23.3
6	R	53	3.8	0.227	48.4	LOS D	28	0.76	0.74	25.8
Approach		**721**	**3.6**	**0.954**	**78.5**	**LOS F**	**254**	**0.95**	**0.98**	**19.0**
Rooty Hill Rd - North										
7	L	173	1.2	0.955	75.4	LOS F	110	1.00	1.06	19.5
8	T	174	1.1	0.954	89.5	LOS F	110	1.00	1.07	17.3
9	R	6	0.0	0.951	105.1	LOS F	94	1.00	1.08	15.5
Approach		**353**	**1.1**	**0.954**	**82.8**	**LOS F**	**110**	**1.00**	**1.07**	**18.3**
Francis Road										
10	L	4	0.0	0.930	75.3	LOS F	282	1.00	1.03	19.5
11	T	502	3.8	0.909	67.1	LOS E	282	1.00	1.03	21.1
12	R	933	2.3	0.978	82.6	LOS F	410	0.95	1.18	18.3
Approach		**1439**	**2.8**	**0.978**	**77.2**	**LOS F**	**410**	**0.97**	**1.12**	**19.2**
All Vehicles		**3409**	**2.7**	**0.978**	**77.3**	**LOS F**	**410**	**0.97**	**1.07**	**19.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	10	44.1	LOS E	0	0.77	0.77
P7	10	55.5	LOS E	0	0.86	0.86
All Peds	**20**	**49.8**	**LOS D**	**0**	**0.81**	**0.81**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node3Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 3 Eastern Rooty.aap
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SIDRA INTERSECTION

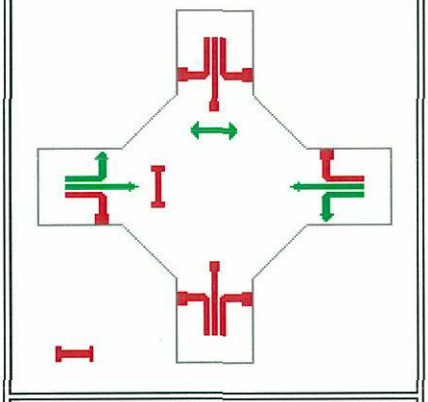
Phasing Summary

Node 3: Rooty Hill Rd and Eastern Rd - Base

2016 Base Layout Without Development - Scenario 1

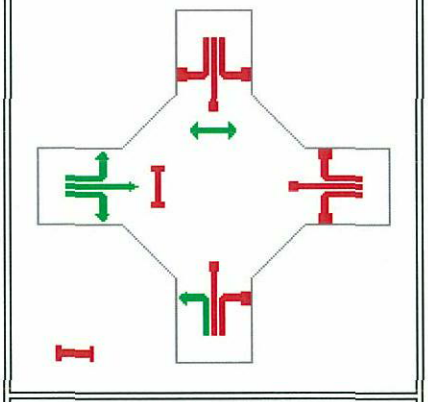
C = **150** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase A



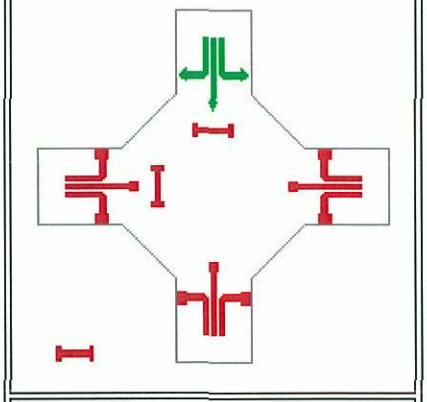
Green Time = **33** seconds
Phase Time = **37** seconds
Phase Split = **25** %

Phase C



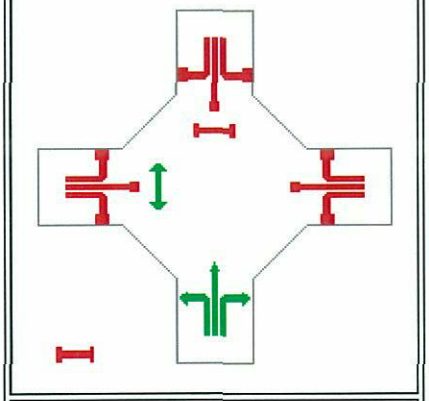
Green Time = **6** seconds
Phase Time = **10** seconds
Phase Split = **7** %

Phase D



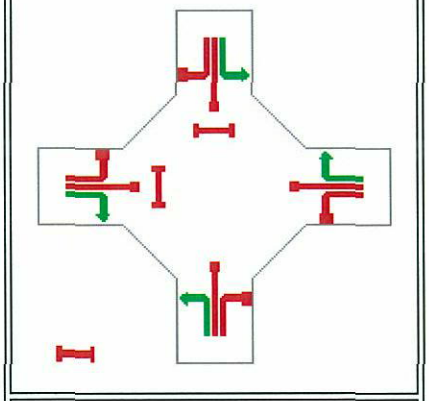
Green Time = **11** seconds
Phase Time = **15** seconds
Phase Split = **10** %

Phase E

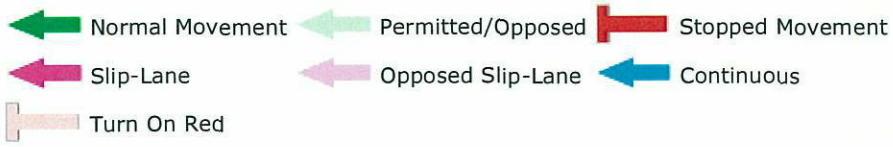


Green Time = **35** seconds
Phase Time = **39** seconds
Phase Split = **26** %

Phase F



Green Time = **45** seconds
Phase Time = **49** seconds
Phase Split = **33** %



SIDRA SOLUTIONS

Site: Node3Base
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SIDRA INTERSECTION

Movement Summary

Node 3: Rooty Hill Rd Eastern Rd - Development

2016 Layout With Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Rooty Hill Rd - South										
1	L	421	1.9	0.788	48.8	LOS D	173	0.90	0.98	27.0
2	T	81	4.9	0.789	40.8	LOS C	173	0.90	0.92	30.0
3	R	407	2.2	0.987	128.7	LOS F	305	1.00	1.30	13.6
Approach		**909**	**2.3**	**0.987**	**83.9**	**LOS F**	**305**	**0.95**	**1.12**	**18.9**
Eastern Road										
4	L	470	3.0	0.975	106.5	LOS F	320	1.00	1.23	15.2
5	T	277	3.6	0.568	52.4	LOS D	127	0.87	0.74	24.6
6	R	53	3.8	0.267	65.2	LOS E	33	0.89	0.75	21.5
Approach		**800**	**3.2**	**0.975**	**85.1**	**LOS F**	**320**	**0.95**	**1.03**	**18.0**
Rooty Hill Rd - North										
7	L	173	1.2	0.961	79.2	LOS F	112	1.00	1.07	18.8
8	T	174	1.1	0.961	92.6	LOS F	112	1.00	1.09	16.9
9	R	6	0.0	0.963	107.8	LOS F	96	1.00	1.09	15.2
Approach		**353**	**1.1**	**0.961**	**86.3**	**LOS F**	**112**	**1.00**	**1.08**	**17.8**
Francis Road										
10	L	4	0.0	0.635	39.8	LOS C	180	0.73	0.83	28.6
11	T	503	3.8	0.621	31.6	LOS C	180	0.73	0.65	32.1
12	R	933	2.3	0.968	61.7	LOS E	270	0.97	1.04	22.3
Approach		**1440**	**2.8**	**0.968**	**51.1**	**LOS D**	**270**	**0.88**	**0.90**	**24.9**
All Vehicles		**3502**	**2.6**	**0.987**	**70.9**	**LOS F**	**320**	**0.93**	**1.01**	**20.6**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	10	30.1	LOS D	0	0.63	0.63
P7	10	56.3	LOS E	0	0.87	0.87
All Peds	**20**	**43.2**	**LOS D**	**0**	**0.75**	**0.75**

SIDRA SOLUTIONS

Site: Node3Design
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SIDRA INTERSECTION

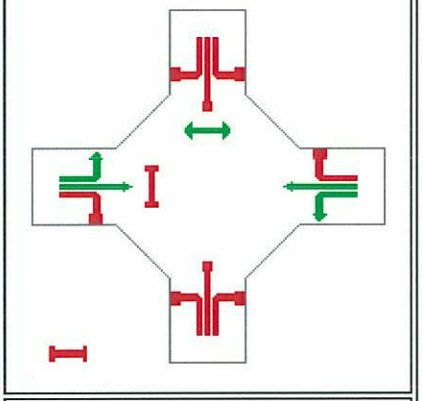
Phasing Summary

Node 3: Rooty Hill Rd Eastern Rd - Development

2016 Layout With Development - Scenario 1

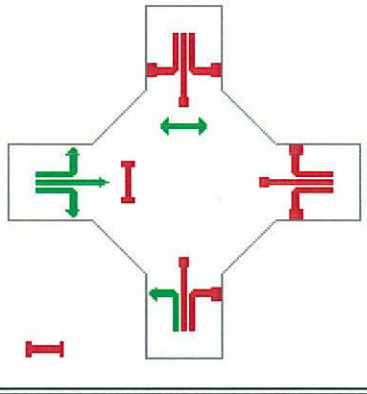
C = **150** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase A



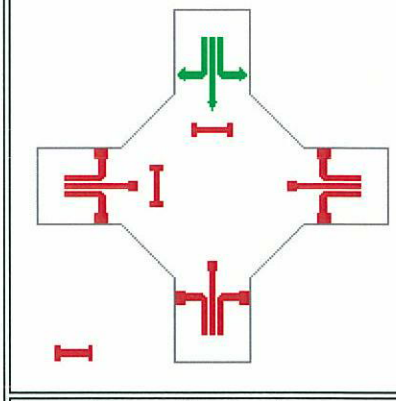
Green Time = **38** seconds
Phase Time = **42** seconds
Phase Split = **28** %

Phase C



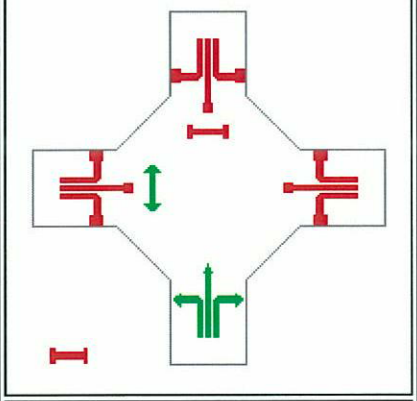
Green Time = **21** seconds
Phase Time = **25** seconds
Phase Split = **17** %

Phase D



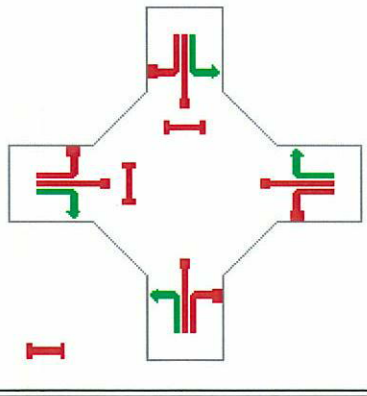
Green Time = **11** seconds
Phase Time = **15** seconds
Phase Split = **10** %

Phase E

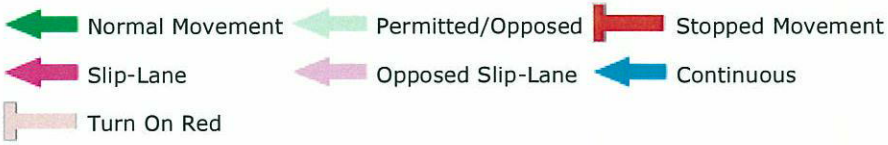


Green Time = **34** seconds
Phase Time = **38** seconds
Phase Split = **25** %

Phase F



Green Time = **26** seconds
Phase Time = **30** seconds
Phase Split = **20** %



Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node3Design
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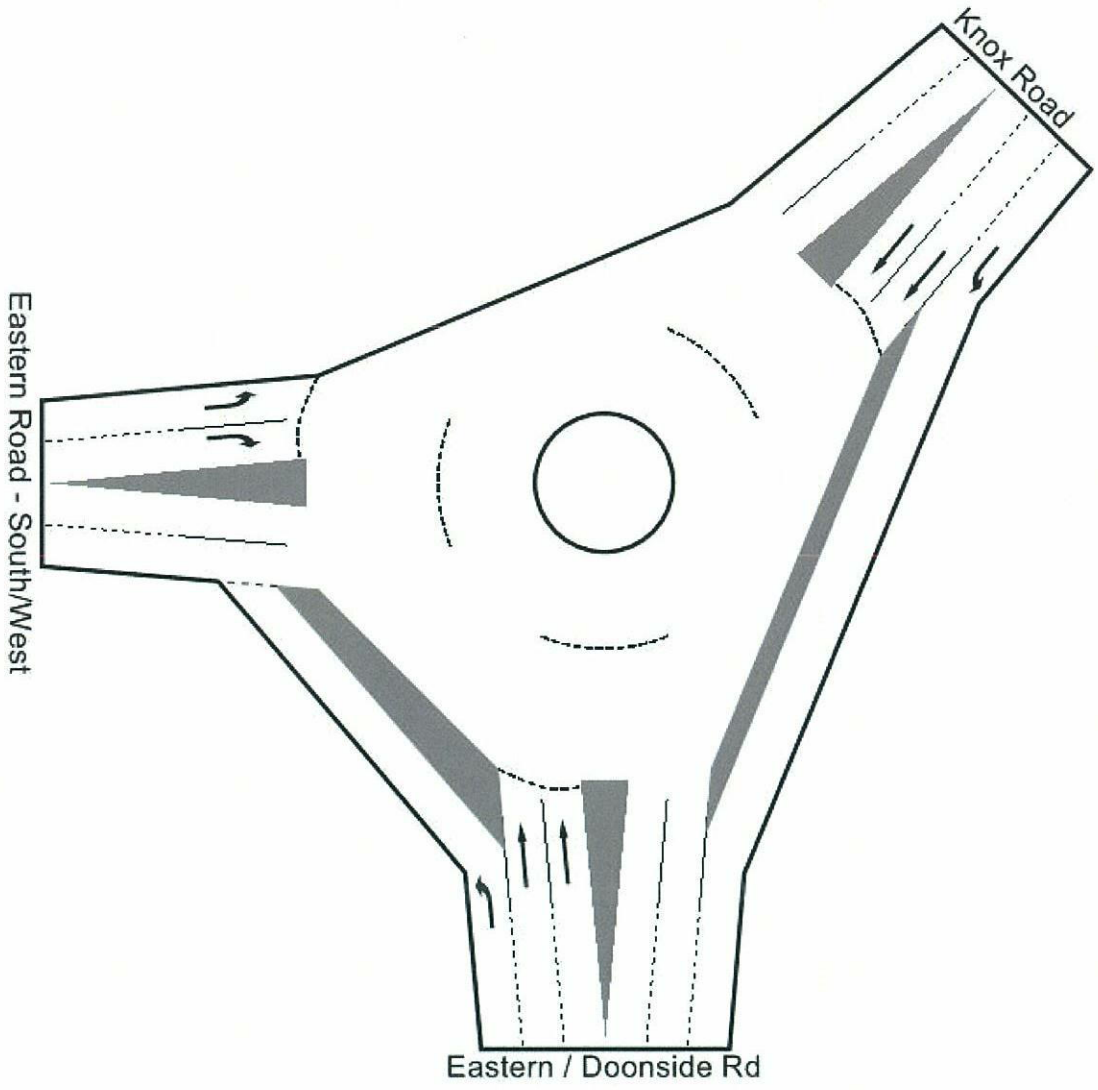
Intersection Summary

Node 4: Eastern Road & Knox Road - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 4: Eastern Road Knox Road - Base

2016 Base Layout Without Development - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Eastern / Doonside Rd										
1	L	354	2.3	0.376	8.2	LOS A	20	0.62	0.70	47.6
2	T	575	9.0	0.318	12.4	LOS A	17	0.60	0.79	44.9
Approach		**929**	**6.5**	**0.376**	**10.8**	**LOS A**	**20**	**0.61**	**0.76**	**45.8**
Knox Road										
24	L	1747	4.0	0.896	6.0	LOS F#	31#	0.00	0.46	51.6
25	T	434	2.5	0.299	14.0	LOS A	19	0.79	0.85	43.8
Approach		**2181**	**3.7**	**0.896**	**7.6**	**LOS A**	**19**	**0.16**	**0.54**	**49.8**
Eastern Road - South/West										
10	L	454	6.4	0.591	10.6	LOS A	39	0.77	0.95	46.6
12	R	647	3.9	0.702	16.7	LOS B	57	0.83	1.05	41.9
Approach		**1101**	**4.9**	**0.702**	**14.2**	**LOS A**	**57**	**0.80**	**1.01**	**43.7**
All Vehicles		**4211**	**4.6**	**0.896**	**10.0**	**LOS A**	**57**	**0.43**	**0.71**	**47.1**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
 # - Density for continuous movement

SIDRA SOLUTIONS

Site: Node4Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 4 Eastern Knox.aap
Processed Apr 10, 2007 08:48:01AM

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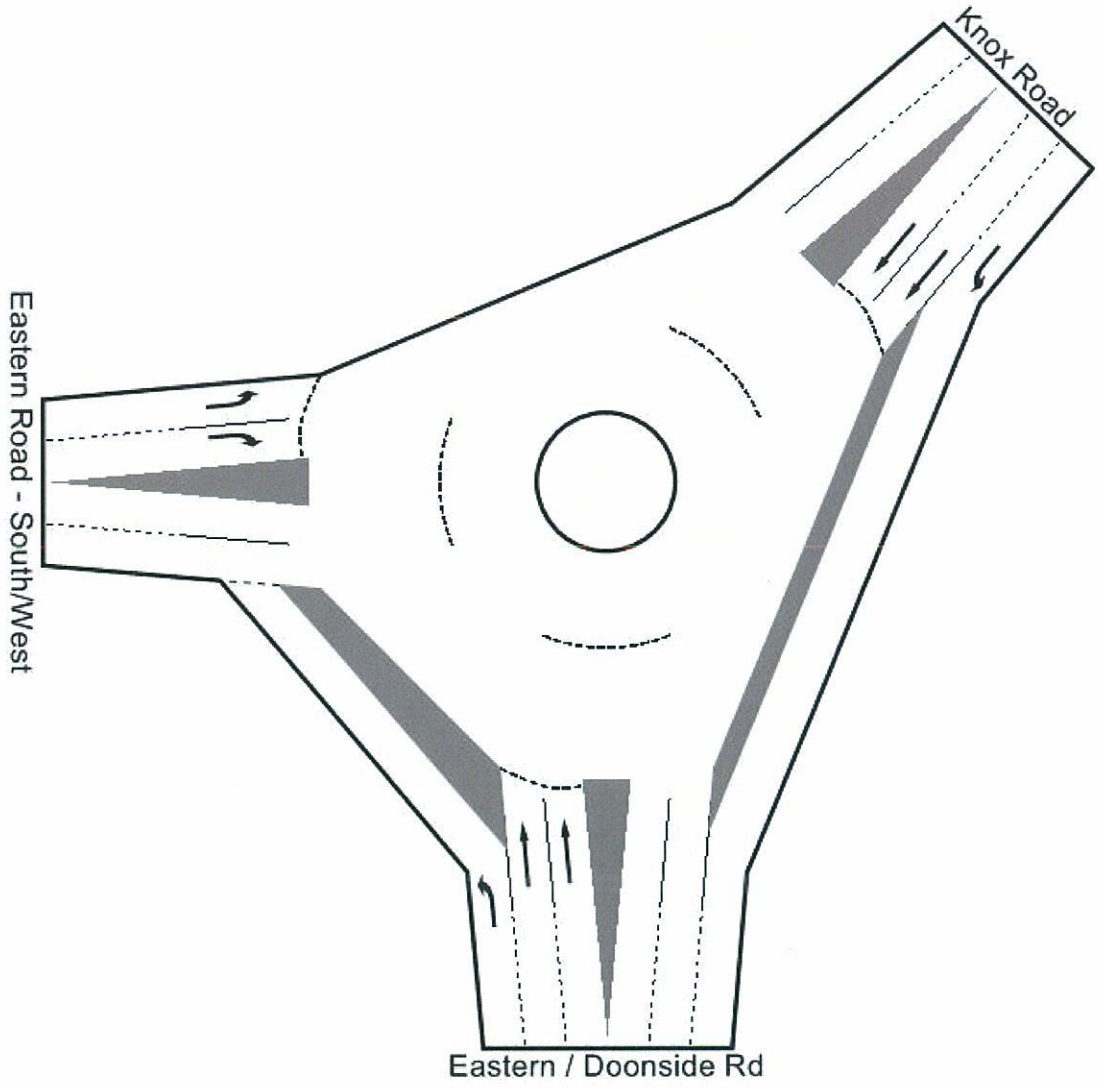
Intersection Summary

Node 4: Eastern Road & Knox Road - Development

2016 Base Layout With Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 4: Eastern Road Knox Road - Development

2016 Layout With Development - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Eastern / Doonside Rd										
1	L	435	1.8	0.459	8.4	LOS A	26	0.67	0.73	47.4
2	T	616	8.4	0.338	12.4	LOS A	18	0.61	0.80	44.8
Approach		**1051**	**5.7**	**0.460**	**10.7**	**LOS A**	**26**	**0.63**	**0.77**	**45.8**
Knox Road										
24	L	1754	4.0	0.899	6.0	LOS F#	31#	0.00	0.46	51.6
25	T	434	2.5	0.307	14.1	LOS A	19	0.80	0.86	43.7
Approach		**2188**	**3.7**	**0.899**	**7.6**	**LOS A**	**19**	**0.16**	**0.54**	**49.7**
Eastern Road - South/West										
10	L	454	6.4	0.612	11.2	LOS A	41	0.79	0.97	46.1
12	R	661	3.8	0.734	17.4	LOS B	62	0.86	1.08	41.3
Approach		**1115**	**4.8**	**0.734**	**14.9**	**LOS B**	**62**	**0.83**	**1.04**	**43.1**
All Vehicles		**4354**	**4.5**	**0.899**	**10.2**	**LOS A**	**62**	**0.45**	**0.72**	**46.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node4Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 4 Eastern Knox.aap
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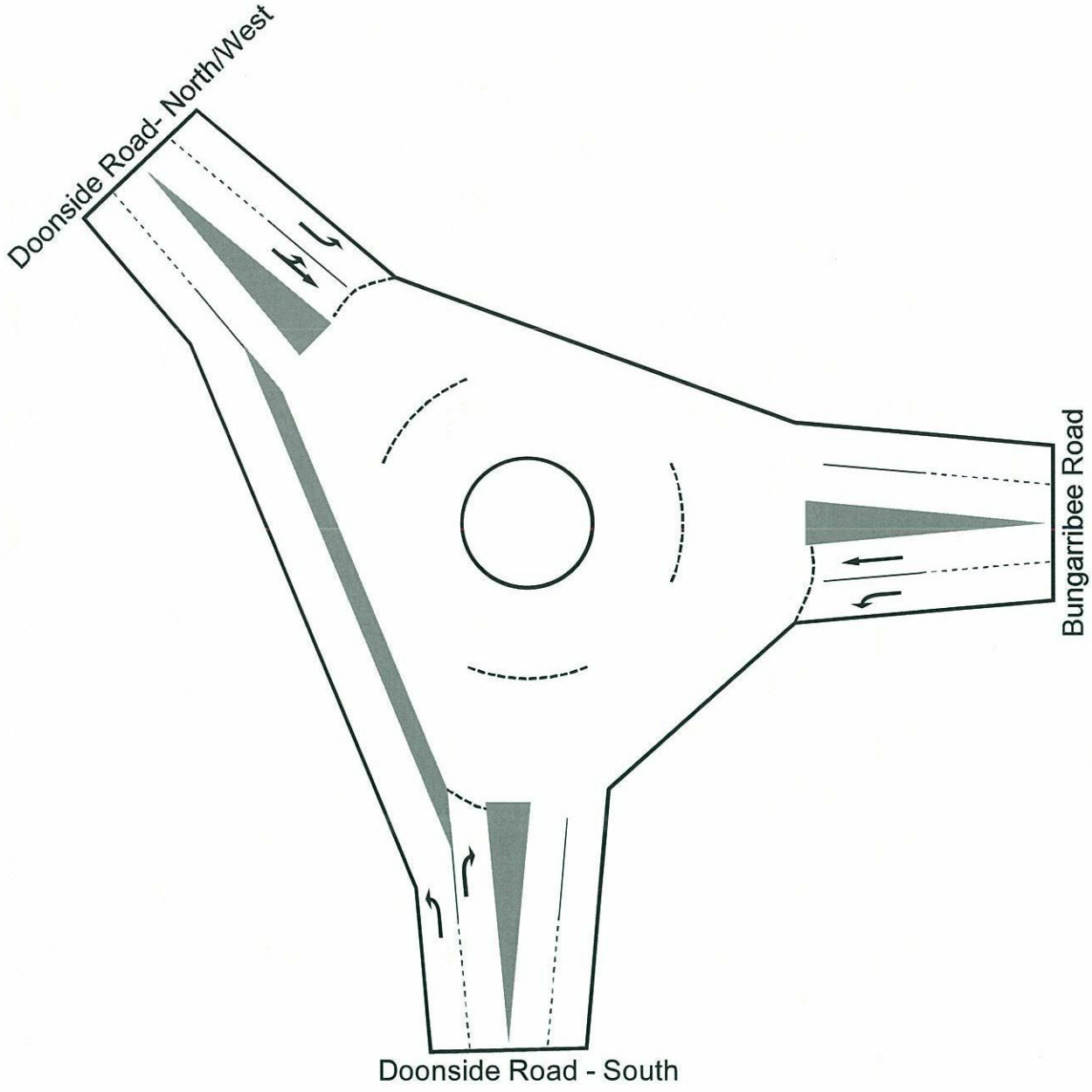
Produced by SIDRA Intersection 3.1.061208.34

Intersection Summary

Node 5: Doonside Road & Bungarribee Road - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 5: Doonside Road Bungarribee Road - Base

2016 Base Layout without Development - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road - South										
1	L	421	8.6	0.216	5.5	LOS B#	8#	0.00	0.46	52.4
3	R	303	4.6	0.345	13.5	LOS A	21	0.63	0.76	44.0
Approach		**724**	**6.9**	**0.345**	**8.9**	**LOS A**	**21**	**0.26**	**0.59**	**48.4**
Bungarribee Road										
4	L	263	1.5	1.065	233.3	LOS F	288	1.00	2.67	8.1
5	T	532	3.4	1.583	1097.3	LOS F	1907	1.00	8.40	2.0
Approach		**795**	**2.8**	**1.582**	**811.5**	**LOS F**	**1907**	**1.00**	**6.50**	**2.7**
Doonside Road- North/West										
27	L	923	2.5	0.865	13.3	LOS A	136	1.00	1.00	44.1
28	T	1196	3.8	0.959	28.2	LOS B	271	1.00	1.27	34.7
Approach		**2119**	**3.3**	**0.959**	**21.7**	**LOS B**	**271**	**1.00**	**1.15**	**38.2**
All Vehicles		**3638**	**3.9**	**1.583**	**191.7**	**LOS F**	**1907**	**0.85**	**2.21**	**9.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 5 Doonside_Bungarribee.aap
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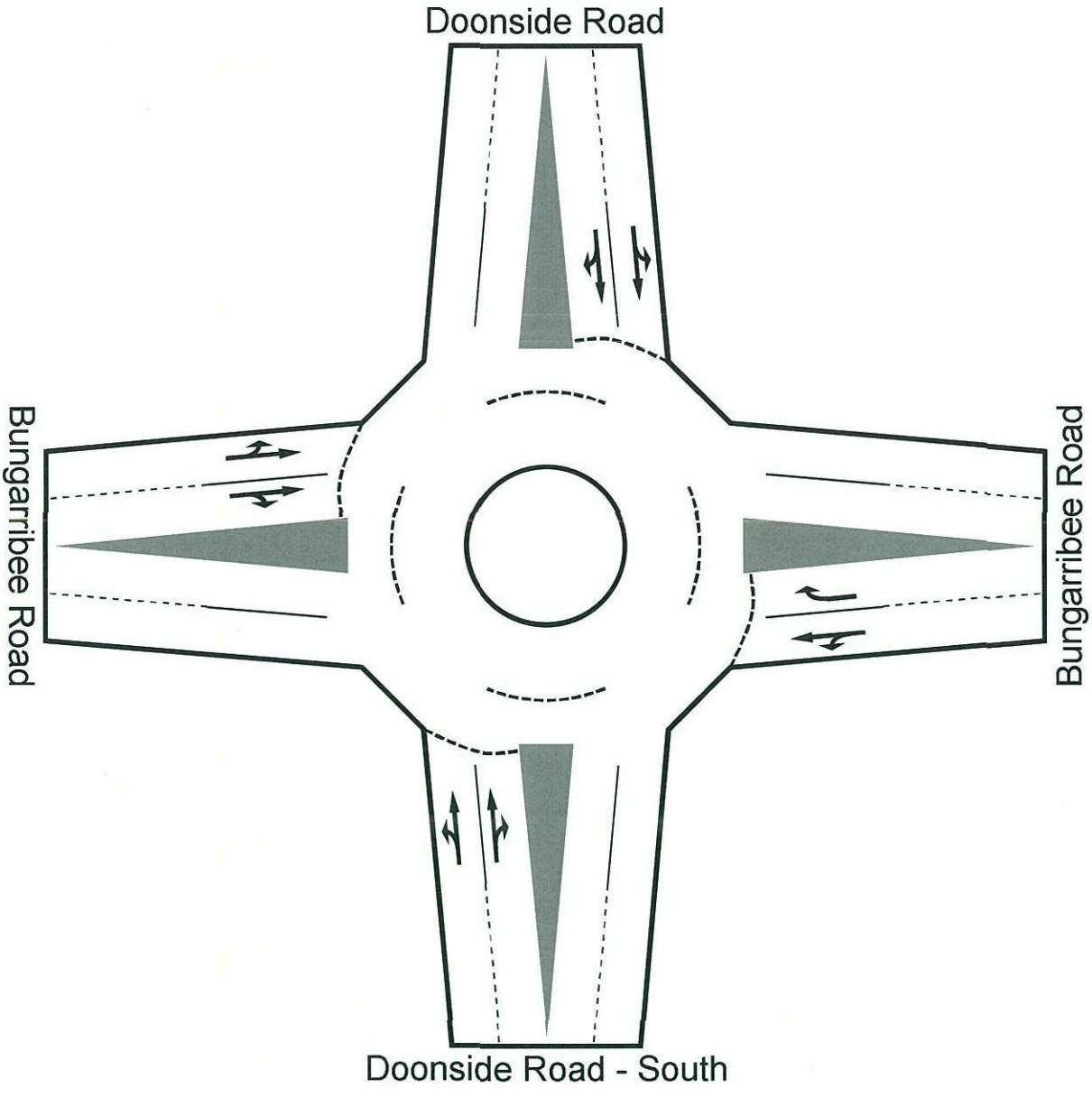
Intersection Summary

Node 5: Doonside Road and Bungarribee Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 1



Movement Summary

Node 5: Doonside Road and Bungarribee Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road - South										
1	L	3	0.0	0.429	9.8	LOS A	32	0.78	0.82	46.5
2	T	424	8.5	0.458	8.5	LOS A	32	0.78	0.75	47.3
3	R	328	4.3	0.458	15.0	LOS B	30	0.78	0.88	43.4
Approach		**755**	**6.6**	**0.458**	**11.4**	**LOS A**	**32**	**0.78**	**0.81**	**45.5**
Bungarribee Road										
4	L	268	1.5	0.691	21.7	LOS B	49	0.98	1.15	37.7
5	T	4	0.0	0.667	21.0	LOS B	49	0.98	1.14	38.2
6	R	532	3.4	0.980	78.8	LOS F	216	1.00	2.18	19.9
Approach		**804**	**2.7**	**0.981**	**59.4**	**LOS E**	**216**	**0.99**	**1.83**	**23.5**
Doonside Road										
7	L	923	2.5	0.956	23.6	LOS B	244	1.00	1.35	36.4
8	T	1215	3.8	0.957	24.8	LOS B	244	1.00	1.41	35.9
9	R	11	0.0	1.000	32.1	LOS C	239	1.00	1.43	33.0
Approach		**2149**	**3.2**	**0.957**	**24.3**	**LOS B**	**244**	**1.00**	**1.39**	**36.1**
Bungarribee Road										
10	L	61	0.0	0.087	9.9	LOS A	4	0.77	0.79	47.0
11	T	25	0.0	0.082	9.8	LOS A	4	0.76	0.80	47.4
12	R	19	0.0	0.082	16.6	LOS B	4	0.76	0.88	42.2
Approach		**105**	**0.0**	**0.087**	**11.1**	**LOS A**	**4**	**0.77**	**0.81**	**46.1**
All Vehicles		**3813**	**3.7**	**1.000**	**28.8**	**LOS C**	**244**	**0.95**	**1.35**	**33.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

Site: Development roundabout
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 5 Doonside_Bungarribee.aap
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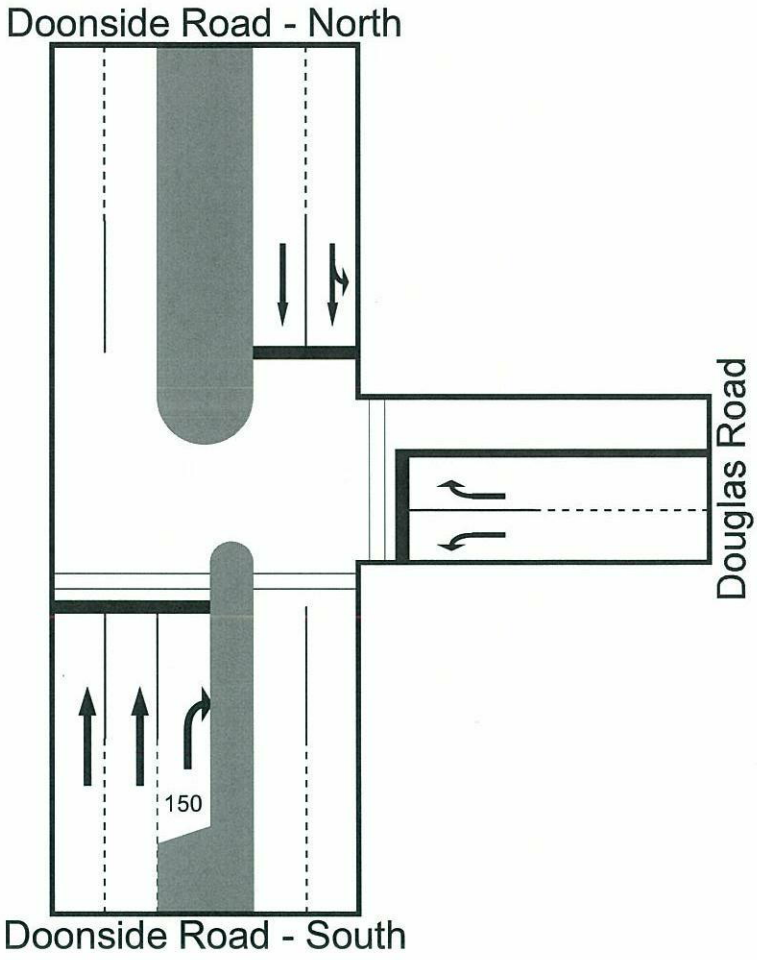
Intersection Summary

Node 6: Doonside Road and Douglas Road - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 6: Doonside Road and Douglas Road - Base

2016 Base Layout Without Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road - South										
2	T	576	10.4	0.194	1.0	LOS A	14	0.07	0.06	58.4
3	R	100	4.0	0.491	18.5	LOS B	41	0.60	0.80	39.8
Approach		**676**	**9.5**	**0.491**	**3.6**	**LOS A**	**41**	**0.14**	**0.17**	**54.6**
Douglas Road										
4	L	201	2.0	0.531	65.6	LOS E	99	0.90	0.82	21.4
6	R	95	4.2	0.395	73.4	LOS F	59	0.96	0.79	19.9
Approach		**296**	**2.7**	**0.531**	**68.1**	**LOS E**	**99**	**0.92**	**0.81**	**20.9**
Doonside Road - North										
7	L	63	0.0	0.532	10.1	LOS A	50	0.11	0.70	46.9
8	T	1429	3.8	0.531	1.9	LOS A	50	0.11	0.10	57.0
Approach		**1492**	**3.7**	**0.530**	**2.3**	**LOS A**	**50**	**0.11**	**0.13**	**56.5**
All Vehicles		**2464**	**5.2**	**0.532**	**10.5**	**LOS A**	**99**	**0.22**	**0.22**	**46.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	6.8	LOS A	0	0.30	0.30
All Peds	**10**	**37.9**	**LOS C**	**0**	**0.63**	**0.63**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 6 Doonside_douglas.aap
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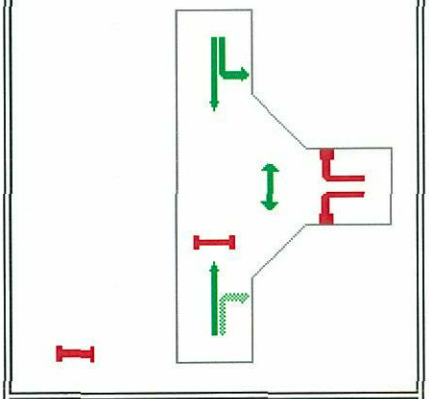
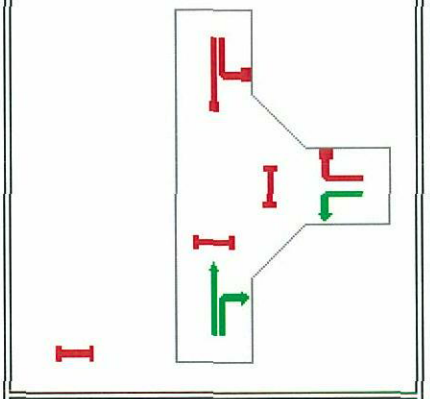
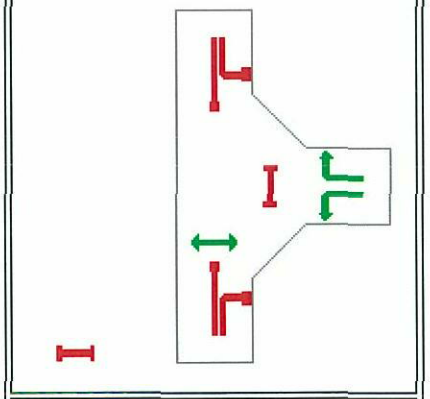
SIDRA INTERSECTION

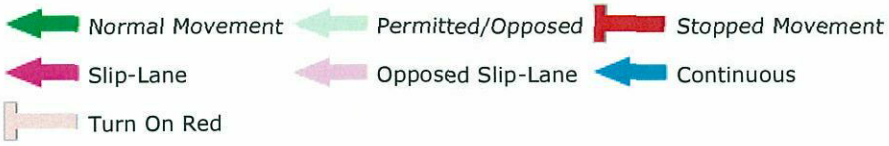
Phasing Summary

Node 6: Doonside Road and Douglas Road - Base

2016 Base Layout Without Development - Scenario 1

C = **150** seconds
Cycle Time Option: ***User-specified cycle time***
Phase times determined by the program.

Phase A	Phase B	Phase C
		
Green Time = **111** seconds Phase Time = **115** seconds Phase Split = **77** %	Green Time = **7** seconds Phase Time = **11** seconds Phase Split = **7** %	Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %



SIDRA SOLUTIONS

Site: BASE
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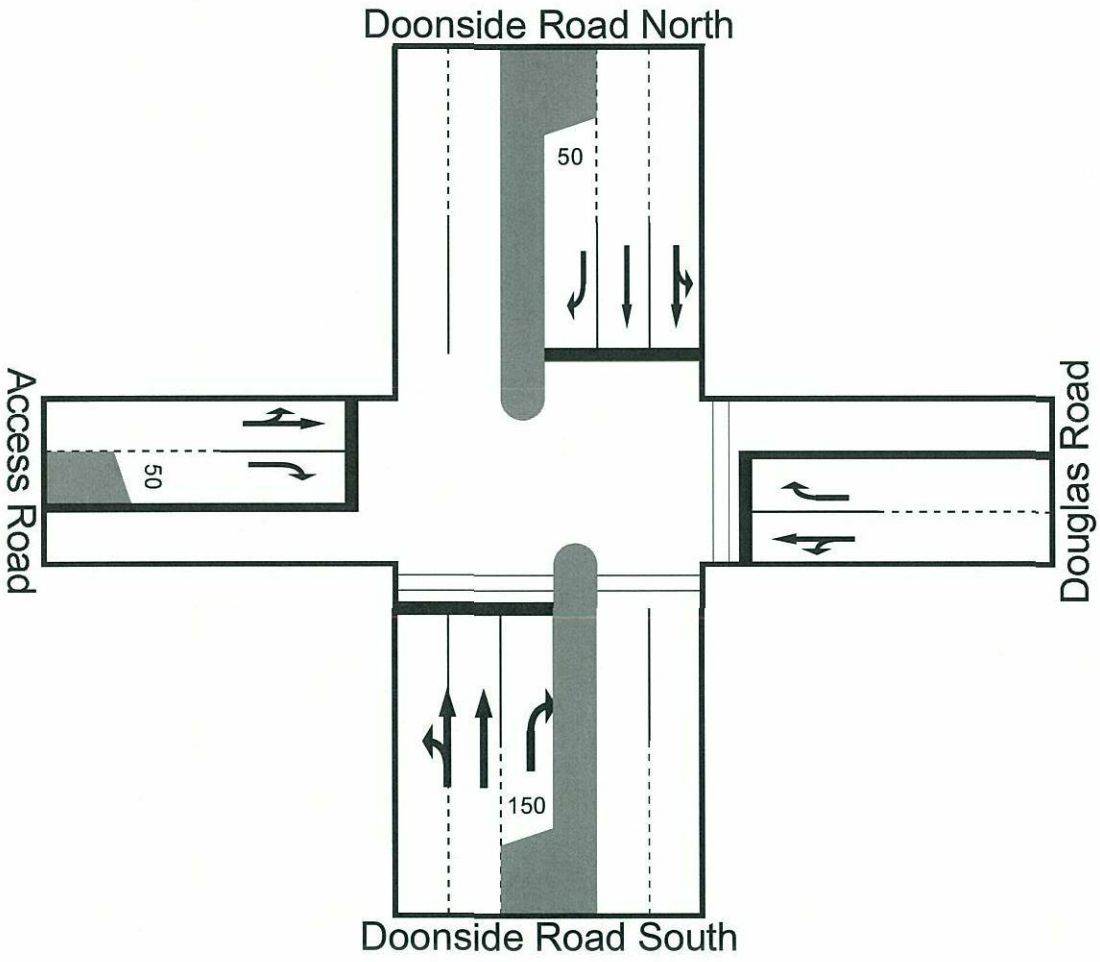
Intersection Summary

Node 6: Doonside Road and Douglas Road - Development

2016 Layout with Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 6: Doonside Road and Douglas Road - Development

2016 Layout with Development - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road South										
1	L	27	0.0	0.255	13.6	LOS A	42	0.20	0.71	43.6
2	T	583	10.3	0.255	5.1	LOS A	42	0.19	0.17	52.6
3	R	100	4.0	0.953	159.2	LOS F	109	1.00	1.33	11.2
Approach		**710**	**9.0**	**0.953**	**27.1**	**LOS B**	**109**	**0.30**	**0.35**	**34.4**
Douglas Road										
4	L	201	2.0	0.846	83.4	LOS F	120	1.00	0.93	18.2
5	T	6	0.0	0.849	75.2	LOS F	120	1.00	0.93	19.6
6	R	95	4.2	0.395	73.3	LOS F	59	0.96	0.78	19.9
Approach		**302**	**2.6**	**0.846**	**80.1**	**LOS F**	**120**	**0.99**	**0.89**	**18.7**
Doonside Road North										
7	L	63	0.0	0.614	15.0	LOS B	118	0.30	0.74	42.5
8	T	1466	3.8	0.615	6.8	LOS A	118	0.30	0.28	50.6
9	R	4	0.0	0.010	17.4	LOS B	1	0.36	0.66	40.5
Approach		**1533**	**3.6**	**0.615**	**7.1**	**LOS A**	**118**	**0.30**	**0.30**	**50.1**
Access Road										
10	L	26	0.0	0.232	71.4	LOS F	37	0.93	0.76	20.2
11	T	33	0.0	0.232	63.2	LOS E	37	0.93	0.72	21.9
12	R	157	0.0	0.956	81.7	LOS F	92	1.00	0.87	18.5
Approach		**216**	**0.0**	**0.955**	**77.6**	**LOS F**	**92**	**0.98**	**0.83**	**19.2**
All Vehicles		**2761**	**4.6**	**0.956**	**25.8**	**LOS B**	**120**	**0.43**	**0.42**	**35.1**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	11.2	LOS B	0	0.39	0.39
All Peds	**10**	**40.2**	**LOS C**	**0**	**0.67**	**0.67**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development intersect
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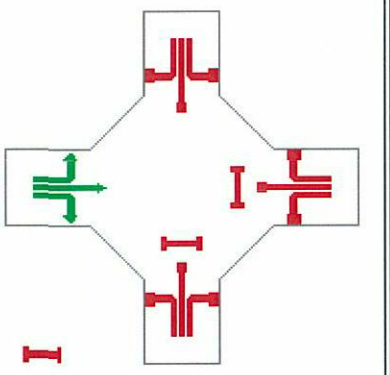
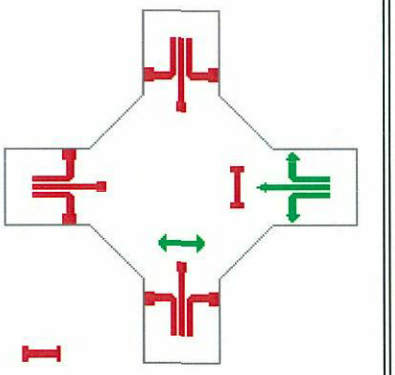
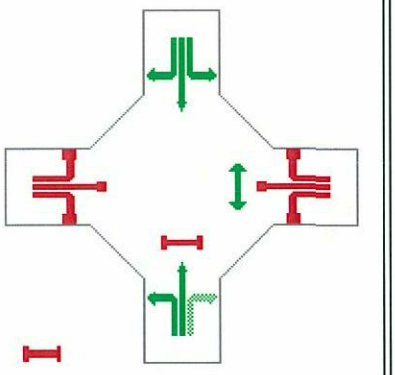
SIDRA INTERSECTION

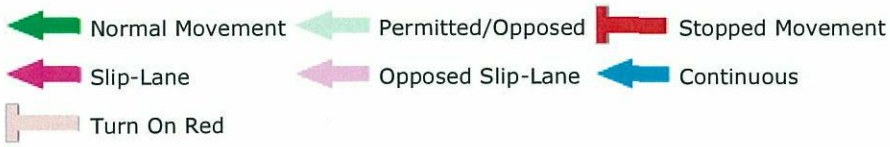
Phasing Summary

Node 6: Doonside Road and Douglas Road - Development

2016 Layout with Development - Scenario 1

C = **150** seconds
Cycle Time Option: ***User-specified cycle time***
Phase times determined by the program.

Phase A	Phase B	Phase C
		
Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %	Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %	Green Time = **98** seconds Phase Time = **102** seconds Phase Split = **68** %



SIDRA SOLUTIONS

Site: Development intersect
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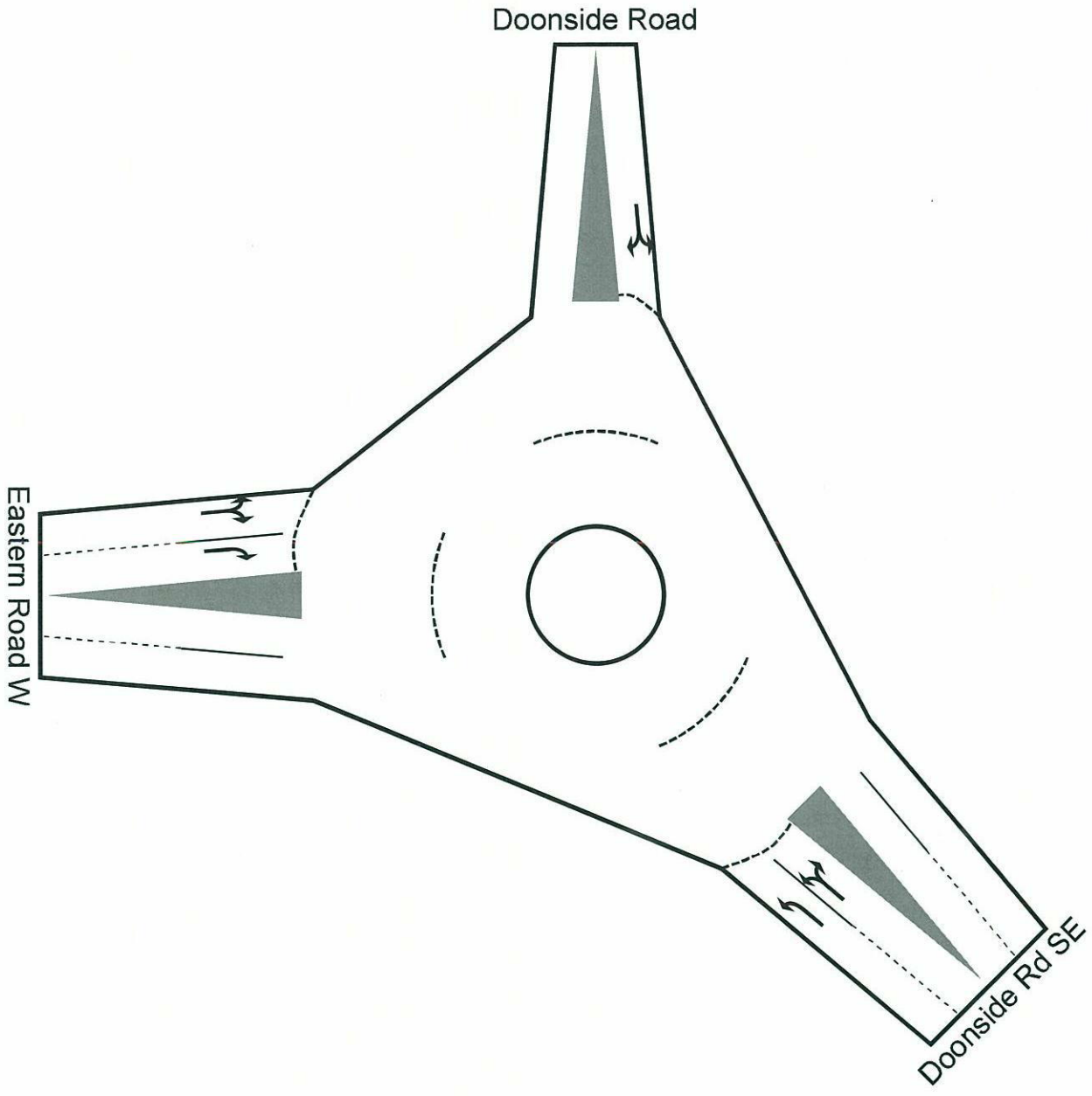
Intersection Summary

Node 11: Doonside Road and Eastern Road - Base

2016 Base Layout Without Development - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 11: Doonside Road and Eastern Road - Base

2016 Base Layout Without Development - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Rd SE										
21	L	902	6.2	0.348	4.9	LOS A	23	0.34	0.43	50.9
23	R	54	5.6	0.348	10.7	LOS A	23	0.35	0.61	46.0
Approach		**956**	**6.2**	**0.348**	**5.2**	**LOS A**	**23**	**0.34**	**0.44**	**50.6**
Doonside Road										
7	L	75	1.3	0.469	17.4	LOS B	24	0.89	1.01	40.7
9	R	100	6.0	0.469	24.5	LOS B	24	0.89	1.05	37.2
Approach		**175**	**4.0**	**0.469**	**21.4**	**LOS B**	**24**	**0.89**	**1.03**	**38.5**
Eastern Road W										
10	L	166	1.8	0.818	6.2	LOS A	119	0.48	0.45	48.9
12	R	2354	4.1	0.820	10.9	LOS A	119	0.51	0.55	45.3
Approach		**2520**	**4.0**	**0.820**	**10.6**	**LOS A**	**119**	**0.51**	**0.54**	**45.5**
All Vehicles		**3651**	**4.5**	**0.820**	**9.7**	**LOS A**	**119**	**0.48**	**0.54**	**46.3**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 11 Doonside Rd_Eastern Rd.aap
Processed Aug 06, 2007 12:13:15PM

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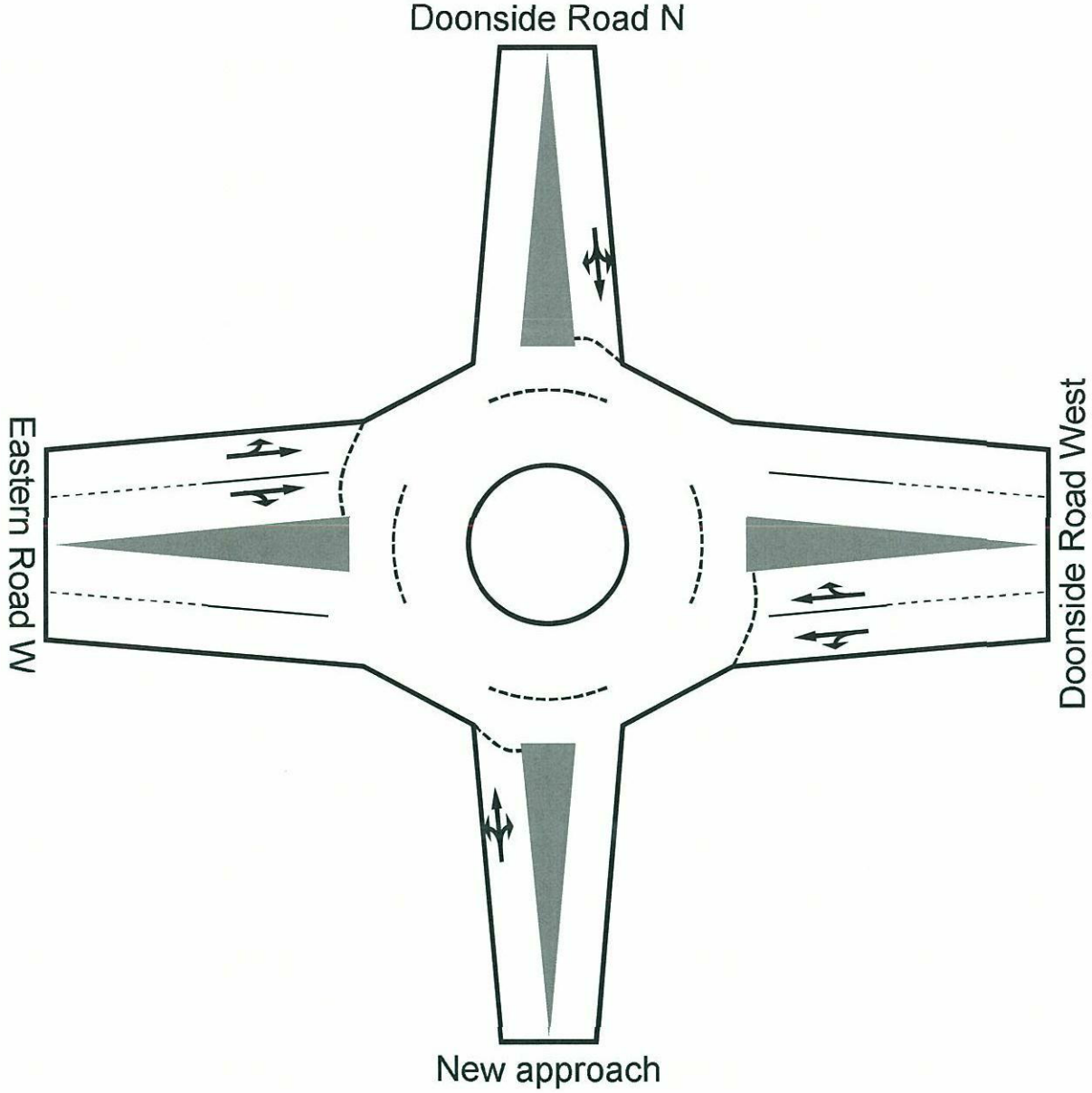
Intersection Summary

Node 11: Doonside Road and Eastern Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 1



SIDRA INTERSECTION

Movement Summary

Node 11: Doonside Road and Eastern Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 1

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
New approach										
1	L	64	0.0	0.123	8.6	LOS A	5	0.63	0.76	48.1
2	T	5	0.0	0.122	7.6	LOS A	5	0.63	0.70	48.7
3	R	20	0.0	0.123	14.5	LOS A	5	0.63	0.81	43.9
Approach		**89**	**0.0**	**0.123**	**9.8**	**LOS A**	**5**	**0.63**	**0.77**	**47.0**
Doonside Road West										
4	L	3	0.0	0.375	6.0	LOS A	23	0.34	0.50	49.7
5	T	949	6.2	0.369	5.0	LOS A	23	0.34	0.44	50.9
6	R	54	5.6	0.370	11.9	LOS A	22	0.35	0.64	45.2
Approach		**1007**	**6.2**	**0.369**	**5.4**	**LOS A**	**23**	**0.34**	**0.45**	**50.5**
Doonside Road N										
7	L	75	1.3	0.547	21.5	LOS B	30	0.92	1.06	37.8
8	T	5	0.0	0.556	20.5	LOS B	30	0.92	1.06	38.5
9	R	100	6.0	0.549	27.5	LOS B	30	0.92	1.08	35.4
Approach		**180**	**3.9**	**0.549**	**24.8**	**LOS B**	**30**	**0.92**	**1.07**	**36.4**
Eastern Road W										
10	L	166	1.8	0.847	6.7	LOS A	125	0.61	0.48	48.1
11	T	2354	4.1	0.848	5.7	LOS A	125	0.65	0.46	48.6
12	R	12	0.0	0.857	12.6	LOS A	121	0.69	0.57	43.8
Approach		**2532**	**3.9**	**0.848**	**5.8**	**LOS A**	**125**	**0.64**	**0.46**	**48.5**
All Vehicles		**3808**	**4.4**	**0.857**	**6.7**	**LOS A**	**125**	**0.58**	**0.50**	**48.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development roundabout
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 11 Doonside Rd_Eastern Rd.aap
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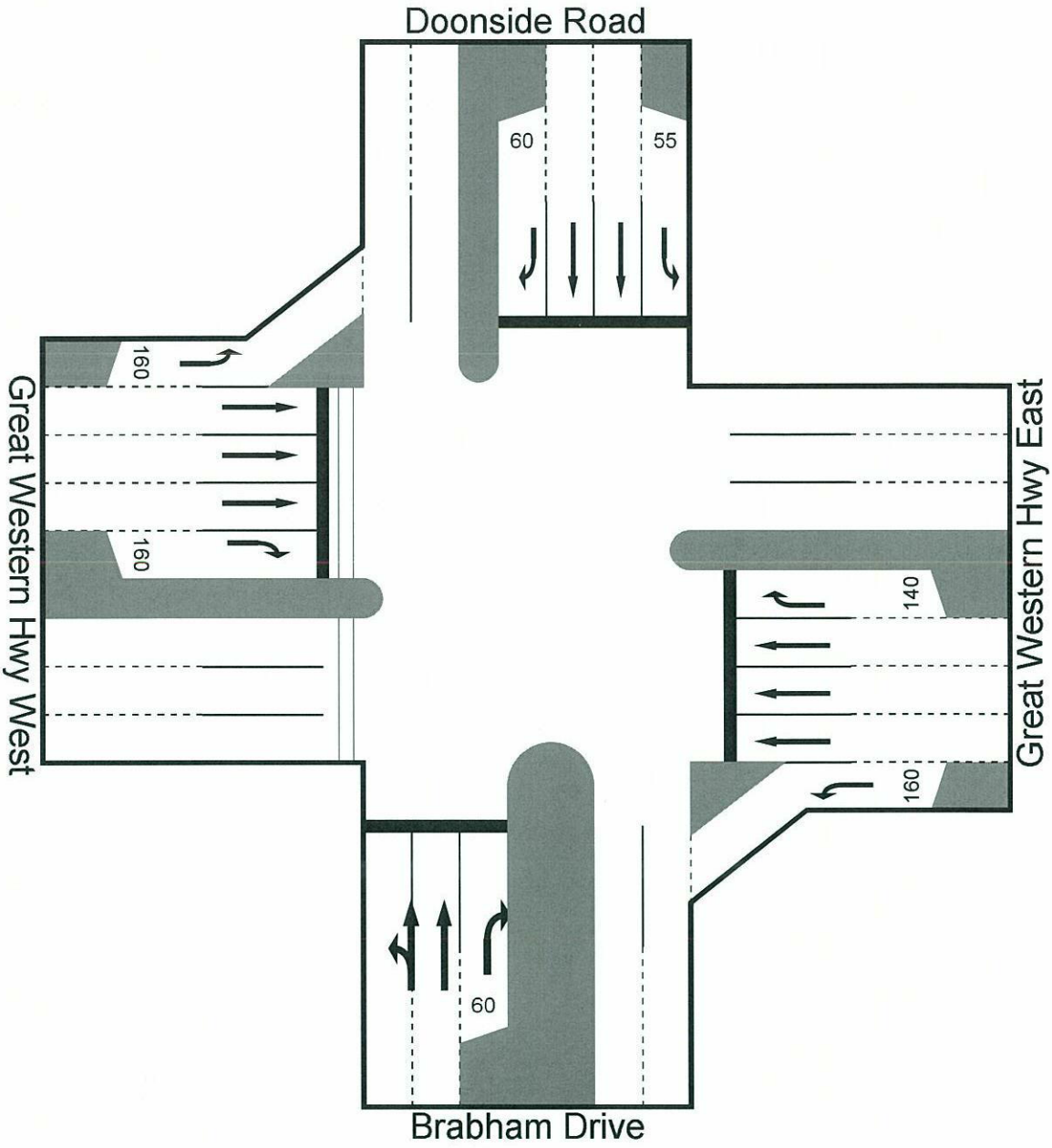
Appendix D: SIDRA Output Scenario 2

Intersection Summary

Node 1: Great Western Highway & Doonside Road - Base

2016 Base Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 1: Great Western Highway Doonside Road - Base

2016 Base Layout Without Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Brabham Drive										
1	L	60	21.7	0.349	55.3	LOS D	92	0.84	0.81	25.2
2	T	280	14.6	0.348	47.4	LOS D	92	0.85	0.72	27.5
3	R	152	29.6	0.922	79.4	LOS F	111	0.95	0.90	20.0
Approach		**492**	**20.1**	**0.923**	**58.3**	**LOS E**	**111**	**0.88**	**0.79**	**24.4**
Great Western Hwy East										
4	L	191	17.8	0.132	10.5	LOS A	6	0.06	0.67	57.1
5	T	422	14.7	0.988	113.9	LOS F	133	1.00	1.08	15.4
6	R	162	20.4	0.538	70.5	LOS E	102	0.96	0.82	22.5
Approach		**775**	**16.6**	**0.988**	**79.3**	**LOS F**	**133**	**0.76**	**0.93**	**20.5**
Doonside Road										
7	L	400	11.6	0.999#	47.9	LOS D	101	1.00	0.85	27.4
8	T	777	6.9	0.985	115.9	LOS F	386	1.00	1.31	14.8
9	R	262	17.1	1.000#	69.7	LOS E	109	0.97	0.82	21.9
Approach		**1239**	**9.0**	**1.000**	**112.5**	**LOS F**	**386**	**1.16**	**1.34**	**17.0**
Great Western Hwy West										
10	L	537	8.2	0.334	10.2	LOS A	17	0.08	0.67	57.0
11	T	1215	8.8	0.987	103.5	LOS F	360	0.99	1.15	16.6
12	R	532	12.1	1.000#	59.1	LOS E	258	1.00	0.89	25.3
Approach		**2258**	**9.3**	**1.000**	**72.6**	**LOS F**	**360**	**0.79**	**0.99**	**22.0**
All Vehicles		**4990**	**11.0**	**1.000**	**78.8**	**LOS F**	**386**	**0.85**	**1.00**	**20.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P7	5	61.7	LOS F	0	0.91	0.91
All Peds	**5**	**61.7**	**LOS E**	**0**	**0.91**	**0.91**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node1Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 1 GWH Doonside.aap
Processed Apr 10, 2007 08:58:30AM

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SIDRA INTERSECTION

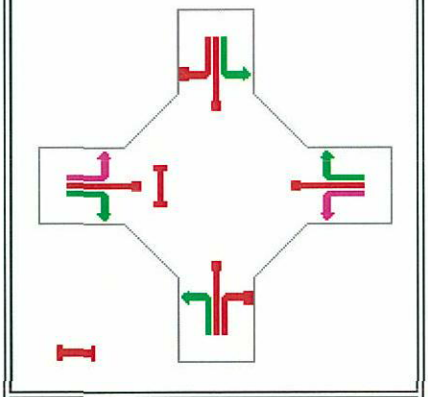
Phasing Summary

Node 1: Great Western Highway Doonside Road - Base

2016 Base Layout Without Development - Scenario 2

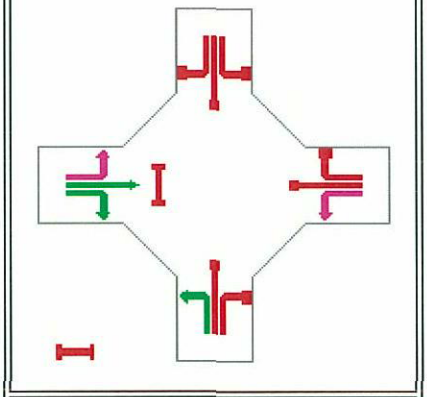
C = **150** seconds
Cycle Time Option: ***Program calculated cycle time***
Phase times determined by the program.

Phase B



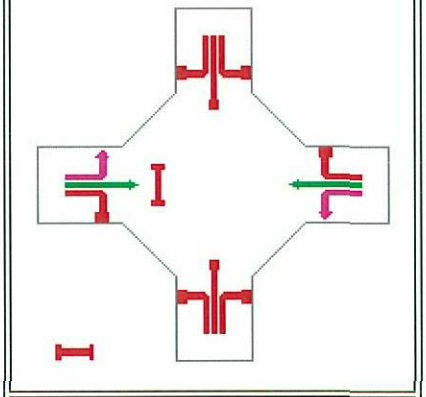
Green Time = **28** seconds
Phase Time = **32** seconds
Phase Split = **21** %

Phase D



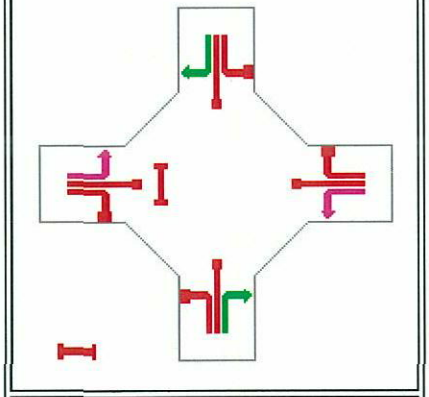
Green Time = **20** seconds
Phase Time = **24** seconds
Phase Split = **16** %

Phase F



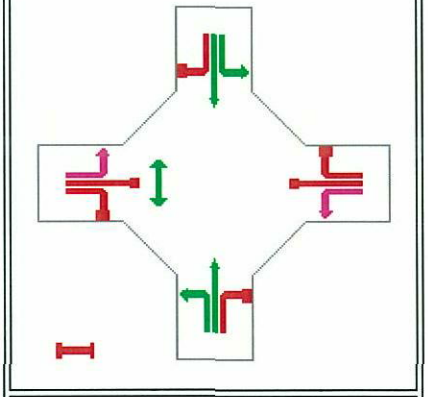
Green Time = **13** seconds
Phase Time = **17** seconds
Phase Split = **11** %

Phase E

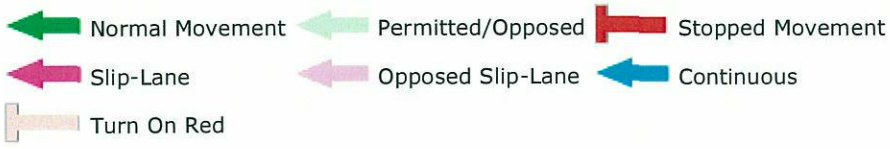


Green Time = **28** seconds
Phase Time = **32** seconds
Phase Split = **21** %

Phase C



Green Time = **41** seconds
Phase Time = **45** seconds
Phase Split = **30** %



SIDRA SOLUTIONS

Site: Node1Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 1 GWH Doonside.aap
Processed Apr 10, 2007 08:58:30AM

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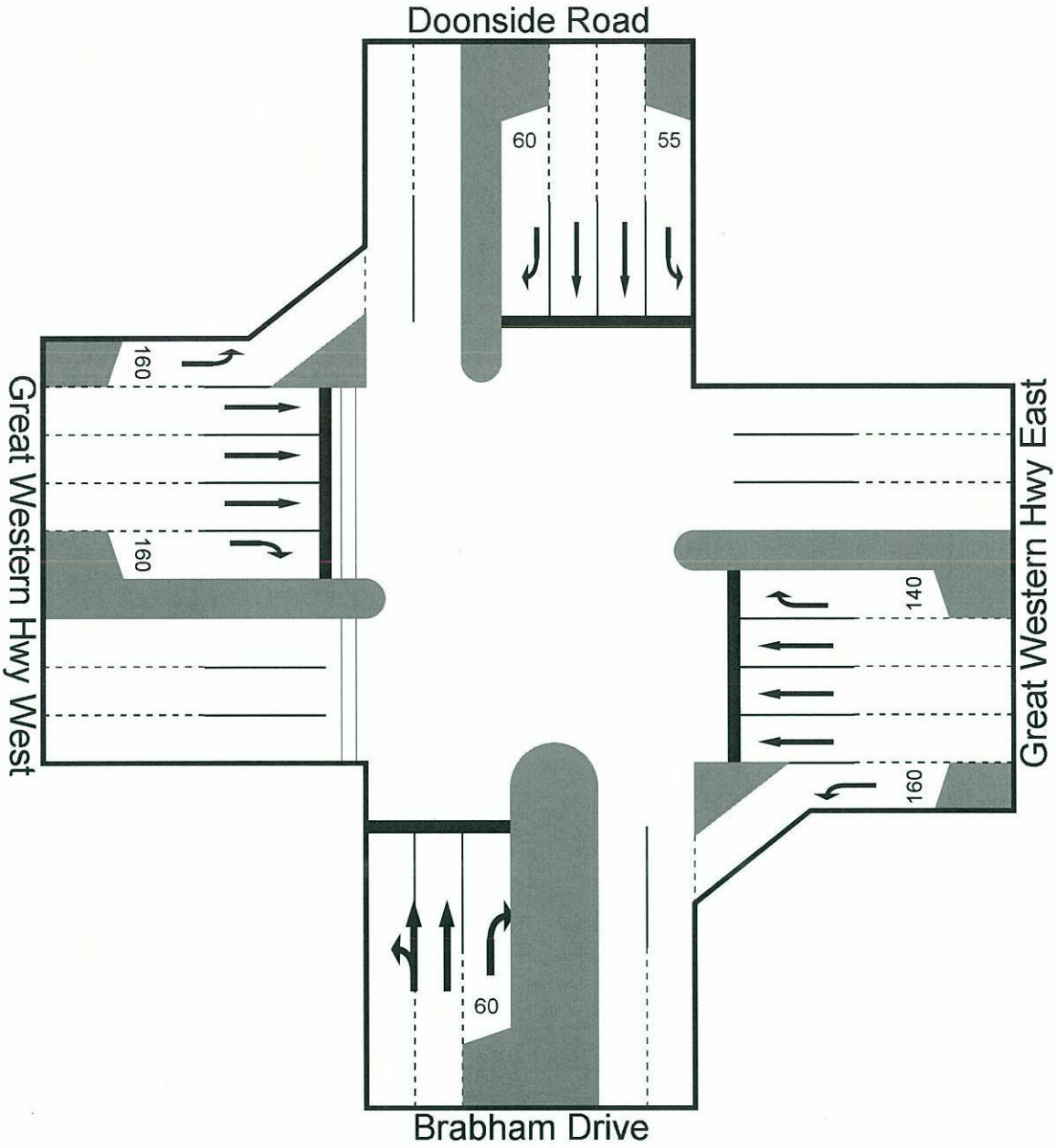
Intersection Summary

Node 1: Great Western Highway & Doonside Road - Development

2016 Base Layout With Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 1: Great Western Highway Doonside Road - Development

2016 Base Layout With Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Brabham Drive										
1	L	60	21.7	0.305	50.2	LOS D	88	0.79	0.80	26.8
2	T	280	14.6	0.304	42.3	LOS C	86	0.80	0.69	29.5
3	R	152	29.6	0.907	79.0	LOS F	111	0.94	0.92	20.1
Approach		**492**	**20.1**	**0.907**	**54.6**	**LOS D**	**111**	**0.84**	**0.77**	**25.4**
Great Western Hwy East										
4	L	191	17.8	0.132	10.5	LOS A	6	0.06	0.67	57.1
5	T	422	14.7	0.988	113.9	LOS F	133	1.00	1.08	15.4
6	R	*180*	*18.3*	*0.870*	*91.6*	*LOS F*	*128*	*1.00*	*0.97*	*18.5*
Approach		**793**	**16.3**	**0.988**	**83.9**	**LOS F**	**133**	**0.77**	**0.96**	**19.6**
Doonside Road										
7	L	501	11.9	1.000#	49.3	LOS D	100	1.00	0.84	26.9
8	T	777	5.8	1.024	157.3	LOS F	541	1.00	1.52	11.5
9	R	347	16.4	1.000#	68.6	LOS E	108	0.98	0.82	22.1
Approach		**1242**	**8.2**	**1.024**	**168.4**	**LOS F**	**541**	**1.30**	**1.74**	**13.6**
Great Western Hwy West										
10	L	552	8.0	0.530	16.1	LOS B	120	0.43	0.76	49.6
11	T	1215	8.6	0.985	102.0	LOS F	367	0.99	1.15	16.8
12	R	532	12.8	1.000#	65.7	LOS E	258	1.00	0.88	23.6
Approach		**2243**	**9.3**	**1.000**	**75.7**	**LOS F**	**367**	**0.88**	**1.03**	**21.5**
All Vehicles		**5209**	**10.3**	**1.024**	**90.7**	**LOS F**	**541**	**0.89**	**1.07**	**18.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P7	5	56.3	LOS E	0	0.87	0.87
All Peds	**5**	**56.3**	**LOS D**	**0**	**0.87**	**0.87**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node1Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 1 GWH Doonside.aap
Processed Aug 06, 2007 01:50:05PM

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SIDRA INTERSECTION

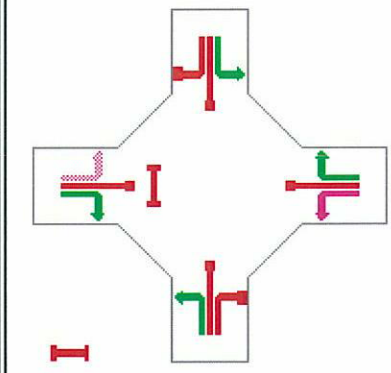
Phasing Summary

Node 1: Great Western Highway Doonside Road - Development

2016 Base Layout With Development - Scenario 2

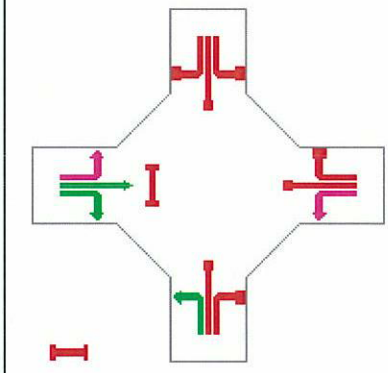
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase B



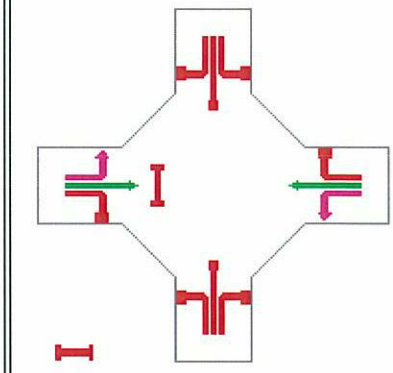
Green Time = **19** seconds
Phase Time = **23** seconds
Phase Split = **15** %

Phase D



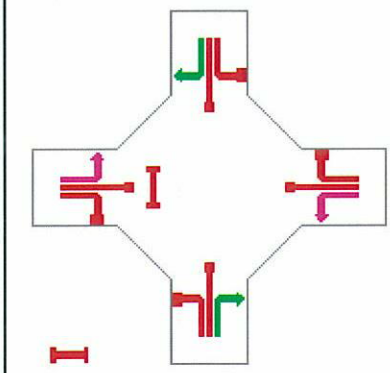
Green Time = **21** seconds
Phase Time = **25** seconds
Phase Split = **17** %

Phase F



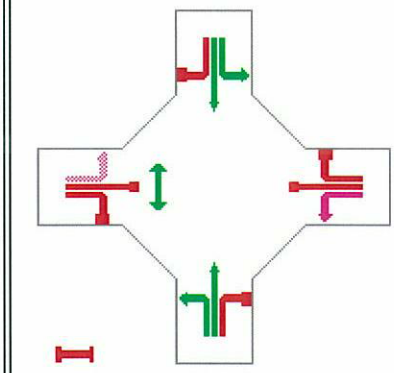
Green Time = **13** seconds
Phase Time = **17** seconds
Phase Split = **11** %

Phase E



Green Time = **30** seconds
Phase Time = **34** seconds
Phase Split = **23** %

Phase C



Green Time = **47** seconds
Phase Time = **51** seconds
Phase Split = **34** %

Normal Movement | Permitted/Opposed | Stopped Movement
Slip-Lane | Opposed Slip-Lane | Continuous
Turn On Red

SIDRA SOLUTIONS

Site: Node1Design
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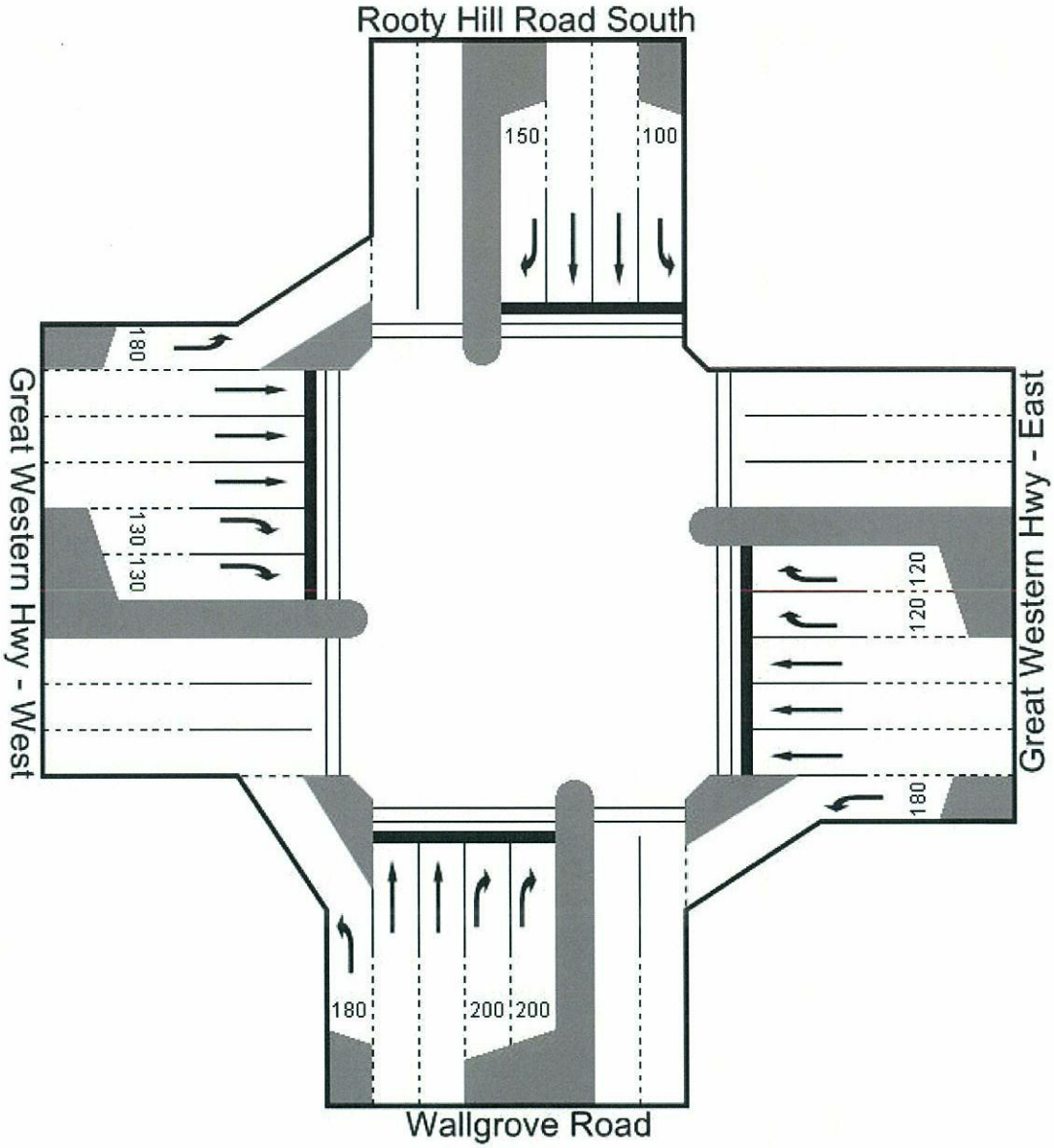
Intersection Summary

Node 2: Great Western Highway & Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 2: Great Western Highway Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Wallgrove Road										
1	L	306	7.2	0.180	10.1	LOS B	8	0.06	0.67	57.1
2	T	423	4.5	0.548	60.8	LOS E	108	0.91	0.78	24.5
3	R	845	11.5	0.749	45.4	LOS D	176	0.95	0.89	30.0
Approach		**1574**	**8.8**	**0.749**	**42.7**	**LOS D**	**176**	**0.77**	**0.82**	**31.1**
Great Western Hwy - East										
4	L	249	35.7	0.179	11.1	LOS B	8	0.06	0.66	57.1
5	T	481	11.4	0.570	67.0	LOS E	94	0.95	0.79	23.0
6	R	100	1.0	0.364	45.1	LOS D	24	0.90	0.75	29.9
Approach		**830**	**17.5**	**0.570**	**47.6**	**LOS D**	**94**	**0.68**	**0.75**	**29.0**
Rooty Hill Road South										
7	L	255	4.7	0.702	59.6	LOS E	116	0.84	0.82	23.9
8	T	565	5.0	0.740	62.9	LOS E	146	0.97	0.84	23.0
9	R	134	2.2	0.219	29.9	LOS C	47	0.69	0.76	35.6
Approach		**954**	**4.5**	**0.740**	**57.4**	**LOS E**	**146**	**0.90**	**0.83**	**24.5**
Great Western Hwy - West										
10	L	61	1.6	0.035	9.9	LOS A	1	0.05	0.67	57.2
11	T	1481	10.5	0.743	44.5	LOS D	220	0.87	0.80	30.1
12	R	668	9.6	0.695	44.3	LOS D	139	0.91	0.84	30.5
Approach		**2210**	**10.0**	**0.743**	**43.5**	**LOS D**	**220**	**0.86**	**0.81**	**30.6**
All Vehicles		**5568**	**9.8**	**0.749**	**46.2**	**LOS D**	**220**	**0.81**	**0.80**	**29.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	66.3	LOS F	0	0.94	0.94
P5	5	41.8	LOS E	0	0.75	0.75

P7	5	68.2	LOS F	0	0.95	0.95
All Peds	**20**	**61.3**	**LOS F**	**0**	**0.90**	**0.90**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node2Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 2 GWH Rooty.aap
Processed May 30, 2007 09:17:23AM

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SIDRA INTERSECTION

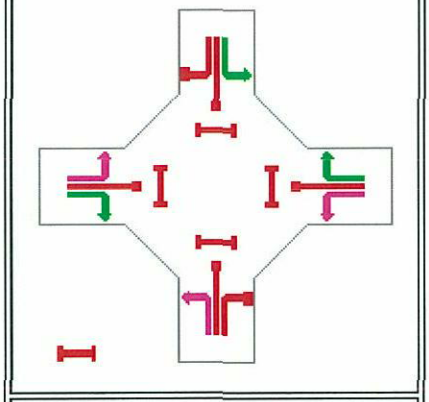
Phasing Summary

Node 2: Great Western Highway Rooty Hill Rd South - Base

2016 Base Layout Without Development - Scenario 2

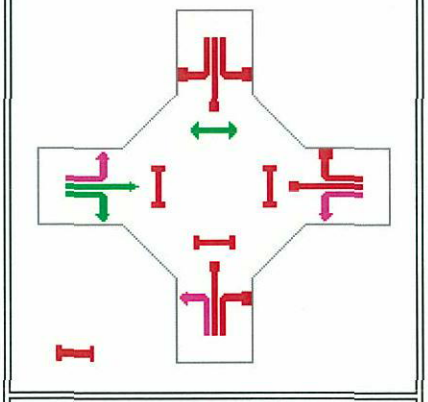
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase C



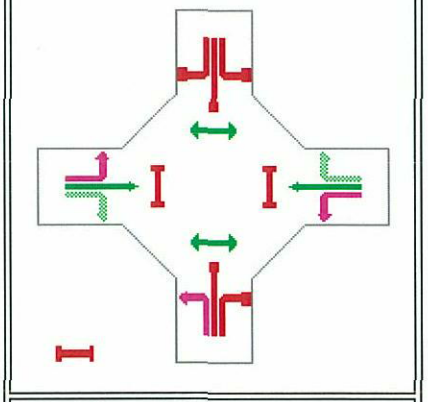
Green Time = **6** seconds
Phase Time = **10** seconds
Phase Split = **7** %

Phase G2



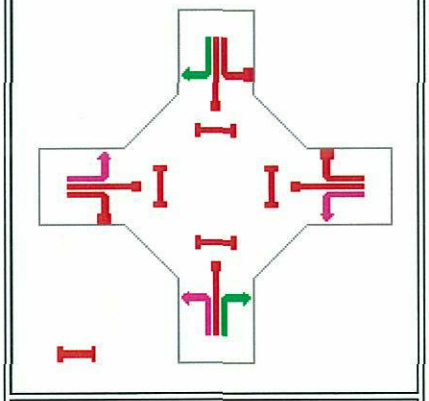
Green Time = **27** seconds
Phase Time = **31** seconds
Phase Split = **21** %

Phase A



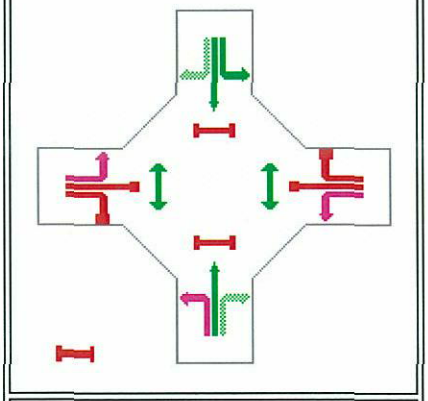
Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase E



Green Time = **44** seconds
Phase Time = **48** seconds
Phase Split = **32** %

Phase D



Green Time = **30** seconds
Phase Time = **34** seconds
Phase Split = **23** %

Normal Movement Permitted/Opposed Stopped Movement
Slip-Lane Opposed Slip-Lane Continuous
Turn On Red

SIDRA SOLUTIONS

Site: Node2Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 2 GWH Rooty.aap
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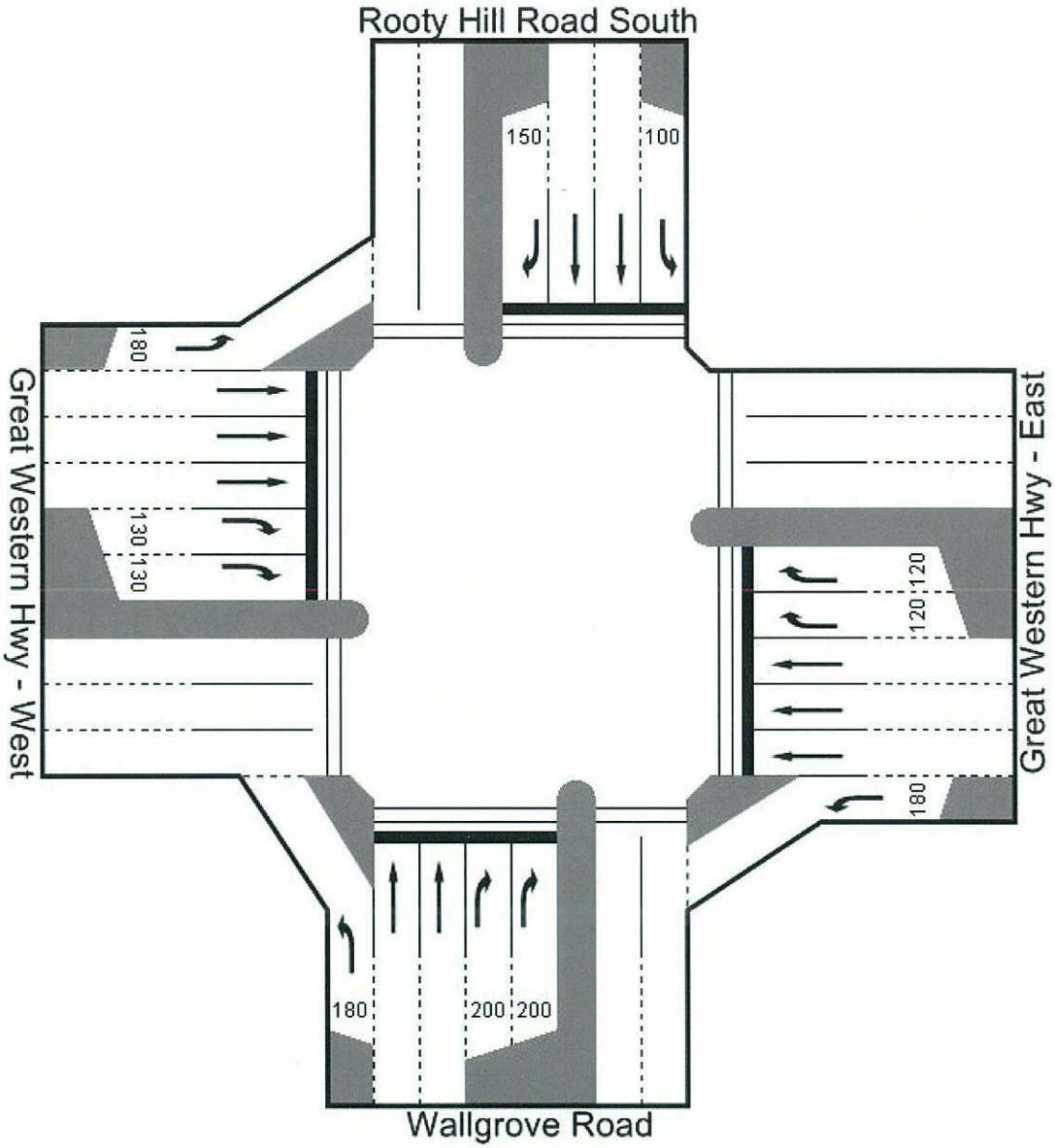
Intersection Summary

Node 2: Great Western Highway & Rooty Hill Rd South - Development

2016 Layout With Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 2: Great Western Highway Rooty Hill Rd South - Development

2016 Layout With Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Wallgrove Road										
1	L	306	7.2	0.179	10.1	LOS A	8	0.06	0.67	57.1
2	T	436	4.4	0.513	58.0	LOS E	108	0.88	0.76	25.4
3	R	855	11.3	0.770	47.4	LOS D	182	0.96	0.90	29.2
Approach		**1597**	**8.6**	**0.770**	**43.2**	**LOS D**	**182**	**0.77**	**0.82**	**30.9**
Great Western Hwy - East										
4	L	305	29.2	0.211	10.9	LOS A	10	0.07	0.66	57.1
5	T	489	11.2	0.579	67.1	LOS E	96	0.95	0.79	22.9
6	R	*100*	*1.0*	*0.370*	*46.8*	*LOS D*	24	*0.91*	*0.75*	29.3
Approach		**894**	**16.2**	**0.579**	**45.6**	**LOS D**	**96**	**0.65**	**0.74**	**29.8**
Rooty Hill Road South										
7	L	255	4.7	0.677	56.4	LOS D	111	0.80	0.81	24.7
8	T	637	4.4	0.756	61.2	LOS E	160	0.97	0.85	23.5
9	R	134	2.2	0.216	28.8	LOS C	46	0.68	0.76	36.2
Approach		**1026**	**4.2**	**0.756**	**55.8**	**LOS D**	**160**	**0.89**	**0.83**	**24.9**
Great Western Hwy - West										
10	L	61	1.6	0.035	9.9	LOS A	1	0.05	0.67	57.2
11	T	1482	10.5	0.772	46.9	LOS D	228	0.90	0.82	29.1
12	R	668	9.6	0.679	46.0	LOS D	142	0.93	0.85	29.8
Approach		**2211**	**10.0**	**0.772**	**45.6**	**LOS D**	**228**	**0.89**	**0.83**	**29.7**
All Vehicles		**5728**	**9.5**	**0.772**	**46.7**	**LOS D**	**228**	**0.82**	**0.81**	**29.0**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	63.5	LOS F	0	0.92	0.92
P5	5	43.3	LOS E	0	0.76	0.76

P7	5	65.3	LOS F	0	0.93	0.93
All Peds	**20**	**60.3**	**LOS E**	**0**	**0.89**	**0.89**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node2Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 2 GWH Rooty.aap
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SIDRA INTERSECTION

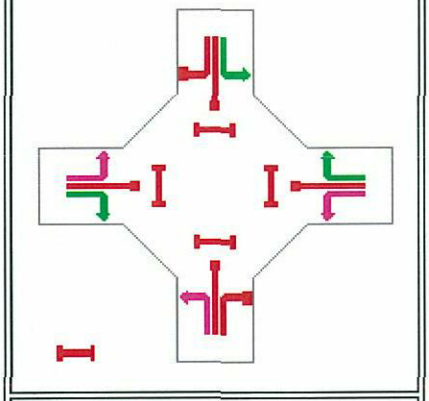
Phasing Summary

Node 2: Great Western Highway Rooty Hill Rd South - Development

2016 Layout With Development - Scenario 2

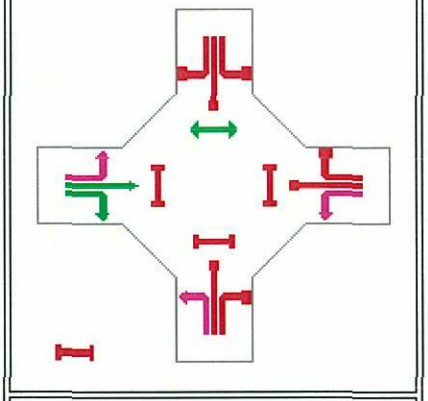
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase C



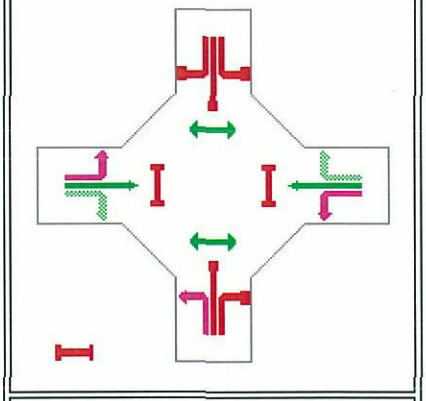
Green Time = **6** seconds
Phase Time = **10** seconds
Phase Split = **7** %

Phase G2



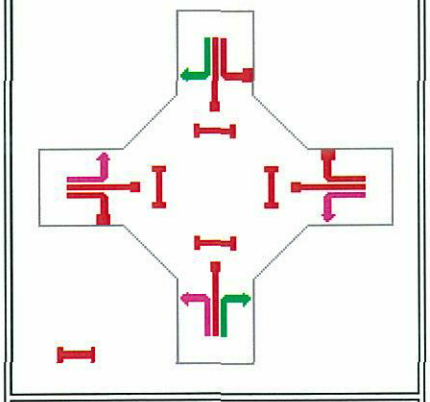
Green Time = **25** seconds
Phase Time = **29** seconds
Phase Split = **19** %

Phase A



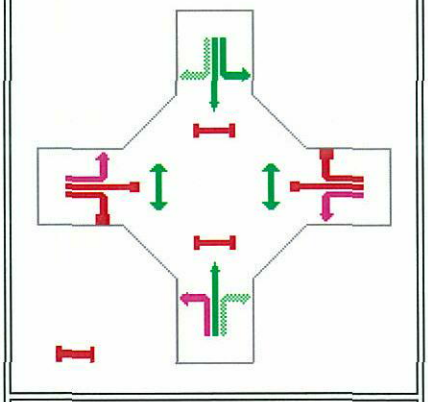
Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase E

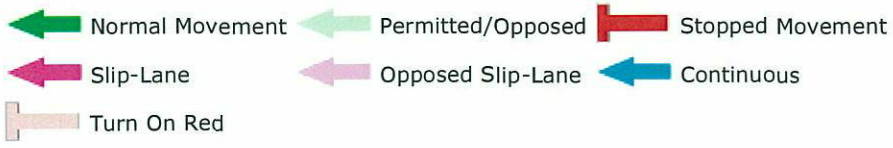


Green Time = **43** seconds
Phase Time = **47** seconds
Phase Split = **31** %

Phase D



Green Time = **33** seconds
Phase Time = **37** seconds
Phase Split = **25** %



SIDRA SOLUTIONS

Site: Node2Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 2 GWH Rooty.aap
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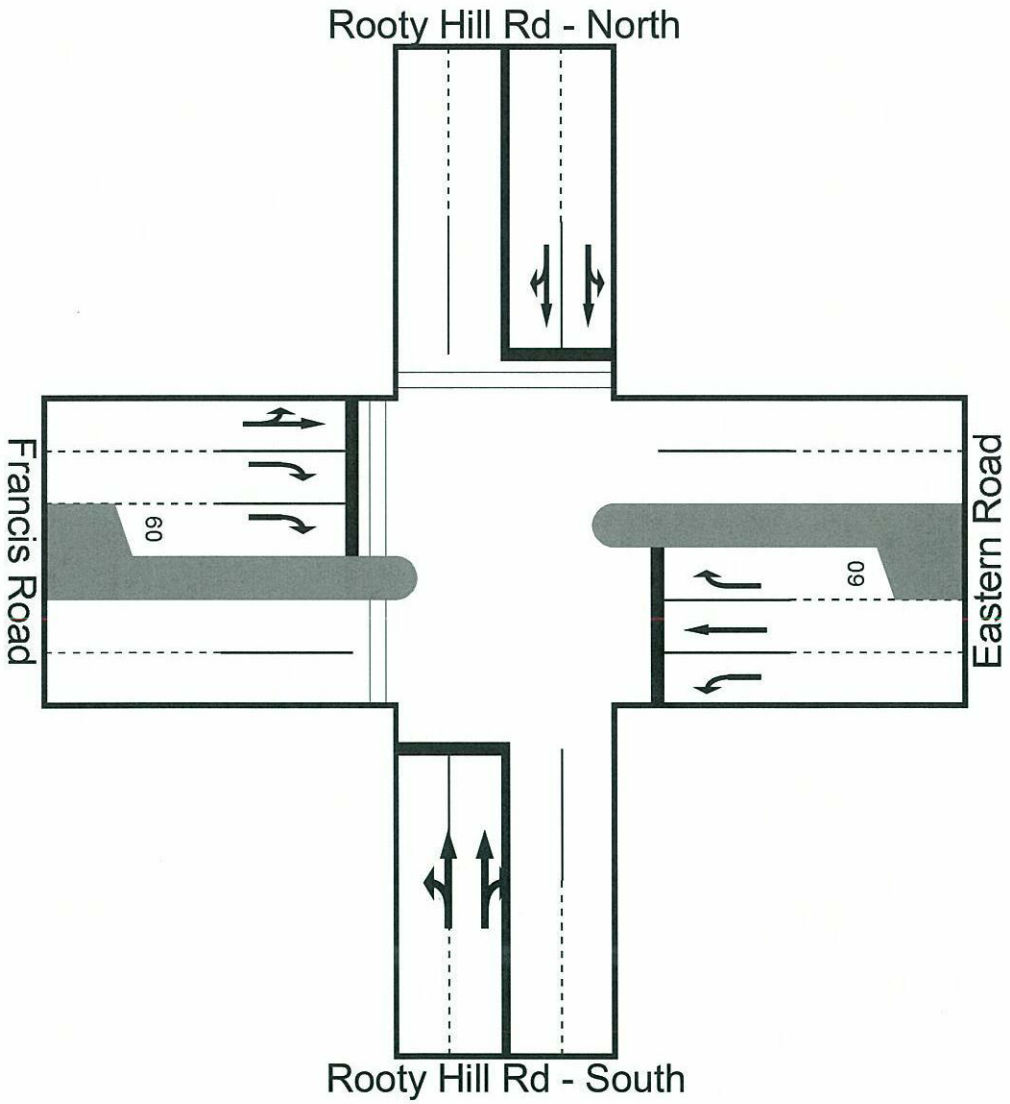
Intersection Summary

Node 3: Rooty Hill Rd & Eastern Rd - Base

2016 Existing Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 3: Rooty Hill Rd Eastern Rd - Base

2016 Existing Layout Without Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Rooty Hill Rd - South										
1	L	376	2.1	0.612	35.7	LOS C	119	0.73	0.90	32.3
2	T	72	5.6	0.612	27.7	LOS B	119	0.73	0.74	36.7
3	R	351	2.6	0.691	60.7	LOS E	167	0.95	0.86	23.6
Approach		**799**	**2.6**	**0.691**	**46.0**	**LOS D**	**167**	**0.83**	**0.87**	**28.1**
Eastern Road										
4	L	254	5.5	0.617	65.4	LOS E	126	0.92	0.83	21.4
5	T	270	3.7	0.638	57.2	LOS E	131	0.92	0.78	23.3
6	R	53	3.8	0.281	71.5	LOS F	35	0.93	0.75	20.2
Approach		**577**	**4.5**	**0.638**	**62.1**	**LOS E**	**131**	**0.92**	**0.80**	**22.2**
Rooty Hill Rd - North										
7	L	173	1.2	0.634	42.4	LOS C	68	0.95	0.81	27.7
8	T	108	1.9	0.634	68.8	LOS E	68	0.99	0.79	20.8
9	R	6	0.0	0.636	83.0	LOS F	63	1.00	0.80	18.3
Approach		**287**	**1.4**	**0.634**	**53.1**	**LOS D**	**68**	**0.97**	**0.80**	**24.4**
Francis Road										
10	L	4	0.0	0.667	42.9	LOS D	190	0.77	0.84	27.5
11	T	502	3.8	0.651	34.7	LOS C	190	0.77	0.68	30.7
12	R	591	3.6	0.687	35.1	LOS C	116	0.91	0.83	30.6
Approach		**1097**	**3.6**	**0.687**	**34.9**	**LOS C**	**190**	**0.85**	**0.76**	**30.6**
All Vehicles		**2760**	**3.3**	**0.691**	**45.7**	**LOS D**	**190**	**0.87**	**0.81**	**27.0**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	10	32.0	LOS D	0	0.65	0.65
P7	10	49.6	LOS E	0	0.81	0.81
All Peds	**20**	**40.8**	**LOS C**	**0**	**0.73**	**0.73**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node3Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 3 Eastern Rooty.aap
Processed Apr 10, 2007 09:02:43AM

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SIDRA INTERSECTION

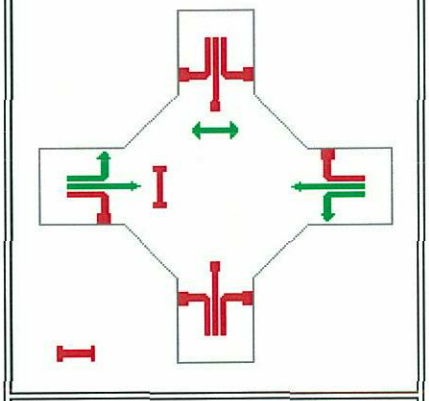
Phasing Summary

Node 3: Rooty Hill Rd Eastern Rd - Base

2016 Existing Layout Without Development - Scenario 2

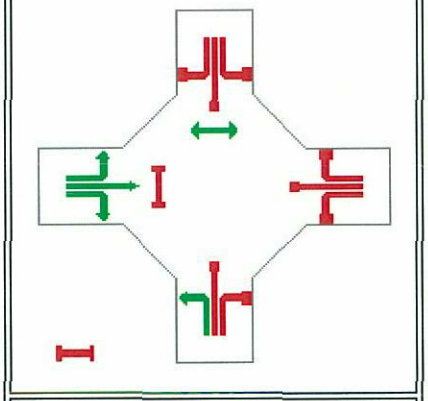
C = **150** seconds
Cycle Time Option: ***User-specified cycle time***
Phase times determined by the program.

Phase A



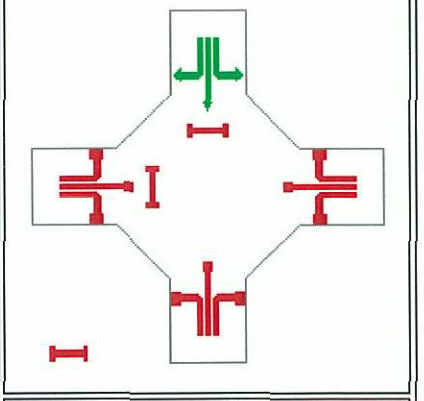
Green Time = **33** seconds
Phase Time = **37** seconds
Phase Split = **25** %

Phase C



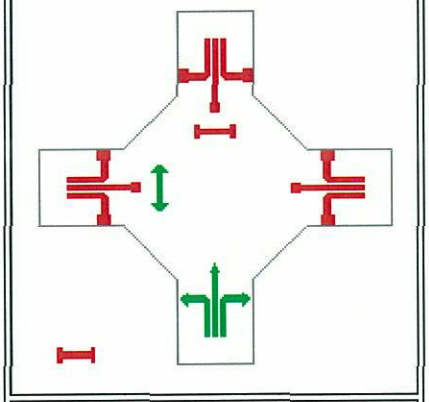
Green Time = **23** seconds
Phase Time = **27** seconds
Phase Split = **18** %

Phase D



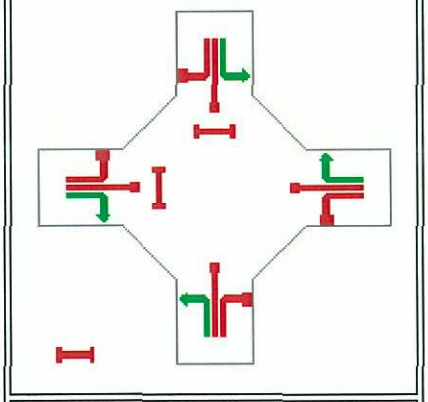
Green Time = **12** seconds
Phase Time = **16** seconds
Phase Split = **11** %

Phase E



Green Time = **42** seconds
Phase Time = **46** seconds
Phase Split = **31** %

Phase F



Green Time = **20** seconds
Phase Time = **24** seconds
Phase Split = **16** %

Normal Movement
Permitted/Opposed
Stopped Movement
Slip-Lane
Opposed Slip-Lane
Continuous
Turn On Red

SIDRA SOLUTIONS

Site: Node3Base
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 3 Eastern Rooty.aap
Processed Apr 10, 2007 09:02:43AM

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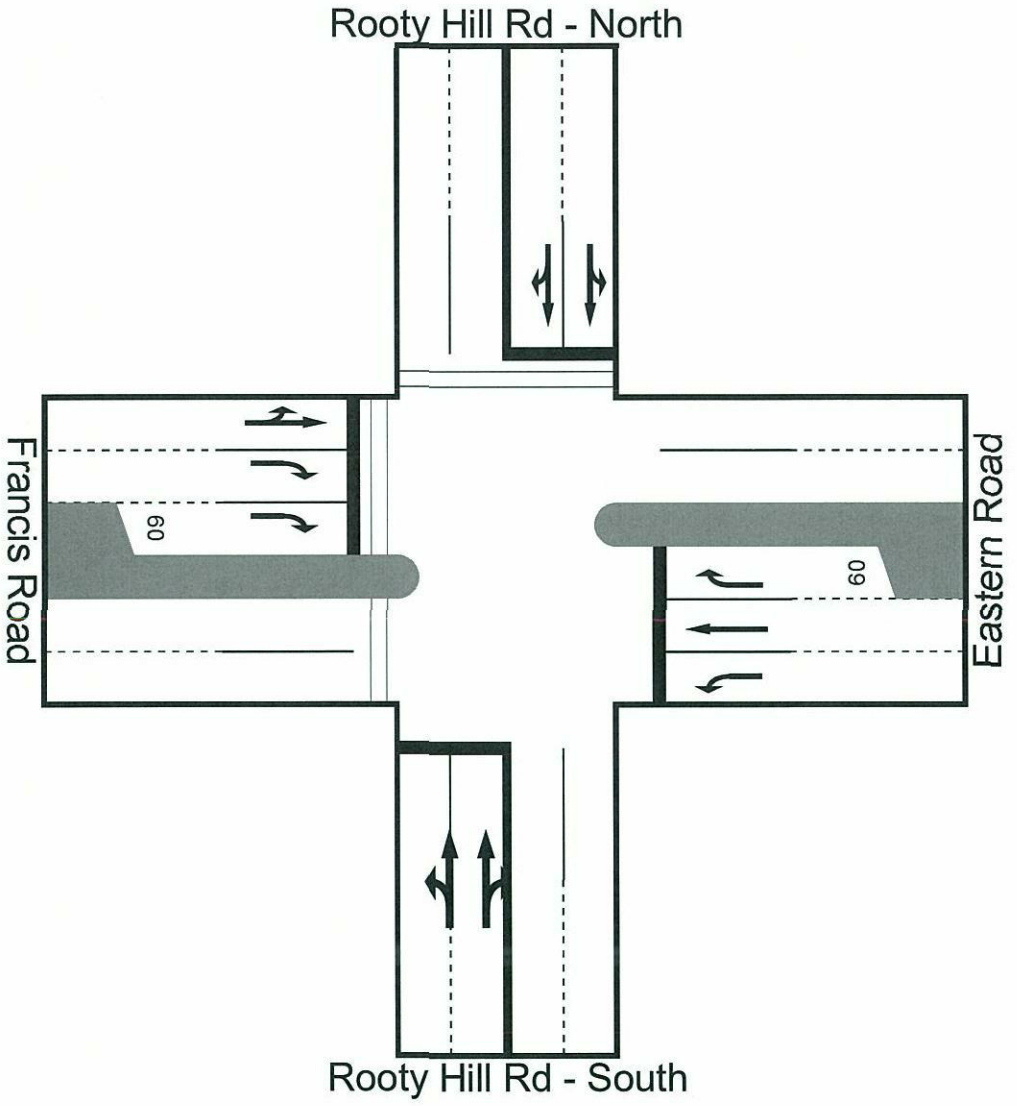
Intersection Summary

Node 3: Rooty Hill Rd & Eastern Rd - Development

2016 Layout With Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 3: Rooty Hill Rd Eastern Rd - Development

2016 Layout With Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Rooty Hill Rd - South										
1	L	376	2.1	0.621	39.3	LOS C	127	0.75	0.92	30.6
2	T	72	5.6	0.621	31.3	LOS C	127	0.75	0.78	34.5
3	R	364	2.5	0.716	61.2	LOS E	173	0.96	0.86	23.5
Approach		**812**	**2.6**	**0.716**	**48.4**	**LOS D**	**173**	**0.84**	**0.88**	**27.2**
Eastern Road										
4	L	326	4.3	0.721	64.8	LOS E	157	0.94	0.85	21.6
5	T	277	3.6	0.600	54.4	LOS D	130	0.90	0.76	24.0
6	R	53	3.8	0.271	67.2	LOS E	34	0.90	0.75	21.1
Approach		**656**	**4.0**	**0.720**	**60.6**	**LOS E**	**157**	**0.92**	**0.80**	**22.5**
Rooty Hill Rd - North										
7	L	173	1.2	0.621	41.8	LOS C	67	0.95	0.81	27.9
8	T	108	1.9	0.621	67.8	LOS E	67	0.99	0.79	21.0
9	R	6	0.0	0.620	82.8	LOS F	61	1.00	0.79	18.4
Approach		**287**	**1.4**	**0.621**	**52.4**	**LOS D**	**67**	**0.96**	**0.80**	**24.6**
Francis Road										
10	L	4	0.0	0.714	47.3	LOS D	204	0.83	0.85	26.0
11	T	503	3.8	0.699	39.1	LOS C	204	0.83	0.74	28.9
12	R	591	3.6	0.716	36.5	LOS C	111	0.94	0.84	30.0
Approach		**1098**	**3.6**	**0.716**	**37.7**	**LOS C**	**204**	**0.89**	**0.79**	**29.5**
All Vehicles		**2853**	**3.2**	**0.721**	**47.5**	**LOS D**	**204**	**0.89**	**0.82**	**26.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	10	34.7	LOS D	0	0.68	0.68
P7	10	49.6	LOS E	0	0.81	0.81
All Peds	**20**	**42.1**	**LOS C**	**0**	**0.75**	**0.75**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node3Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 3 Eastern Rooty.aap
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SIDRA INTERSECTION

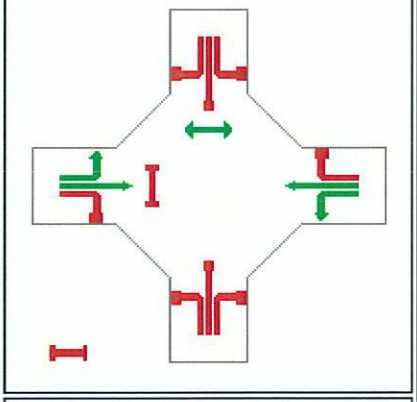
Phasing Summary

Node 3: Rooty Hill Rd Eastern Rd - Development

2016 Layout With Development - Scenario 2

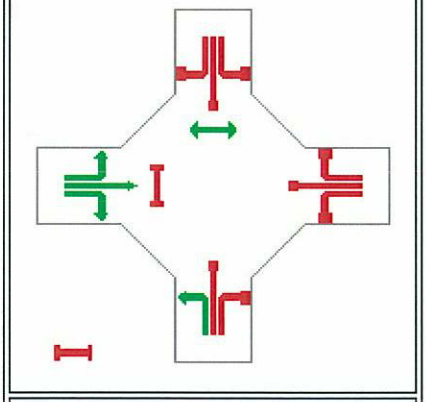
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase A



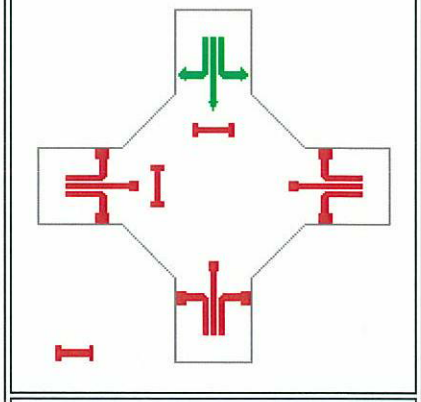
Green Time = **36** seconds
Phase Time = **40** seconds
Phase Split = **27** %

Phase C



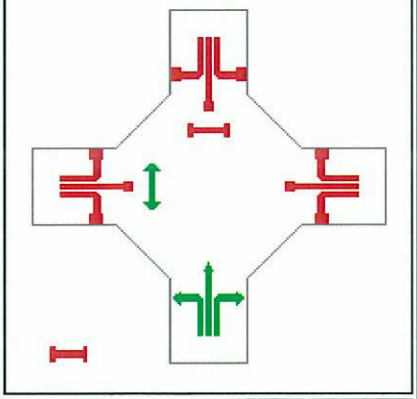
Green Time = **16** seconds
Phase Time = **20** seconds
Phase Split = **13** %

Phase D



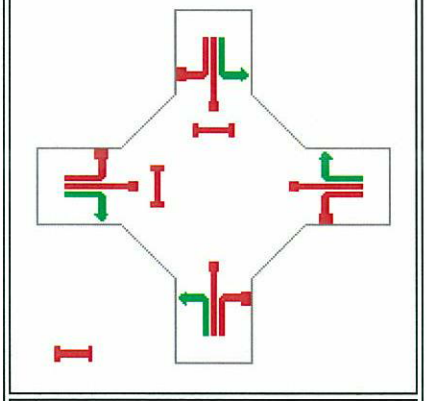
Green Time = **12** seconds
Phase Time = **16** seconds
Phase Split = **11** %

Phase E

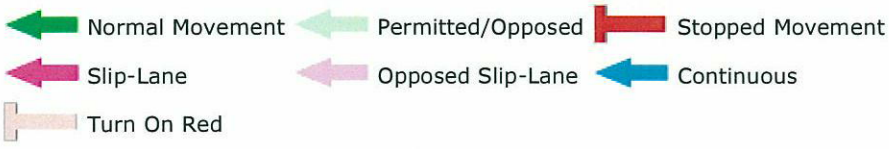


Green Time = **42** seconds
Phase Time = **46** seconds
Phase Split = **31** %

Phase F



Green Time = **24** seconds
Phase Time = **28** seconds
Phase Split = **19** %



SIDRA SOLUTIONS

Site: Node3Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 3 Eastern Rooty.aap
Processed Aug 06, 2007 03:58:54PM

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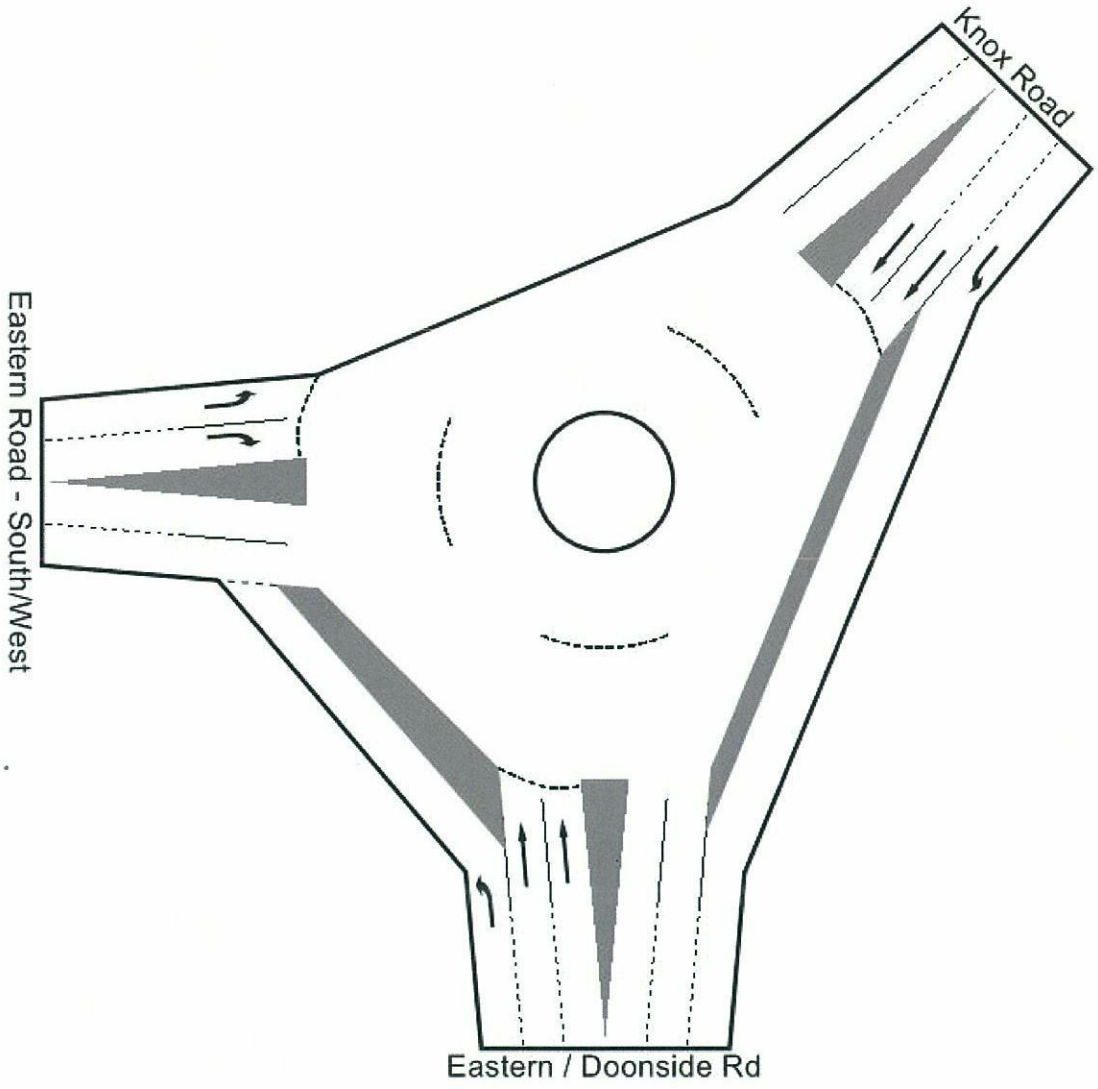
Intersection Summary

Node 4: Eastern Road & Knox Road - Base

2016 Base Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 4: Eastern Road Knox Road - Base

2016 Base Layout Without Development - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Eastern / Doonside Rd										
1	L	290	2.8	0.292	7.8	LOS A	15	0.55	0.66	48.0
2	T	563	9.2	0.292	12.0	LOS A	16	0.55	0.75	45.1
Approach		**853**	**7.0**	**0.292**	**10.6**	**LOS A**	**16**	**0.55**	**0.72**	**46.0**
Knox Road										
24	L	1656	4.2	0.849	5.8	LOS F#	29#	0.00	0.46	51.8
25	T	355	3.1	0.235	13.7	LOS A	14	0.74	0.82	44.1
Approach		**2011**	**4.0**	**0.849**	**7.2**	**LOS A**	**14**	**0.13**	**0.53**	**50.2**
Eastern Road - South/West										
10	L	437	6.6	0.562	10.2	LOS A	36	0.75	0.92	47.0
12	R	621	4.0	0.665	16.1	LOS B	50	0.79	1.01	42.4
Approach		**1058**	**5.1**	**0.665**	**13.7**	**LOS A**	**50**	**0.78**	**0.98**	**44.1**
All Vehicles		**3922**	**5.0**	**0.849**	**9.7**	**LOS A**	**50**	**0.40**	**0.69**	**47.5**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
 # - Density for continuous movement

SIDRA SOLUTIONS

Site: Node4Base
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Processed Apr 10, 2007 09:18:08AM

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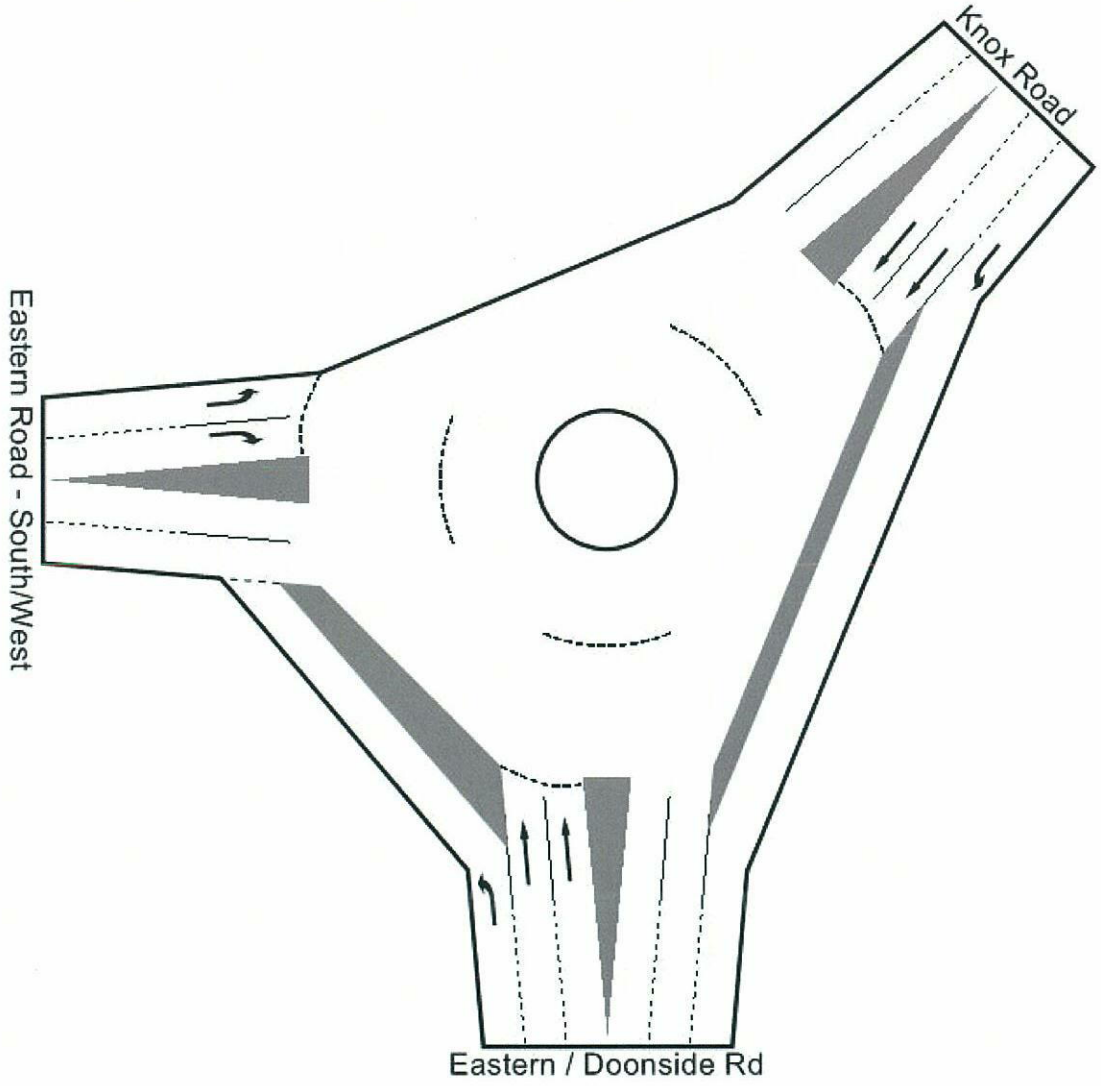
Intersection Summary

Node 4: Eastern Road & Knox Road - Development

2016 Layout With Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 4: Eastern Road Knox Road - Development

2016 Layout With Development - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Eastern / Doonside Rd										
1	L	370	2.2	0.370	7.8	LOS A	20	0.58	0.67	47.8
2	T	605	8.6	0.312	12.0	LOS A	17	0.56	0.76	45.0
Approach		**975**	**6.2**	**0.370**	**10.4**	**LOS A**	**20**	**0.57**	**0.73**	**46.0**
Knox Road										
24	L	1664	4.2	0.853	5.8	LOS F#	29#	0.00	0.46	51.8
25	T	355	3.1	0.241	13.8	LOS A	15	0.76	0.83	44.0
Approach		**2019**	**4.0**	**0.853**	**7.2**	**LOS A**	**15**	**0.13**	**0.53**	**50.2**
Eastern Road - South/West										
10	L	437	6.6	0.581	10.8	LOS A	37	0.77	0.95	46.5
12	R	636	3.9	0.697	16.7	LOS B	55	0.82	1.05	41.9
Approach		**1073**	**5.0**	**0.697**	**14.3**	**LOS A**	**55**	**0.80**	**1.01**	**43.6**
All Vehicles		**4067**	**4.8**	**0.853**	**9.9**	**LOS A**	**55**	**0.41**	**0.70**	**47.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Node4Design
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 4 Eastern Knox.aap
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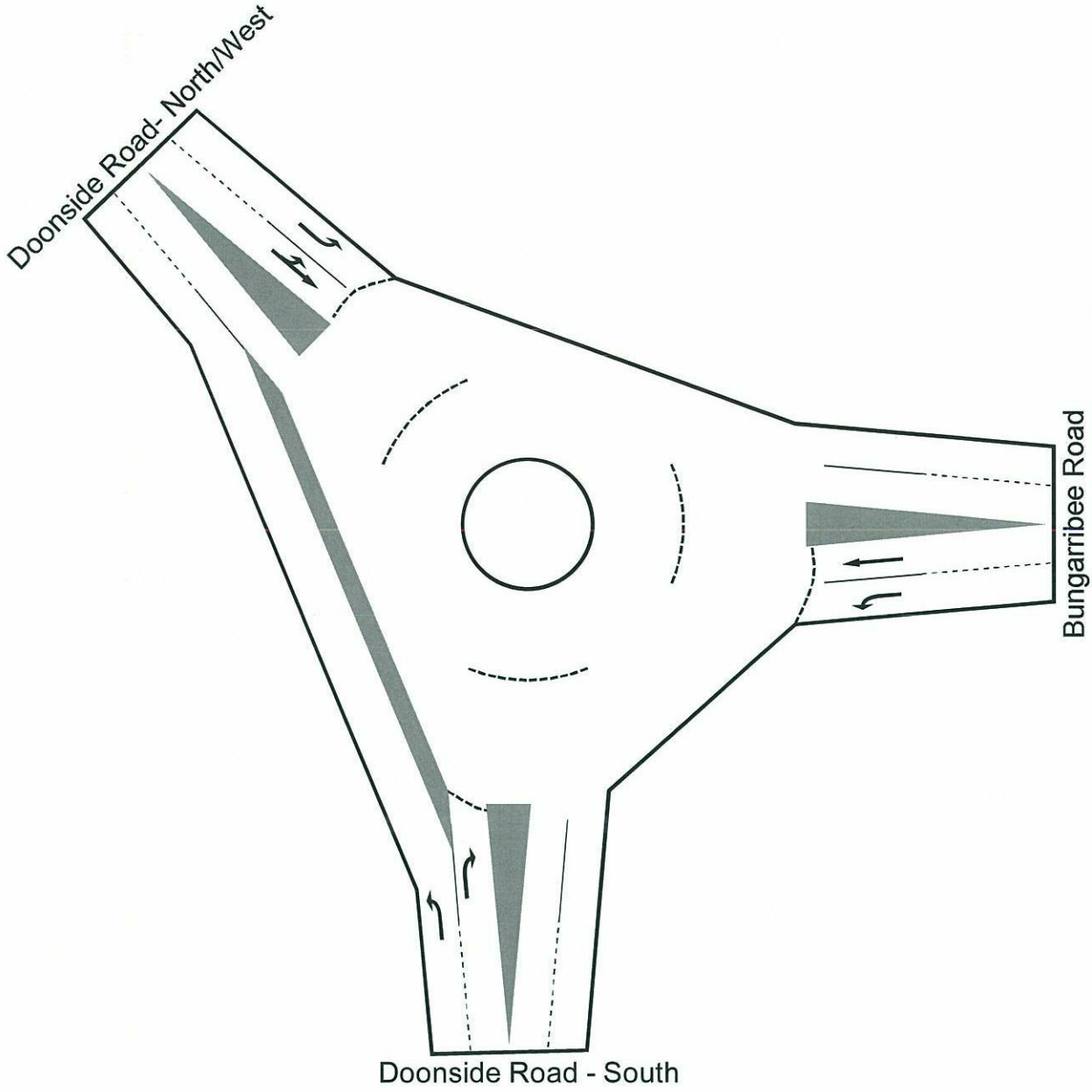
Intersection Summary

Node 5: Doonside Road & Bungarribee Road - Base

2016 Base layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 5: Doonside Road Bungarribee Road - Base

2016 Base layout Without Development - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road - South										
1	L	409	8.8	0.210	5.5	LOS B#	7#	0.00	0.46	52.4
3	R	295	4.7	0.359	14.0	LOS B	22	0.68	0.79	43.8
Approach		**704**	**7.1**	**0.359**	**9.1**	**LOS A**	**22**	**0.29**	**0.60**	**48.3**
Bungarribee Road										
4	L	248	1.6	0.827	52.3	LOS D	87	1.00	1.36	24.7
5	T	468	3.8	1.170	370.0	LOS F	764	1.00	4.80	5.6
Approach		**716**	**3.1**	**1.169**	**260.0**	**LOS F**	**764**	**1.00**	**3.61**	**7.6**
Doonside Road- North/West										
27	L	898	2.6	0.831	11.4	LOS B	116	0.96	0.92	45.8
28	T	1102	3.8	0.883	18.1	LOS B	153	1.00	0.95	40.9
Approach		**2000**	**3.2**	**0.883**	**15.1**	**LOS B**	**153**	**0.98**	**0.94**	**42.9**
All Vehicles		**3420**	**4.0**	**1.170**	**65.1**	**LOS E**	**764**	**0.84**	**1.43**	**22.0**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
 # - Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 5 Doonside_Bungarribee.aap
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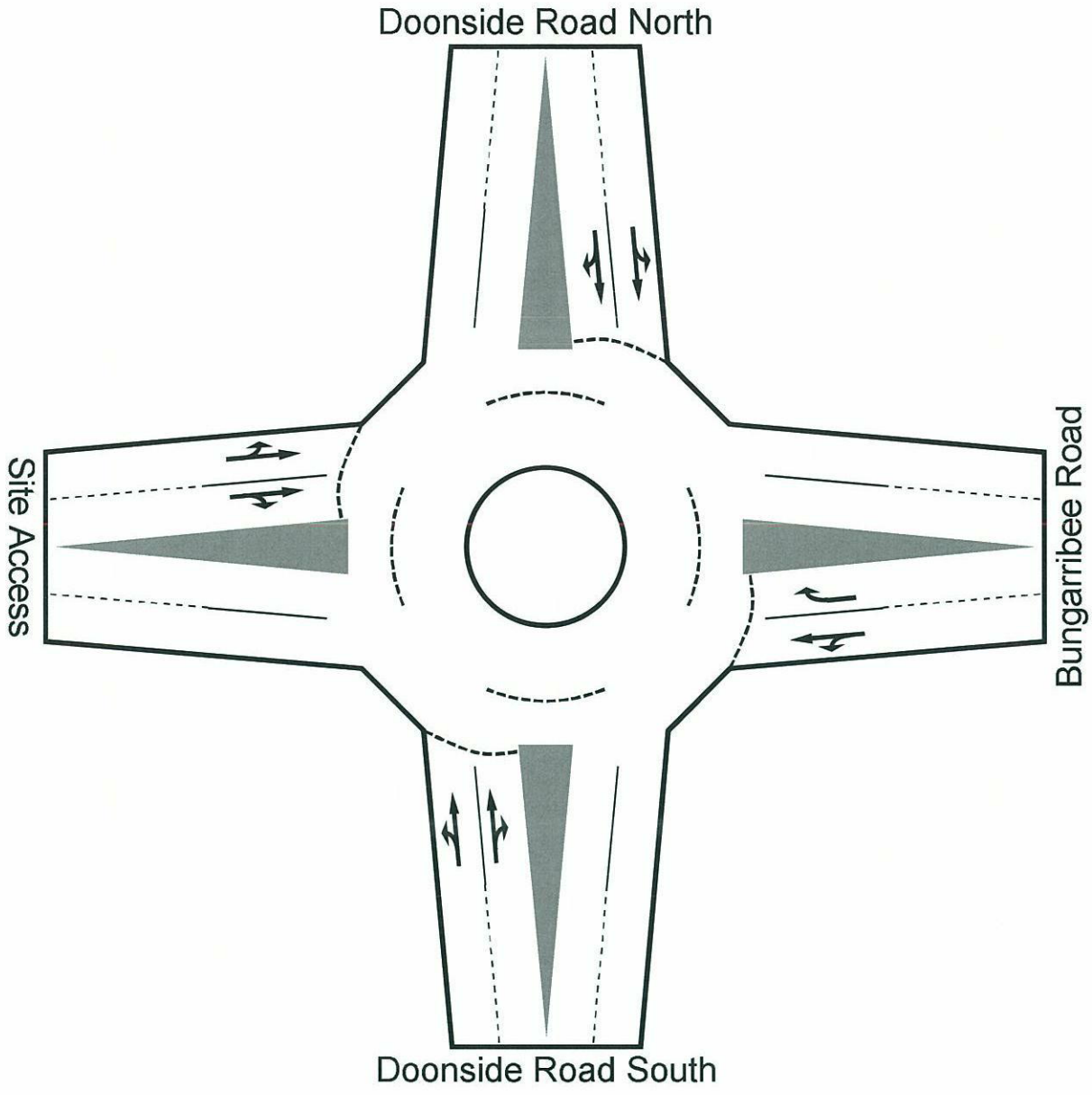
Intersection Summary

Node 5: Doonside Road & Bungarribee Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 5: Doonside Road Bungarribee Road - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road South										
1	L	3	0.0	0.429	9.1	LOS A	28	0.73	0.77	46.8
2	T	413	8.7	0.421	7.8	LOS A	28	0.73	0.68	47.7
3	R	320	4.4	0.422	14.2	LOS A	26	0.74	0.83	43.6
Approach		**736**	**6.8**	**0.421**	**10.6**	**LOS A**	**28**	**0.74**	**0.74**	**45.7**
Bungarribee Road										
4	L	252	1.6	0.589	16.9	LOS B	39	0.95	1.07	41.0
5	T	4	0.0	0.571	16.2	LOS B	39	0.95	1.07	41.6
6	R	468	3.8	0.796	28.0	LOS B	81	1.00	1.26	35.1
Approach		**724**	**3.0**	**0.796**	**24.0**	**LOS B**	**81**	**0.98**	**1.20**	**36.9**
Doonside Road North										
7	L	898	2.6	0.896	14.9	LOS B	153	1.00	1.06	42.6
8	T	1124	4.1	0.896	15.1	LOS B	153	1.00	1.11	42.6
9	R	11	0.0	0.917	22.1	LOS B	152	1.00	1.12	38.3
Approach		**2033**	**3.4**	**0.896**	**15.1**	**LOS B**	**153**	**1.00**	**1.09**	**42.6**
Site Access										
10	L	61	0.0	0.080	9.2	LOS A	4	0.73	0.77	47.2
11	T	25	0.0	0.076	9.0	LOS A	3	0.73	0.78	48.0
12	R	19	0.0	0.075	15.8	LOS B	3	0.73	0.86	42.8
Approach		**105**	**0.0**	**0.080**	**10.4**	**LOS A**	**4**	**0.73**	**0.79**	**46.5**
All Vehicles		**3598**	**3.9**	**0.917**	**15.8**	**LOS B**	**153**	**0.93**	**1.03**	**41.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development roundabout
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 5 Doonside_Bungarribee.aap
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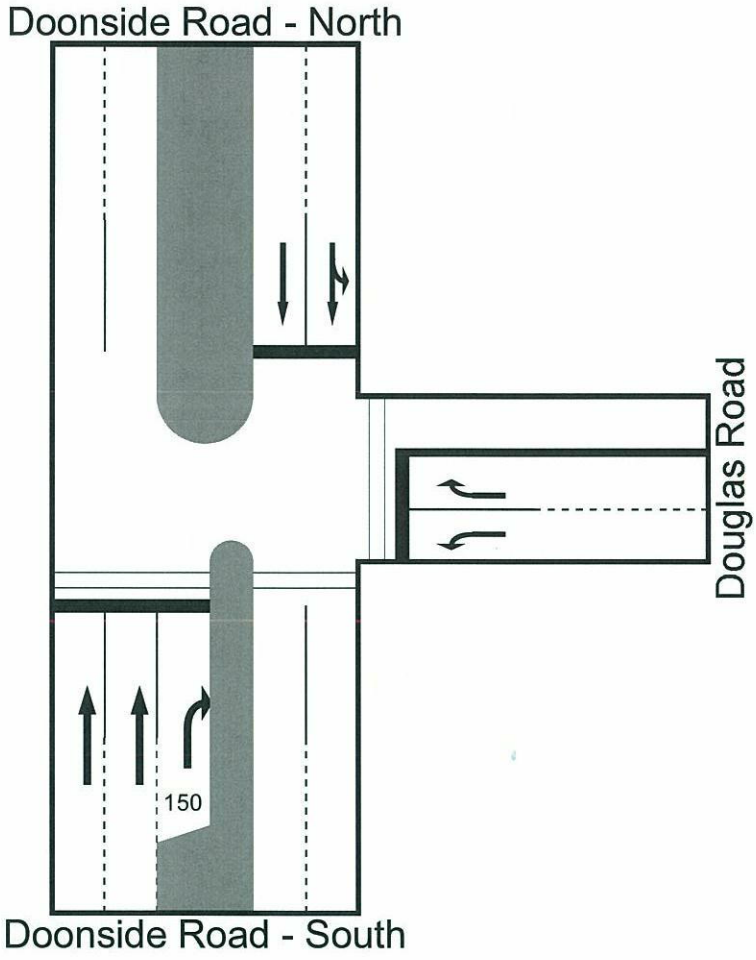
Intersection Summary

Node 6: Doonside Road & Douglas Road - Base

2016 Base Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 6: Doonside Road Douglas Road - Base

2016 Base Layout Without Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road - South										
2	T	556	10.8	0.188	1.0	LOS A	14	0.07	0.06	58.4
3	R	97	4.1	0.479	18.3	LOS B	39	0.58	0.79	40.0
Approach		**653**	**9.8**	**0.480**	**3.6**	**LOS A**	**39**	**0.14**	**0.17**	**54.7**
Douglas Road										
4	L	187	2.1	0.495	65.1	LOS E	93	0.89	0.81	21.5
6	R	95	4.2	0.395	73.4	LOS F	59	0.96	0.79	19.9
Approach		**282**	**2.8**	**0.495**	**67.9**	**LOS E**	**93**	**0.91**	**0.80**	**20.9**
Doonside Road - North										
7	L	63	0.0	0.492	10.0	LOS A	44	0.10	0.69	47.0
8	T	1321	4.2	0.493	1.8	LOS A	45	0.10	0.09	57.1
Approach		**1384**	**4.0**	**0.493**	**2.2**	**LOS A**	**45**	**0.10**	**0.12**	**56.5**
All Vehicles		**2319**	**5.5**	**0.495**	**10.6**	**LOS A**	**93**	**0.21**	**0.22**	**46.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	6.8	LOS A	0	0.30	0.30
All Peds	**10**	**37.9**	**LOS C**	**0**	**0.63**	**0.63**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
 # - Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
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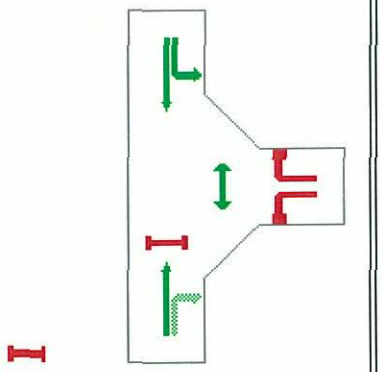
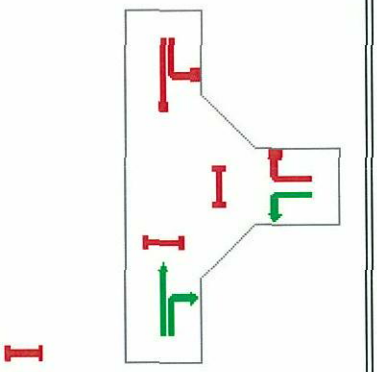
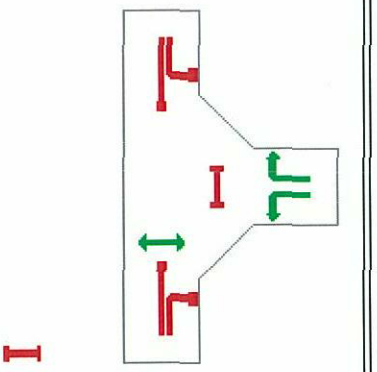
SIDRA INTERSECTION

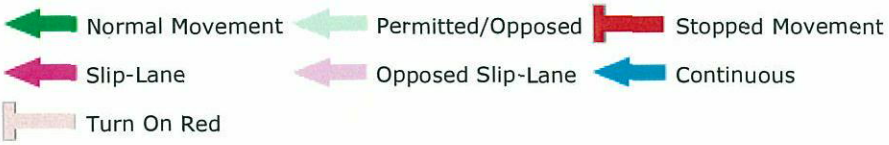
Phasing Summary

Node 6: Doonside Road Douglas Road - Base

2016 Base Layout Without Development - Scenario 2

C = **150** seconds
Cycle Time Option: ***User-specified cycle time***
Phase times determined by the program.

Phase A	Phase B	Phase C
		
Green Time = **111** seconds Phase Time = **115** seconds Phase Split = **77** %	Green Time = **7** seconds Phase Time = **11** seconds Phase Split = **7** %	Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %



SIDRA SOLUTIONS

Site: BASE
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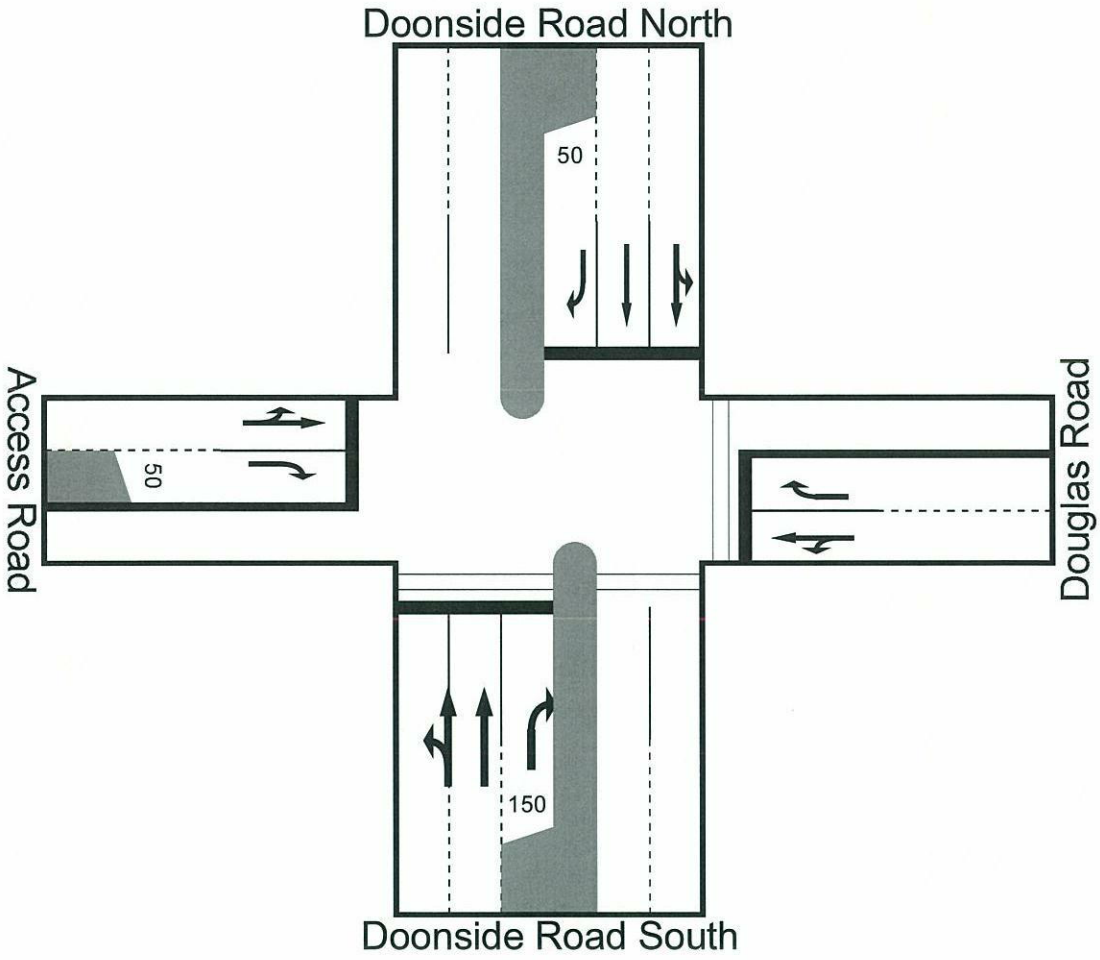
Intersection Summary

Node 6: Doonside Road & Douglas Road - Development

2016 Layout With Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 6: Doonside Road Douglas Road - Development

2016 Layout With Development - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Road South										
1	L	26	0.0	0.247	13.6	LOS A	40	0.20	0.71	43.7
2	T	563	10.7	0.247	5.1	LOS A	40	0.19	0.16	52.6
3	R	97	4.1	0.926	135.5	LOS F	99	0.98	1.26	12.7
Approach		**686**	**9.3**	**0.926**	**23.8**	**LOS B**	**99**	**0.30**	**0.34**	**36.3**
Douglas Road										
4	L	187	2.1	0.790	80.2	LOS F	110	1.00	0.89	18.7
5	T	6	0.0	0.789	71.9	LOS F	110	1.00	0.89	20.2
6	R	95	4.2	0.395	73.3	LOS F	59	0.96	0.78	19.9
Approach		**288**	**2.8**	**0.790**	**77.7**	**LOS F**	**110**	**0.99**	**0.85**	**19.1**
Doonside Road North										
7	L	63	0.0	0.574	14.7	LOS B	104	0.28	0.74	42.7
8	T	1360	4.0	0.574	6.5	LOS A	105	0.28	0.26	50.9
9	R	4	0.0	0.010	17.4	LOS B	1	0.36	0.66	40.5
Approach		**1427**	**3.9**	**0.574**	**6.9**	**LOS A**	**105**	**0.28**	**0.28**	**50.5**
Access Road										
10	L	25	0.0	0.220	71.2	LOS F	35	0.93	0.76	20.2
11	T	31	0.0	0.220	63.0	LOS E	35	0.93	0.71	22.0
12	R	149	0.0	0.906	87.5	LOS F	92	0.99	0.97	17.6
Approach		**205**	**0.0**	**0.906**	**81.8**	**LOS F**	**92**	**0.98**	**0.90**	**18.5**
All Vehicles		**2606**	**4.9**	**0.926**	**25.1**	**LOS B**	**110**	**0.42**	**0.41**	**35.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	5	69.1	LOS F	0	0.96	0.96
P3	5	11.2	LOS B	0	0.39	0.39
All Peds	**10**	**40.2**	**LOS C**	**0**	**0.67**	**0.67**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development intersect
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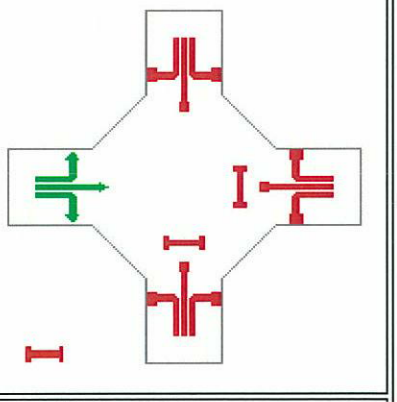
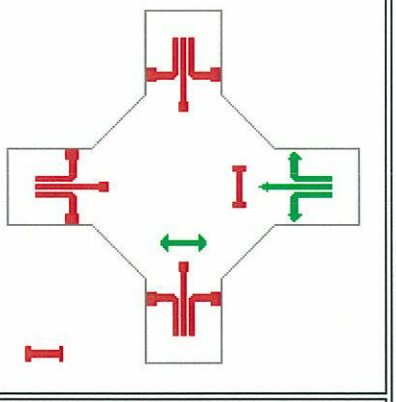
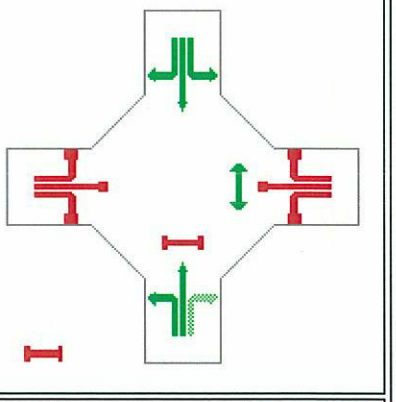
SIDRA INTERSECTION

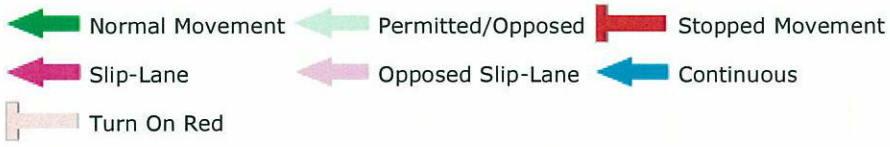
Phasing Summary

Node 6: Doonside Road Douglas Road - Development

2016 Layout With Development - Scenario 2

C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase A	Phase B	Phase C
		
Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %	Green Time = **20** seconds Phase Time = **24** seconds Phase Split = **16** %	Green Time = **98** seconds Phase Time = **102** seconds Phase Split = **68** %



SIDRA SOLUTIONS

Site: Development intersect
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 6 Doonside_douglas.aap
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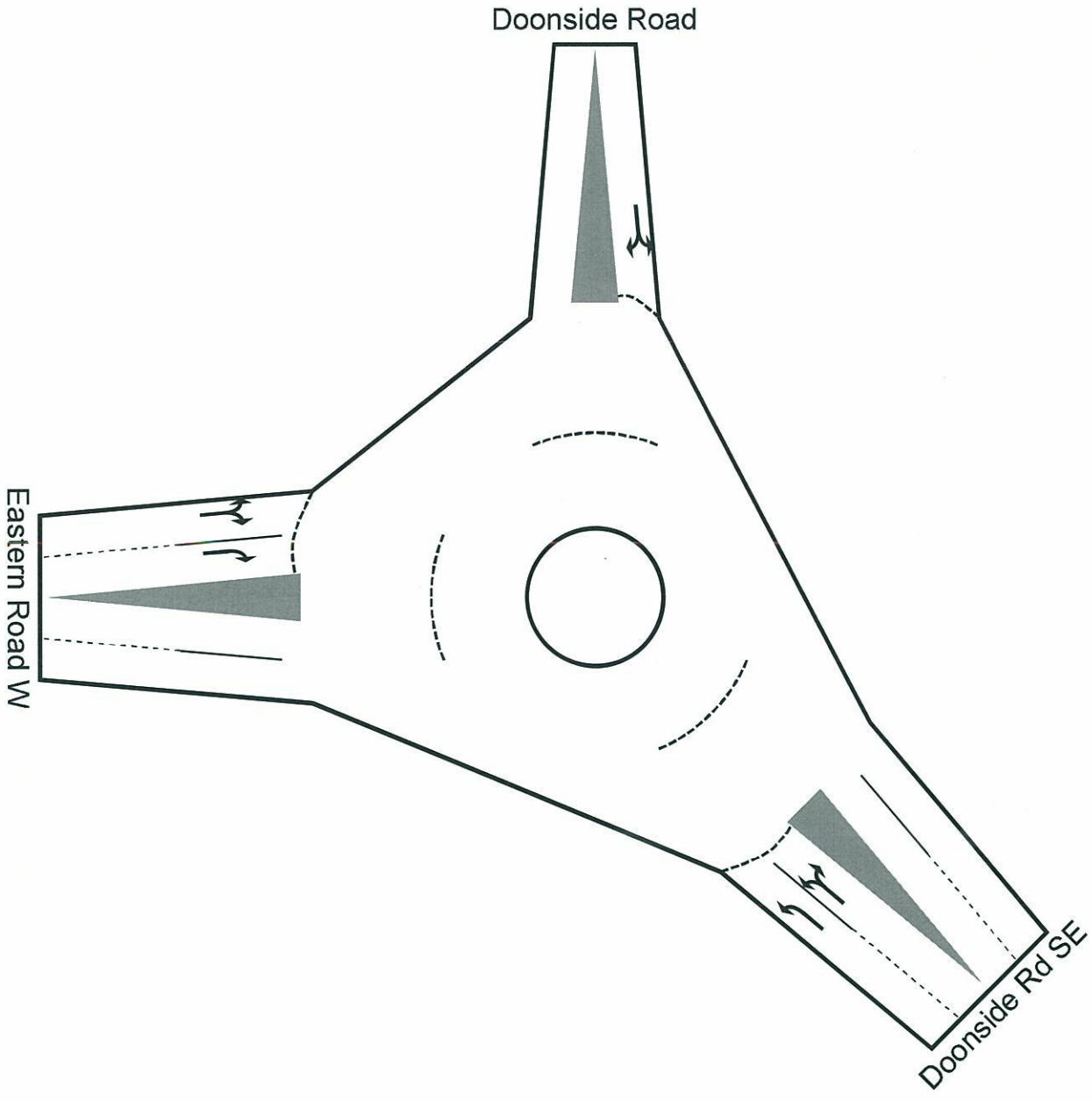
Intersection Summary

Node 11 - Doonside Rd_Eastern Rd - Base

2016 Base Layout Without Development - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 11 - Doonside Rd_Eastern Rd - Base

2016 Base Layout Without Development - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Rd SE										
21	L	826	6.8	0.323	4.9	LOS A	21	0.33	0.43	51.0
23	R	54	5.6	0.323	10.7	LOS A	21	0.34	0.61	46.1
Approach		**880**	**6.7**	**0.323**	**5.3**	**LOS A**	**21**	**0.33**	**0.44**	**50.6**
Doonside Road										
7	L	75	1.3	0.417	14.7	LOS B	20	0.86	0.98	42.8
9	R	100	6.0	0.417	21.8	LOS B	20	0.86	1.02	38.8
Approach		**175**	**4.0**	**0.417**	**18.8**	**LOS B**	**20**	**0.86**	**1.00**	**40.3**
Eastern Road W										
10	L	166	1.8	0.783	6.1	LOS A	99	0.42	0.45	49.2
12	R	2233	4.3	0.781	10.8	LOS A	99	0.45	0.56	45.6
Approach		**2399**	**4.2**	**0.781**	**10.5**	**LOS A**	**99**	**0.45**	**0.55**	**45.8**
All Vehicles		**3454**	**4.8**	**0.783**	**9.6**	**LOS A**	**99**	**0.44**	**0.55**	**46.6**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
 # - Density for continuous movement

SIDRA SOLUTIONS

Site: BASE
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 11 Doonside Rd_Eastern Rd.aap
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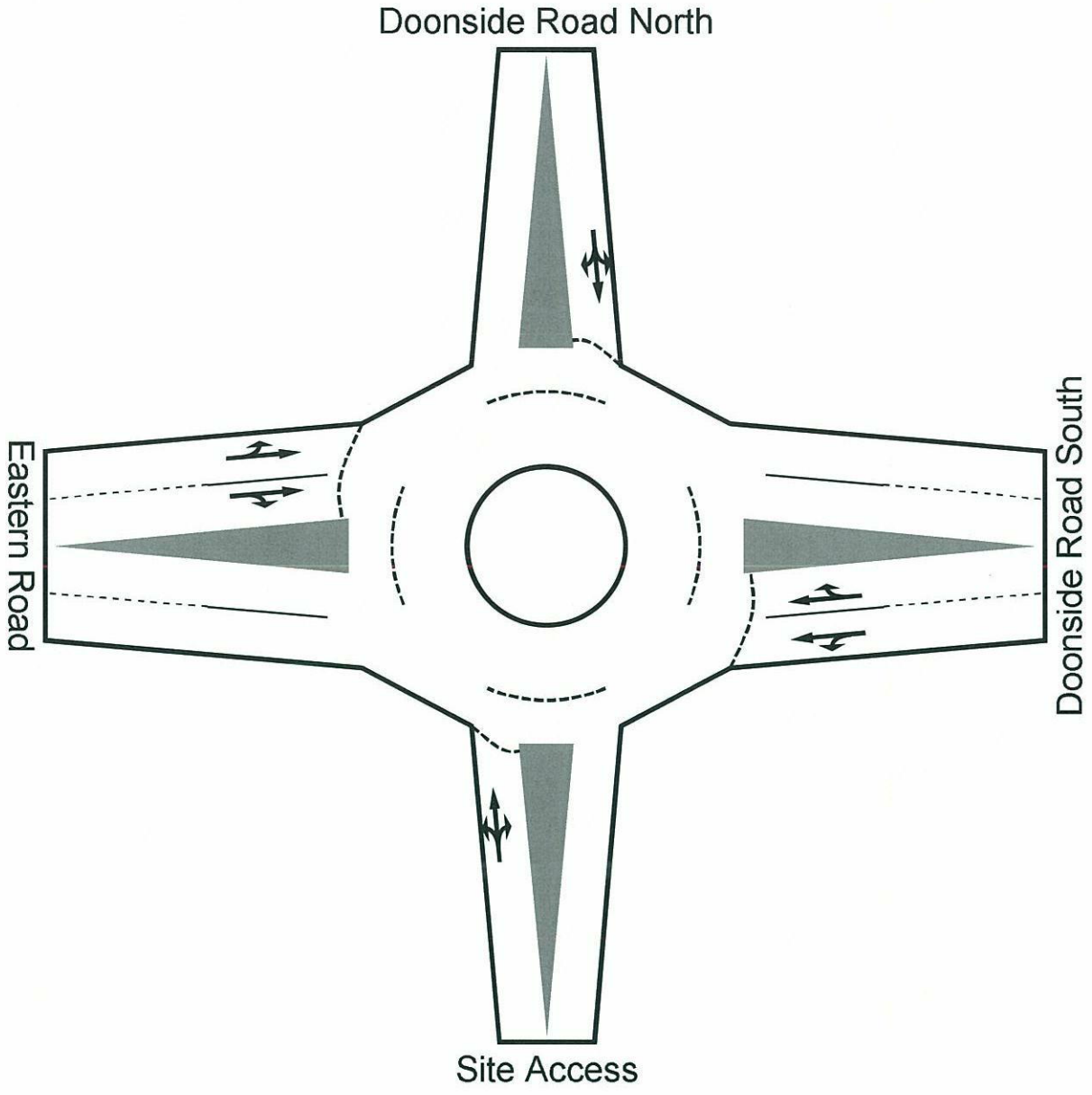
Intersection Summary

Node 11 - Doonside Rd_Eastern Rd - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 11 - Doonside Rd_Eastern Rd - Development (Roundabout)

2016 Layout With Development (Roundabout) - Scenario 2

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Site Access										
1	L	64	0.0	0.119	8.4	LOS A	4	0.61	0.74	48.2
2	T	5	0.0	0.119	7.4	LOS A	4	0.61	0.68	48.9
3	R	20	0.0	0.118	14.3	LOS A	4	0.61	0.80	44.1
Approach		**89**	**0.0**	**0.119**	**9.6**	**LOS A**	**4**	**0.61**	**0.75**	**47.2**
Doonside Road South										
4	L	3	0.0	0.333	6.0	LOS A	20	0.33	0.50	49.8
5	T	869	6.8	0.342	5.0	LOS A	20	0.33	0.44	50.9
6	R	54	5.6	0.342	11.9	LOS A	20	0.34	0.64	45.3
Approach		**927**	**6.7**	**0.342**	**5.4**	**LOS A**	**20**	**0.33**	**0.45**	**50.5**
Doonside Road North										
7	L	75	1.3	0.478	17.7	LOS B	25	0.89	1.02	40.4
8	T	5	0.0	0.500	16.7	LOS B	25	0.89	1.01	41.3
9	R	100	6.0	0.478	23.7	LOS B	25	0.89	1.05	37.6
Approach		**180**	**3.9**	**0.479**	**21.0**	**LOS B**	**25**	**0.89**	**1.03**	**38.8**
Eastern Road										
10	L	166	1.8	0.810	6.5	LOS A	103	0.54	0.48	48.5
11	T	2233	4.3	0.809	5.5	LOS A	103	0.57	0.45	49.2
12	R	12	0.0	0.800	12.4	LOS A	100	0.60	0.58	44.2
Approach		**2411**	**4.1**	**0.809**	**5.6**	**LOS A**	**103**	**0.57**	**0.45**	**49.1**
All Vehicles		**3607**	**4.7**	**0.810**	**6.4**	**LOS A**	**103**	**0.52**	**0.49**	**48.7**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development roundabout
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 2\Node 11 Doonside Rd_Eastern Rd.aap
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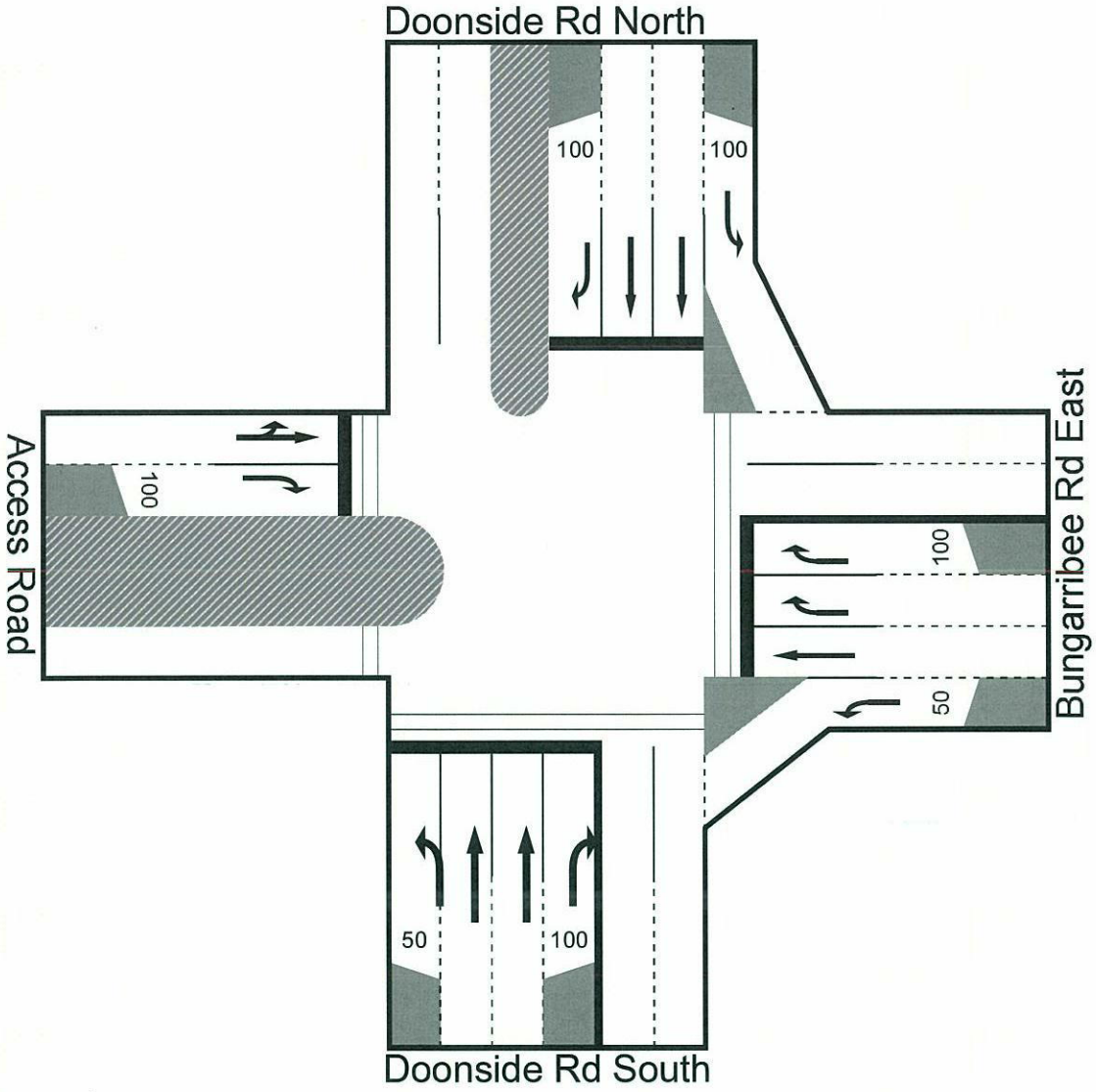
Appendix E: SIDRA Output Signalled Option

Intersection Summary

Node 5: Doonside Road and Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario



Movement Summary

Node 5: Doonside Road and Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Rd South										
1	L	3	0.0	0.014	42.2	LOS C	2	0.68	0.65	27.7
2	T	424	8.5	0.337	39.2	LOS C	97	0.79	0.67	28.9
3	R	328	4.3	0.941	65.7	LOS E	166	0.93	0.91	21.5
Approach		**755**	**6.6**	**0.941**	**50.7**	**LOS D**	**166**	**0.85**	**0.77**	**25.1**
Bungarribee Rd East										
4	L	268	1.5	0.215	7.9	LOS A	10	0.10	0.63	49.2
5	T	4	0.0	0.013	56.2	LOS D	3	0.86	0.56	23.6
6	R	532	3.4	0.917	93.6	LOS F	167	1.00	1.09	16.8
Approach		**804**	**2.7**	**0.917**	**64.8**	**LOS E**	**167**	**0.70**	**0.93**	**21.7**
Doonside Rd North										
7	L	923	2.5	0.624	8.4	LOS A	50	0.24	0.66	48.5
8	T	1215	3.8	0.939	76.7	LOS F	383	1.00	1.15	19.3
9	R	11	0.0	0.030	48.5	LOS D	6	0.74	0.69	25.7
Approach		**2149**	**3.2**	**0.939**	**47.2**	**LOS D**	**383**	**0.67**	**0.94**	**26.1**
Access Road										
10	L	61	0.0	0.856	94.5	LOS F	60	1.00	0.94	16.6
11	T	25	0.0	0.857	86.3	LOS F	60	1.00	0.94	17.8
12	R	19	0.0	0.228	85.5	LOS F	15	0.99	0.71	17.9
Approach		**105**	**0.0**	**0.856**	**90.9**	**LOS F**	**60**	**1.00**	**0.90**	**17.1**
All Vehicles		**3813**	**3.7**	**0.941**	**52.8**	**LOS D**	**383**	**0.72**	**0.90**	**24.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	65.3	LOS F	0	0.93	0.93
P3	53	40.3	LOS E	0	0.73	0.73

P7	53	36.8	LOS D	0	0.70	0.70
All Peds	**159**	**47.5**	**LOS D**	**0**	**0.79**	**0.79**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

Site: Development intersect
\\AUSYD1FP001\Projects\20018906_00_WSPKLNDS2\05_Eng_Plan\Analysis\aaSIDRA Modelling\DOONSIDE REV F\Scenario 1\Node 5 Doonside_Bungarribee.aap
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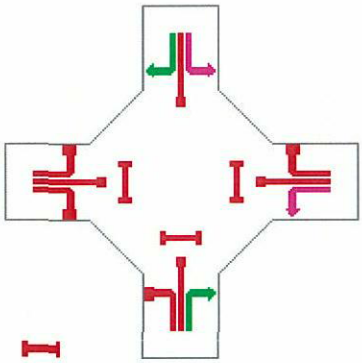
Phasing Summary

Node 5: Doonside Road and Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 1

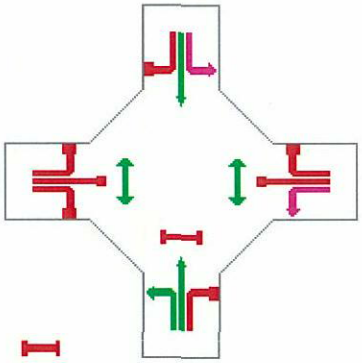
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase A



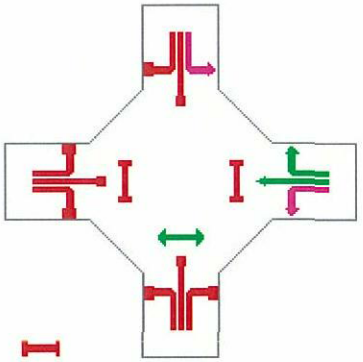
Green Time = **43** seconds
Phase Time = **49** seconds
Phase Split = **33** %

Phase B



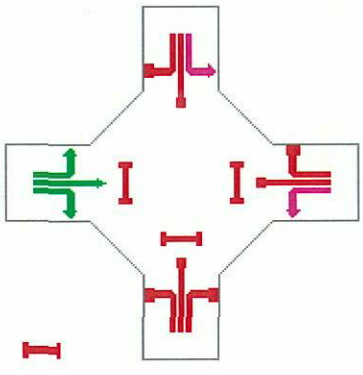
Green Time = **51** seconds
Phase Time = **57** seconds
Phase Split = **38** %

Phase C



Green Time = **24** seconds
Phase Time = **30** seconds
Phase Split = **20** %

Phase D



Green Time = **8** seconds
Phase Time = **14** seconds
Phase Split = **9** %

Normal Movement | Permitted/Opposed | Stopped Movement
Slip-Lane | Opposed Slip-Lane | Continuous
Turn On Red

Site: Development intersect
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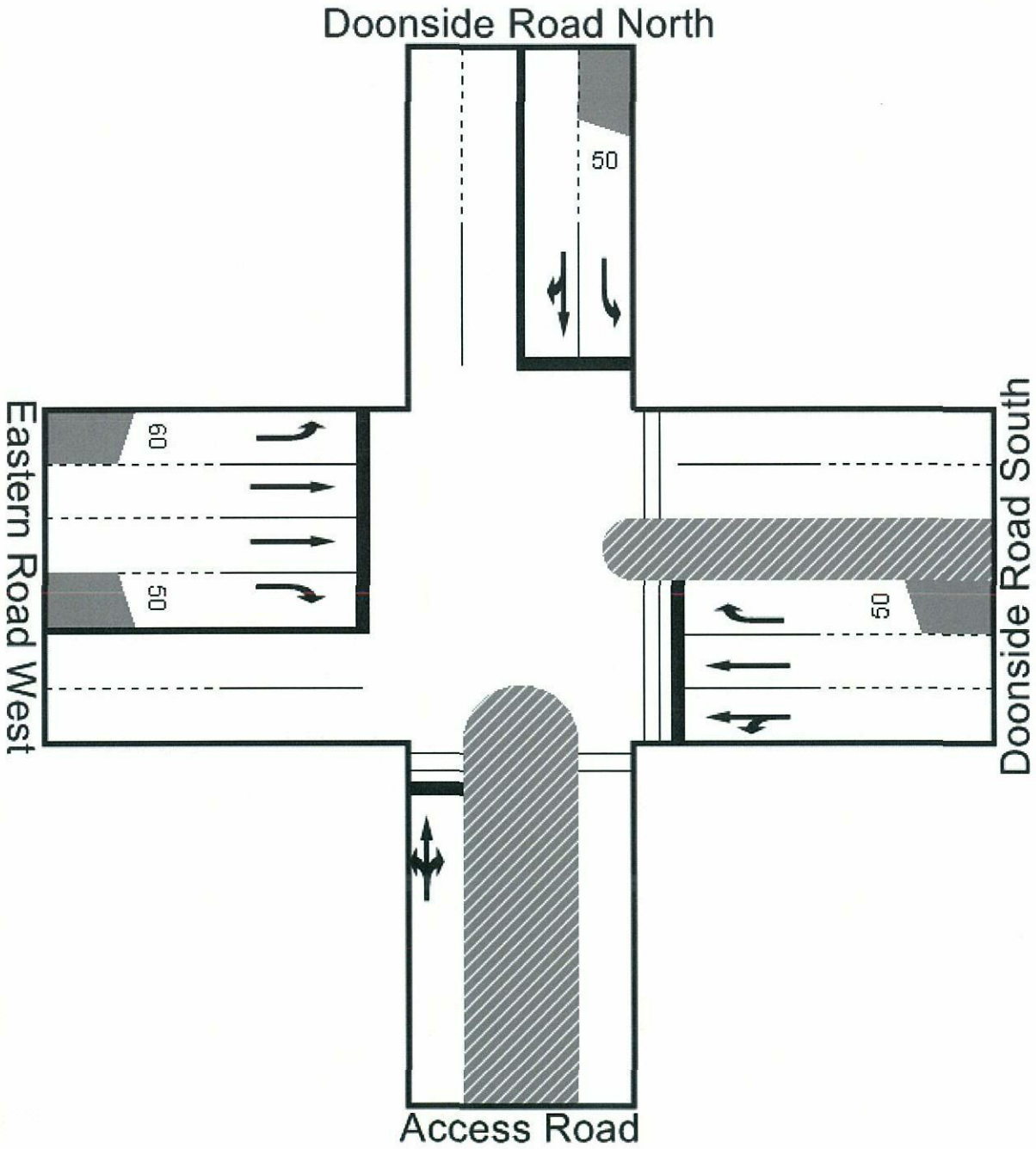
Intersection Summary

Node 11 Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised)



SIDRA INTERSECTION

Movement Summary

Node 11: Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Access Road										
1	L	61	0.0	0.990	130.6	LOS F	71	1.00	1.16	13.0
2	T	5	0.0	0.992	122.5	LOS F	71	1.00	1.16	13.7
3	R	20	0.0	0.990	130.6	LOS F	71	1.00	1.16	13.0
Approach		**86**	**0.0**	**0.990**	**130.2**	**LOS F**	**71**	**1.00**	**1.16**	**13.1**
Doonside Road South										
4	L	3	0.0	0.361	18.1	LOS B	112	0.44	0.77	40.0
5	T	949	6.2	0.367	9.9	LOS A	112	0.44	0.40	47.2
6	R	54	5.6	0.756	93.3	LOS F	42	1.00	0.84	16.8
Approach		**1007**	**6.2**	**0.756**	**14.4**	**LOS A**	**112**	**0.47**	**0.42**	**43.0**
Doonside Road North										
7	L	75	1.3	0.679	87.7	LOS F	52	1.00	0.81	17.6
8	T	5	0.0	0.980	116.0	LOS F	86	1.00	1.18	14.3
9	R	100	6.0	0.979	124.3	LOS F	86	1.00	1.18	13.6
Approach		**180**	**3.9**	**0.979**	**108.8**	**LOS F**	**86**	**1.00**	**1.03**	**15.0**
Eastern Road West										
10	L	166	1.8	0.958	55.7	LOS D	752	1.00	1.10	23.7
11	T	2354	4.1	0.959	47.3	LOS D	756	1.00	1.10	26.1
12	R	12	0.0	0.162	87.4	LOS F	10	0.99	0.68	17.6
Approach		**2532**	**3.9**	**0.959**	**48.1**	**LOS D**	**756**	**1.00**	**1.10**	**25.8**
All Vehicles		**3805**	**4.4**	**0.992**	**43.9**	**LOS D**	**756**	**0.86**	**0.92**	**27.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development intersect
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SIDRA INTERSECTION

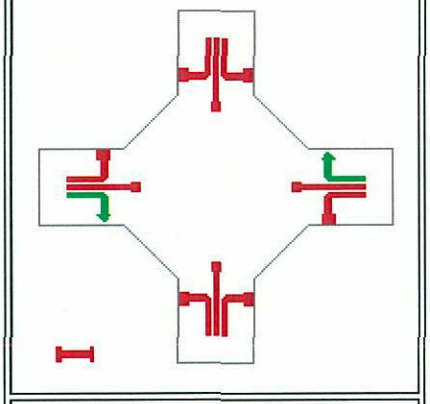
Phasing Summary

Node 11: Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 1

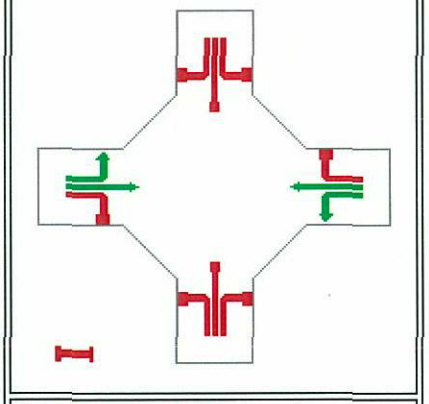
C = **150** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase A



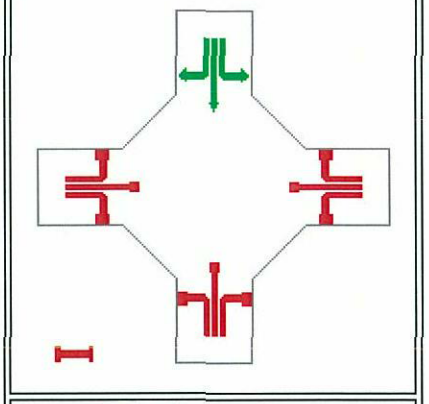
Green Time = **6** seconds
Phase Time = **12** seconds
Phase Split = **8** %

Phase B



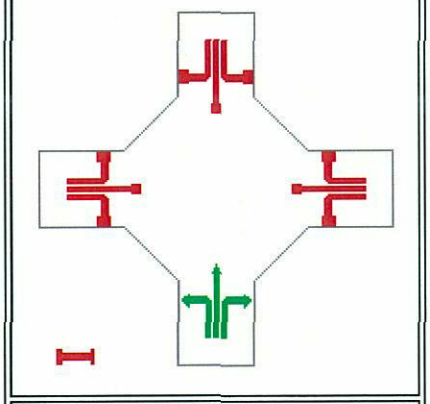
Green Time = **104** seconds
Phase Time = **110** seconds
Phase Split = **73** %

Phase C

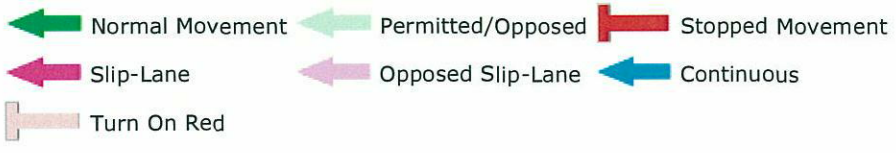


Green Time = **9** seconds
Phase Time = **15** seconds
Phase Split = **10** %

Phase D



Green Time = **7** seconds
Phase Time = **13** seconds
Phase Split = **9** %



SIDRA SOLUTIONS

Site: Development intersect
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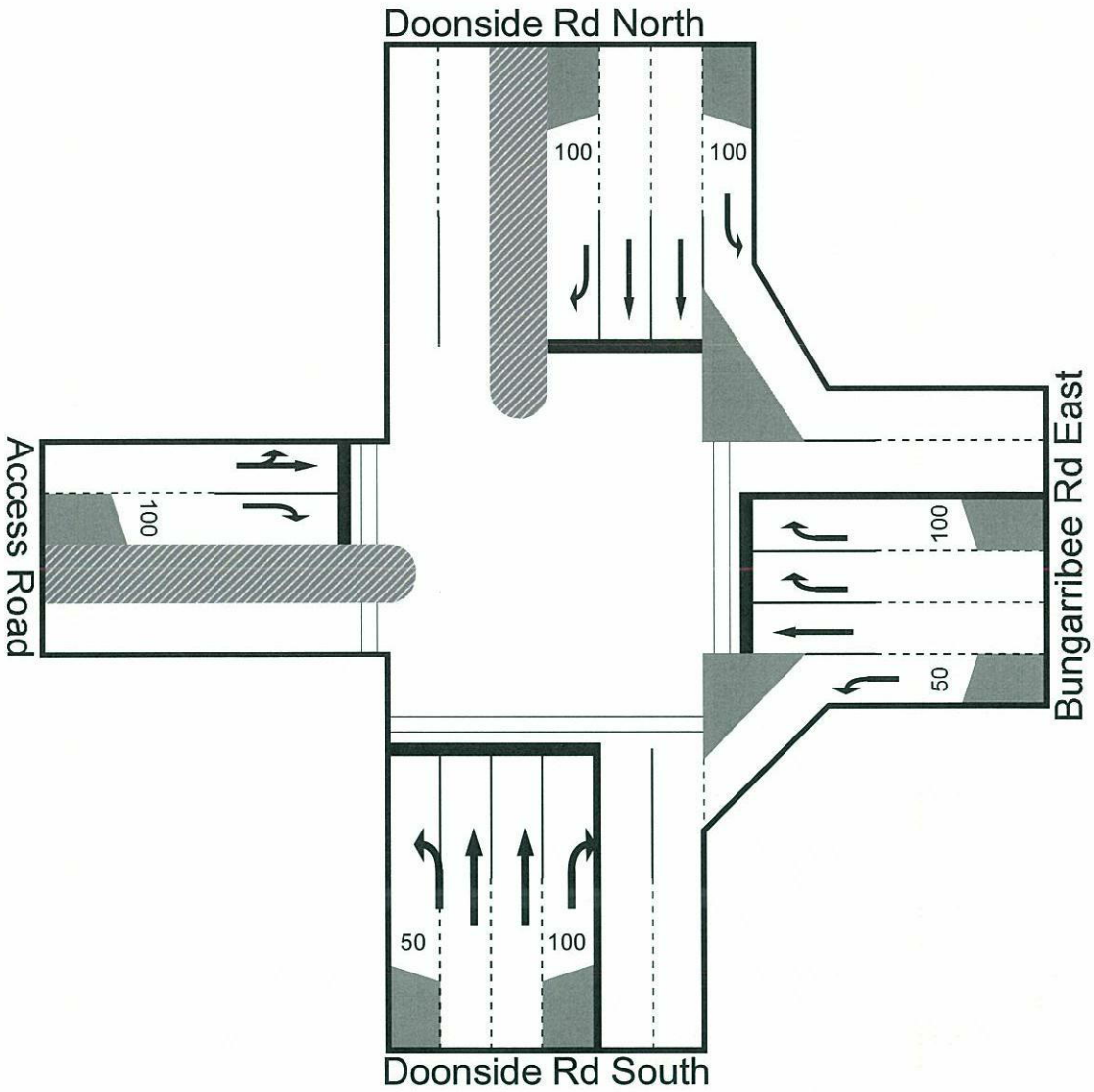
Intersection Summary

Node 5: Doonside Road & Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 2



SIDRA INTERSECTION

Movement Summary

Node 5: Doonside Road Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Doonside Rd South										
1	L	3	0.0	0.014	43.0	LOS D	2	0.69	0.65	27.5
2	T	383	1.6	0.298	39.3	LOS C	84	0.79	0.66	28.9
3	R	320	4.4	0.896	67.2	LOS E	166	0.90	0.96	21.1
Approach		**706**	**2.8**	**0.896**	**52.0**	**LOS D**	**166**	**0.84**	**0.79**	**24.8**
Bungarribee Rd East										
4	L	252	1.6	0.203	7.9	LOS A	9	0.10	0.63	49.2
5	T	4	0.0	0.014	58.1	LOS E	3	0.88	0.57	23.1
6	R	468	3.8	0.883	88.2	LOS F	143	1.00	1.02	17.6
Approach		**724**	**3.0**	**0.883**	**60.1**	**LOS E**	**143**	**0.69**	**0.88**	**22.7**
Doonside Rd North										
7	L	898	2.6	0.492	7.7	LOS C#	15#	0.00	0.60	49.7
8	T	1124	4.1	0.888	61.3	LOS E	310	1.00	1.02	22.3
9	R	11	0.0	0.029	46.2	LOS D	6	0.72	0.69	26.4
Approach		**2033**	**3.4**	**0.888**	**37.6**	**LOS C**	**310**	**0.56**	**0.83**	**29.6**
Access Road										
10	L	61	0.0	0.856	94.5	LOS F	60	1.00	0.94	16.6
11	T	25	0.0	0.857	86.3	LOS F	60	1.00	0.94	17.8
12	R	19	0.0	0.192	84.4	LOS F	15	0.99	0.70	18.1
Approach		**105**	**0.0**	**0.856**	**90.7**	**LOS F**	**60**	**1.00**	**0.90**	**17.2**
All Vehicles		**3568**	**3.1**	**0.896**	**46.5**	**LOS D**	**310**	**0.65**	**0.84**	**26.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	67.2	LOS F	0	0.95	0.95
P3	53	41.1	LOS E	0	0.74	0.74
P7	53	37.5	LOS D	0	0.71	0.71

All Peds	**159**	**48.6**	**LOS D**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development intersect
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SIDRA INTERSECTION

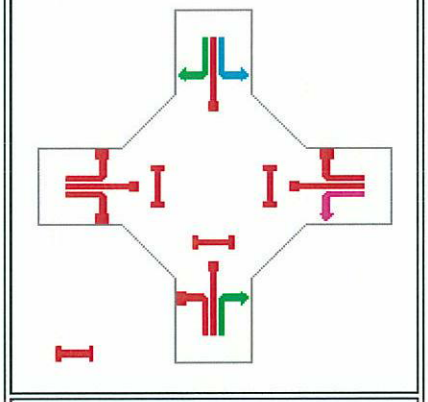
Phasing Summary

Node 5: Doonside Road Bungarribee Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 2

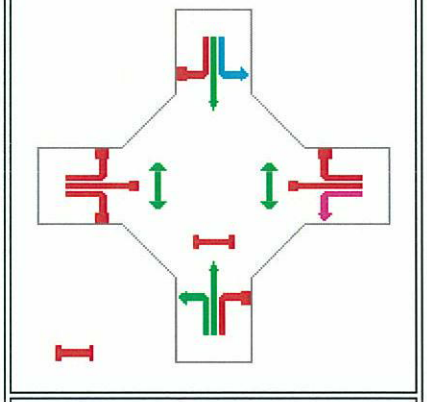
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase A



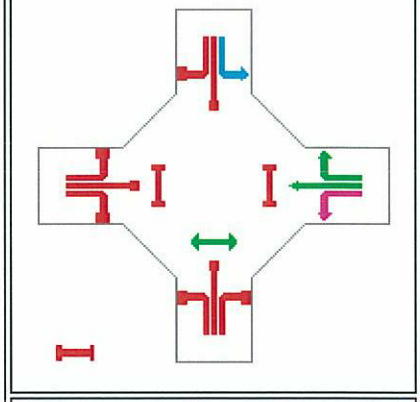
Green Time = **46** seconds
Phase Time = **52** seconds
Phase Split = **35** %

Phase B



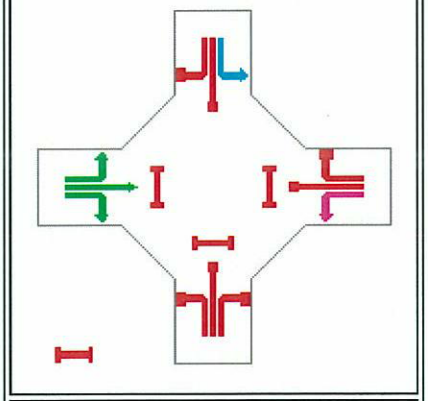
Green Time = **50** seconds
Phase Time = **56** seconds
Phase Split = **37** %

Phase C

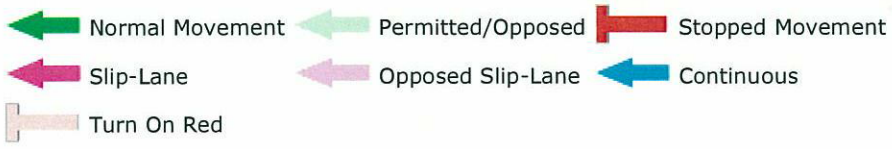


Green Time = **22** seconds
Phase Time = **28** seconds
Phase Split = **19** %

Phase D



Green Time = **8** seconds
Phase Time = **14** seconds
Phase Split = **9** %



SIDRA SOLUTIONS

Site: Development intersect
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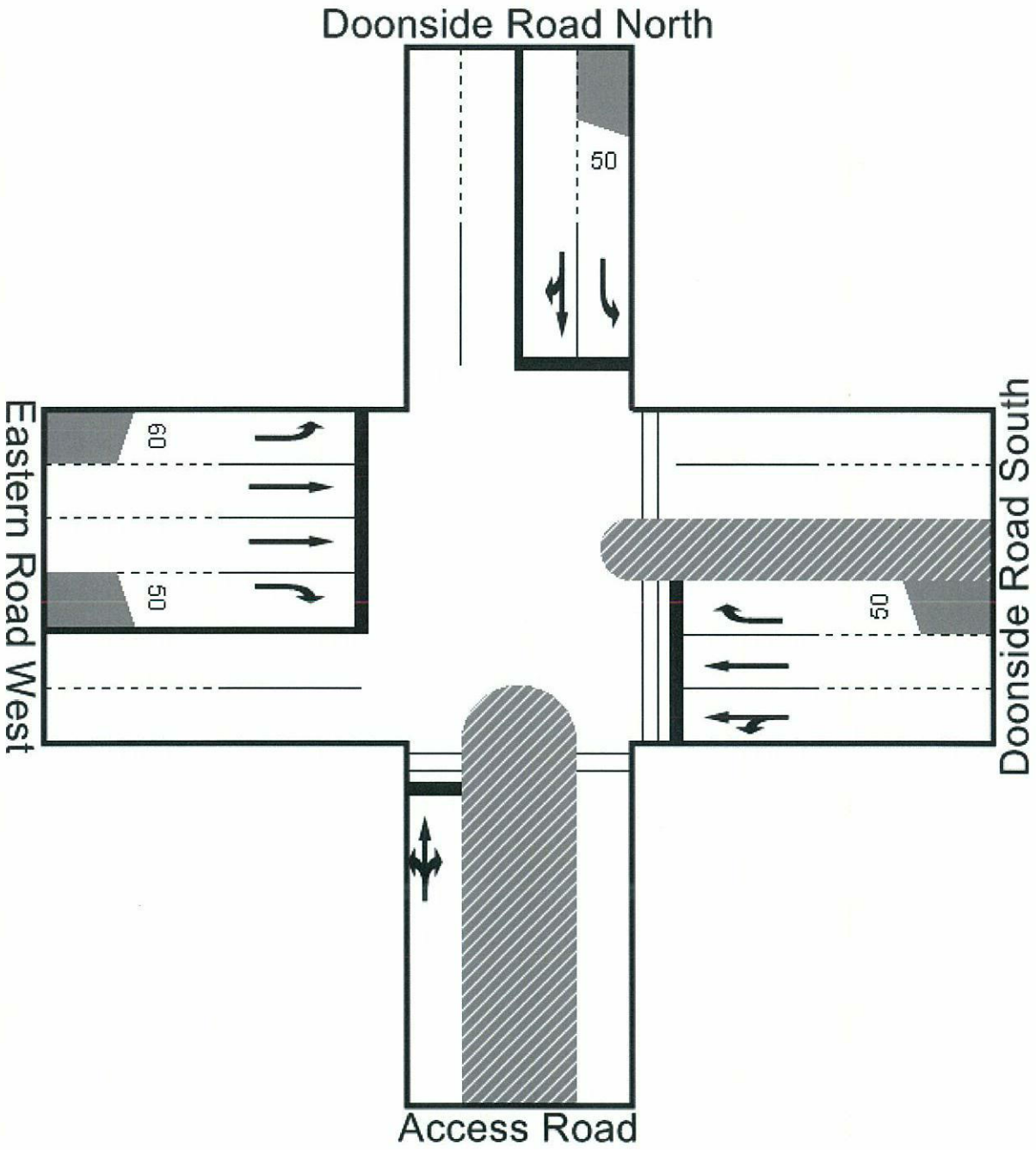
Intersection Summary

Node 11 Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised)



SIDRA INTERSECTION

Movement Summary

Node 11 Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 2

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Access Road										
1	L	61	0.0	0.245	68.3	LOS E	50	0.92	0.77	20.8
2	T	5	0.0	0.245	60.1	LOS E	50	0.92	0.72	22.6
3	R	19	0.0	0.245	69.3	LOS E	50	0.93	0.78	20.6
Approach		**85**	**0.0**	**0.245**	**68.0**	**LOS E**	**50**	**0.92**	**0.77**	**20.9**
Doonside Road South										
4	L	3	0.0	0.338	21.8	LOS B	113	0.51	0.78	37.5
5	T	826	6.8	0.350	13.6	LOS A	113	0.51	0.45	43.7
6	R	51	5.9	0.358	81.3	LOS F	37	0.99	0.75	18.5
Approach		**880**	**6.7**	**0.358**	**17.5**	**LOS B**	**113**	**0.54**	**0.47**	**40.5**
Doonside Road North										
7	L	71	1.4	0.263	54.7	LOS D	39	0.93	0.76	23.9
8	T	5	0.0	0.843	84.0	LOS F	71	1.00	0.94	18.1
9	R	95	6.3	0.840	92.2	LOS F	71	1.00	0.94	17.0
Approach		**171**	**4.1**	**0.840**	**76.4**	**LOS F**	**71**	**0.97**	**0.86**	**19.4**
Eastern Road West										
10	L	158	1.9	0.386	19.8	LOS B	43	0.43	0.73	38.9
11	T	2121	4.3	0.883	25.3	LOS B	458	0.91	0.86	35.4
12	R	110	0.0	0.740	85.9	LOS F	70	1.00	0.86	17.8
Approach		**2389**	**4.0**	**0.883**	**27.7**	**LOS B**	**458**	**0.88**	**0.85**	**34.1**
All Vehicles		**3525**	**4.6**	**0.883**	**28.5**	**LOS C**	**458**	**0.80**	**0.76**	**33.6**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	11.2	LOS B	0	0.39	0.39
P3	50	69.1	LOS F	0	0.96	0.96
P4	50	69.1	LOS F	0	0.96	0.96

All Peds	**150**	**49.8**	**LOS D**	**0**	**0.77**	**0.77**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Development intersect
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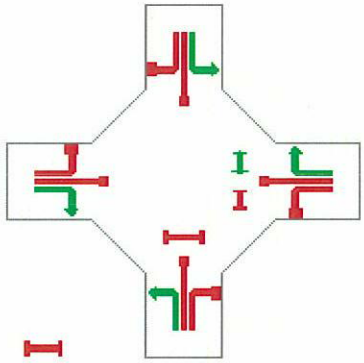
Phasing Summary

Node 11 Doonside Road and Eastern Road - Development (Signalised)

2016 Layout With Development (Signalised) - Scenario 2

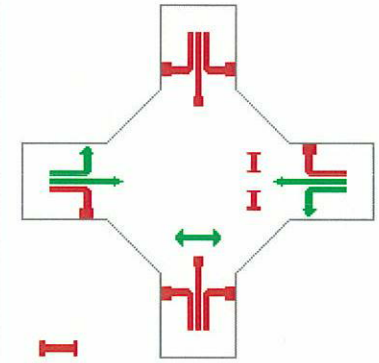
C = **150** seconds
Cycle Time Option: **User-specified cycle time**
Phase times determined by the program.

Phase A



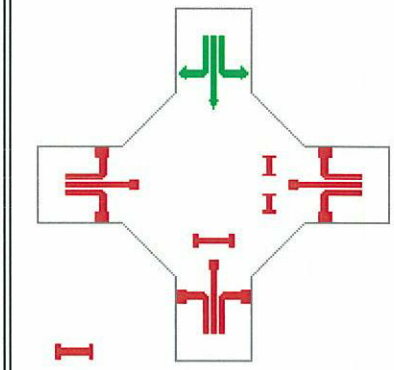
Green Time = **12** seconds
Phase Time = **18** seconds
Phase Split = **12** %

Phase B



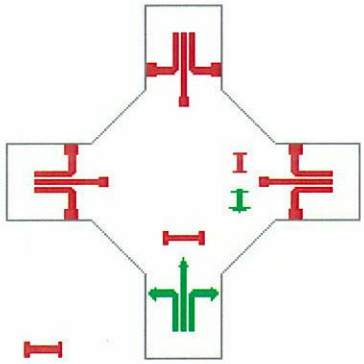
Green Time = **95** seconds
Phase Time = **101** seconds
Phase Split = **67** %

Phase C



Green Time = **10** seconds
Phase Time = **16** seconds
Phase Split = **11** %

Phase D



Green Time = **9** seconds
Phase Time = **15** seconds
Phase Split = **10** %

Normal Movement | Permitted/Opposed | Stopped Movement
Slip-Lane | Opposed Slip-Lane | Continuous
Turn On Red

SIDRA SOLUTIONS

Site: Development intersect
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