FINAL REPORT

WB & ME Walls

Seascape Grove, Belle O'Connor Street, South West Rocks, Stage 1

Traffic Impact Assessment

August 2006

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Reference: 0043974 traffic

For and on behalf of Environmental Resources Management Australia	
Approved by:	Christine Allen
Signed:	
Position:	Project Director
Date:	15 August 2006

This report was prepared in accordance with the scope of services set out in the contract between Environmental Resources Management Australia Pty Ltd ACN 002 773 248 (ERM) and representatives of WB & ME Walls. To the best of our knowledge, the proposal presented herein accurately reflects the intentions of and representatives of WB & ME Walls when the report was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In preparing the report, ERM used data, surveys, analyses, designs, plans and other information provided by the individuals and organisations referenced herein. While checks were undertaken to ensure that such materials were the correct and current versions of the materials provided, except as otherwise stated, ERM did not independently verify the accuracy or completeness of these information sources.

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1 INTRODUCTION

1.1 BACKGROUND

WB & ME Walls commissioned Environmental Resources Management Australia Pty Ltd (ERM) to undertake a traffic impact assessment for a proposed residential subdivision, Seascape Grove, at Lot 21 DP 1071657, Belle O'Connor Street, South West Rocks.

The development proposal comprises Stage 1(b) of a residential subdivision of Lot 21 DP 1071657, Belle O'Connor Street, South West Rocks (the site). Stage 1(a) was approved by Kempsey Council in 2004 and amended in 2005 to be consistent with the Master Plan for the site. Ancillary works to the subdivision on Lot 21 DP 1071657 are also proposed in Lot 22 DP 1071657, including drainage, a temporary construction access and a bushfire perimeter road.

The proponent is seeking project approval for a 108 lot residential subdivision to be constructed in four stages (precincts). Stage 1c will be subject to a future application and include further residential subdivision and an integrated housing precinct.

The development footprint and land use is consistent with the Master Plan approved by NSW DoP for the site

Existing allotments (Stage 1a) and potential future residential development within Stage 1(c) and on vacant cleared land to the east of the site (Stage 2) are also considered when assessing the future road network needs of the vicinity.

A traffic impact assessment was submitted to the NSW Department of Planning (DoP) to accompany a Master Plan for the site. The report was reviewed by the Regional Traffic Committee during the Master Plan exhibition. The comments provided by the committee were adopted by DoP in the approval of the Master Plan and are incorporated into this updated assessment.

Chapter 1 of this report provides background information of the site and the proposed development. *Chapter 2* provides an examination of the existing road network and *Chapter 3* describes the proposed road network. An assessment of traffic impacts is provided in *Chapter 4* and the final chapter, *Chapter 5*, draws conclusions on the suitability of the proposed development having regard to traffic considerations.

1.2 SITE DESCRIPTION

The area subject to the development application (the site) is Lot 21 DP 1071657, Belle O'Connor Street, South West Rocks, within the Kempsey Local Government Area (LGA).

The site is situated adjacent to the South West Rocks Golf Course (to the north west of the study site), an existing residential subdivision (Oceanside Estate, to the west) and rural and rural residential land to the south, east and north east. Vehicular access is currently provided from Belle O'Connor Street.

1.3 PROJECT DESCRIPTION

The proponent is seeking project approval for a 108 lot residential subdivision to be constructed in four stages (precincts). Stage 1c will be subject to a future application and include further residential subdivision and an integrated housing precinct.

The development footprint and land use is consistent with the Master Plan approved by NSW DoP for the site

Existing allotments (Stage 1a) and potential future residential development within Stage 1(c) and on vacant cleared land to the east of the site (Stage 2) are also considered when assessing the future road network needs of the vicinity

1.4 CONSULTATION

1.4.1 *Regional Traffic Committee*

Following submission of a traffic assessment with the Master Plan for Stage 1 of Seascape Grove, the Regional Traffic committee provided the following comments (letter, dated 16 August 2005) relevant to this traffic assessment and subdivision design issues:

- all junctions should be located and designed to meet AUSTROADS (1988) Safe Intersection Sight Distances;
- the proposed junction of Belle O'Connor Street and the [sewage] treatment works access should be designed as a proper T-junction. Consideration should also be given to the road reserve and improvements required to manage turning traffic if further development is undertaken to the north as indicated;
- access to Road No.7 from Road No.2 is constrained by a median. This appears unnecessary and will encourage U-turns at other junctions;

- provisions should be made for mid-block pedestrian/cycle connections/corridors between streets to encourage other modes of travel;

- consideration needs to be given to street lighting of internal roads and external junctions;

- any proposed median plantings should be designed so as not to restrict sight distances at junctions;

- further consideration is required of pedestrian/cycleway facilities within the proposed development and connections to the existing network. This should include both recreational and commercial destinations such as the existing town centre, crossing Gregory Street and to the northern integrated housing precinct to the recreation reserve on Road No.3; and

- the subdivision should be designed so that DEC guidelines for road traffic noise are complied with, especially adjacent to arterial roads. If this is not possible then mitigation measures should be built into individual residences.

1.4.2 Kempsey Shire Council

In discussions with Council staff (meeting 20/7/04, subsequent discussions) regarding traffic and transport within the subdivision, it was indicated that:

- cycleways and pedestrian links would need to be clarified in a traffic report or the development application;

- Belle O'Connor Street is likely to become a bus route; and

- the existing Section 94 contributions plan indicates an average daily traffic (ADT) of 10,000 vehicles per day (v.p.d.) for Belle O'Connor Street, which is be unrealistic. As part of the S96 Modification to Consent for Stage 1a, a reduction in overall internal road sealed widths compared to the standard requirements under the Kempsey DCP No 36 was approved (Kempsey DA T6-03-523). This would create a lower speed environment, increase public amenity and reduce area of hard surfaces to promote better stormwater management.

2 EXISTING ROAD NETWORK

2.1 INTERNAL ROADS

Vehicular access to the site is obtained from Belle O'Connor Street. Stage 1a has been constructed, which includes:

- an extension of Belle O'Connor Street;
- commencement of Rosedale Avenue and Burrawong Drive to terminate at the boundaries of the Stage 1a area;
- creation of a T-intersection with the access road to the north (Sewage Treatment Plant).

The existing Stage 1a road network is indicated in the *Overall Plan* (King & Campbell).

2.2 EXTERNAL ROADS

The external road network is indicated in *Figure 1.1*. This includes:

- **Belle O'Connor Street**: This road operates as a collector road for the Oceanside Estate to the west of the study site, linking to Gregory Street. Through Oceanside Estate it is a two-lane divided road with raised, landscaped median and a 50 km/hr speed limit.
- **Gregory Street** is the main arterial road into South West Rocks with 60 km/hr speed limit. Immediately south of the Belle O'Connor Street intersection the road consists of a two-lane divided carriageway. Access to 'The Rocks' Shopping Centre is provided directly from this road. North of the Belle O'Connor Street intersection and south of the Shopping Centre, the two-lane road is undivided.
- **Arakoon Road** links Gregory Street/South West Rocks Road with the residential and rural residential areas of Arakoon to the east. It also caters for tourist vehicle movements to Lighthouse Road, Hat Head National Park and the Arakoon State Recreation Area. The site does not have direct road frontage to Arakoon Road.

The primary access intersection for the site linking the local network to the arterial is the Belle O'Connor Street/Gregory Street roundabout. This intersection is arranged as a four-way single-lane roundabout. Steve Eagleton Place forms the western approach to this intersection, linking to further residential areas.

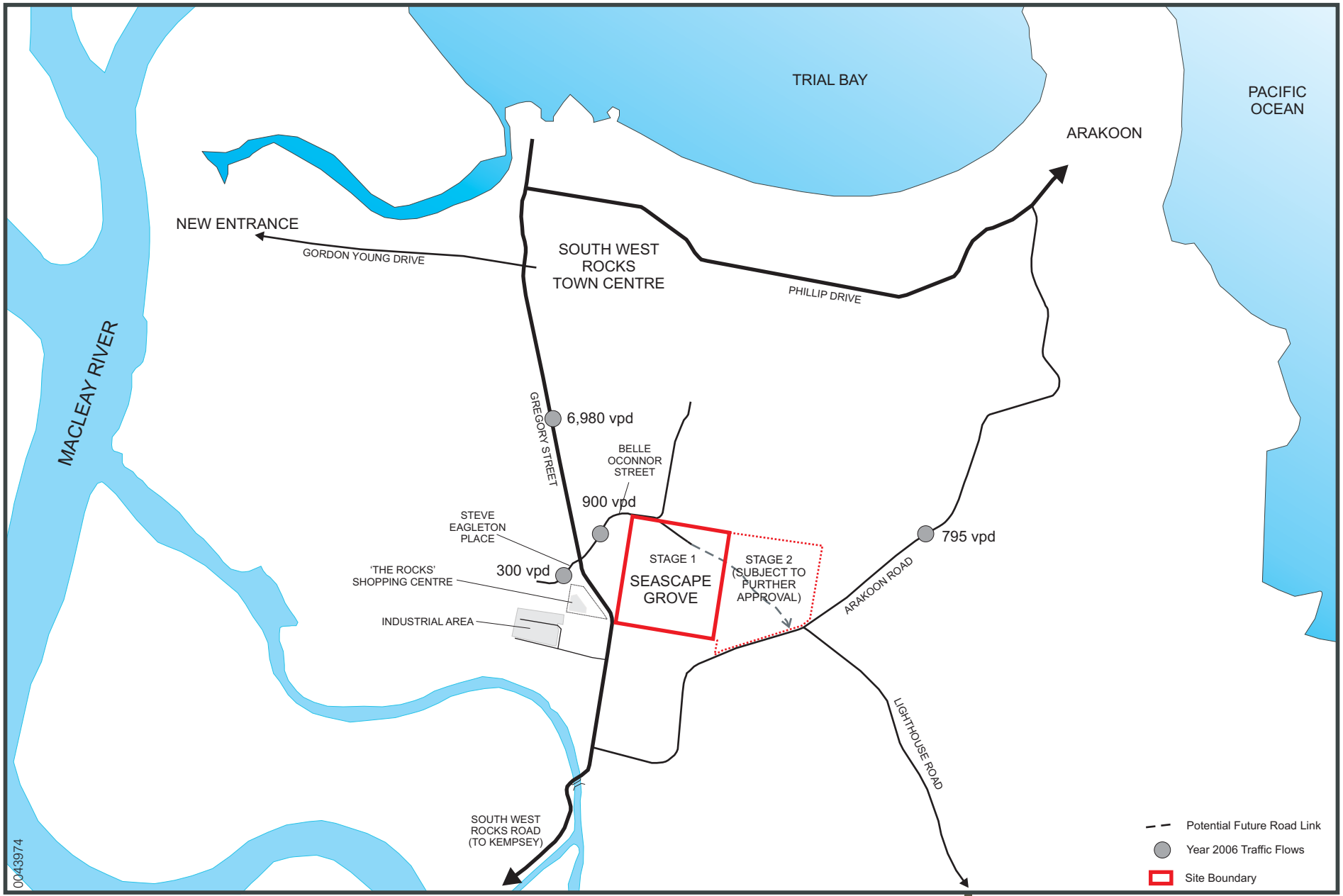

Figure 1.1 **External Road Network & Year 2006 Traffic Flows**

Seascape Grove, South West Rocks
WB & ME Wall

With exception of the extension to Belle O'Connor Street and property access to rural properties to the north of the site, the 20m road reserves along the northern and western boundaries of the site are unformed. It is not proposed to utilise these areas for the proposed development.

2.3 *ROAD VOLUME DATA*

The historic growth trends in daily traffic volumes on the major road network have been determined from Council and RTA surveys and are summarised in *Table 2.1*. Estimates for the year 2006 traffic flows were obtained by traffic surveys undertaken by ERM at the Gregory Street/Belle O'Connor Street roundabout (see details below), and assuming urban peak hour flows at approximately 10% of daily flows. Estimated Year 2006 traffic volumes are also indicated on *Figure 2.2*.

Having regard to population projections, it is envisaged that traffic growth will continue to occur on most roads in South West Rocks. Traffic volume growth, independent of the proposed subdivision, was considered likely along Gregory Street and Steve Eagleton Place to the west of Gregory Street where undeveloped residential zoned areas are located.

Base data for year 2016 traffic flows were estimated using the following:

- Gregory Street and Arakoon Road flows were estimated through linear projections from data obtained in previous years, including both Council data and data collected by ERM in a 2004 traffic survey;

- Belle O'Connor Street flows were estimated based on total development yield from existing residential areas (Oceanside Estate), at RTA generation rates of nine vehicles per day per dwelling and 0.85 trips in peak hour per dwelling plus a conservative 10% weighting for other traffic (eg SWR STP, other land use); and

- Steve Eagleton Place traffic flows were based on the relative area of undeveloped zone 2(a) residential land to the west of Gregory Street. This was estimated at 300% from Steve Eagleton Place to the west of Gregory Street, representing future development of residential zoned areas, with 6 hectares of existing development and 18 hectares undeveloped.

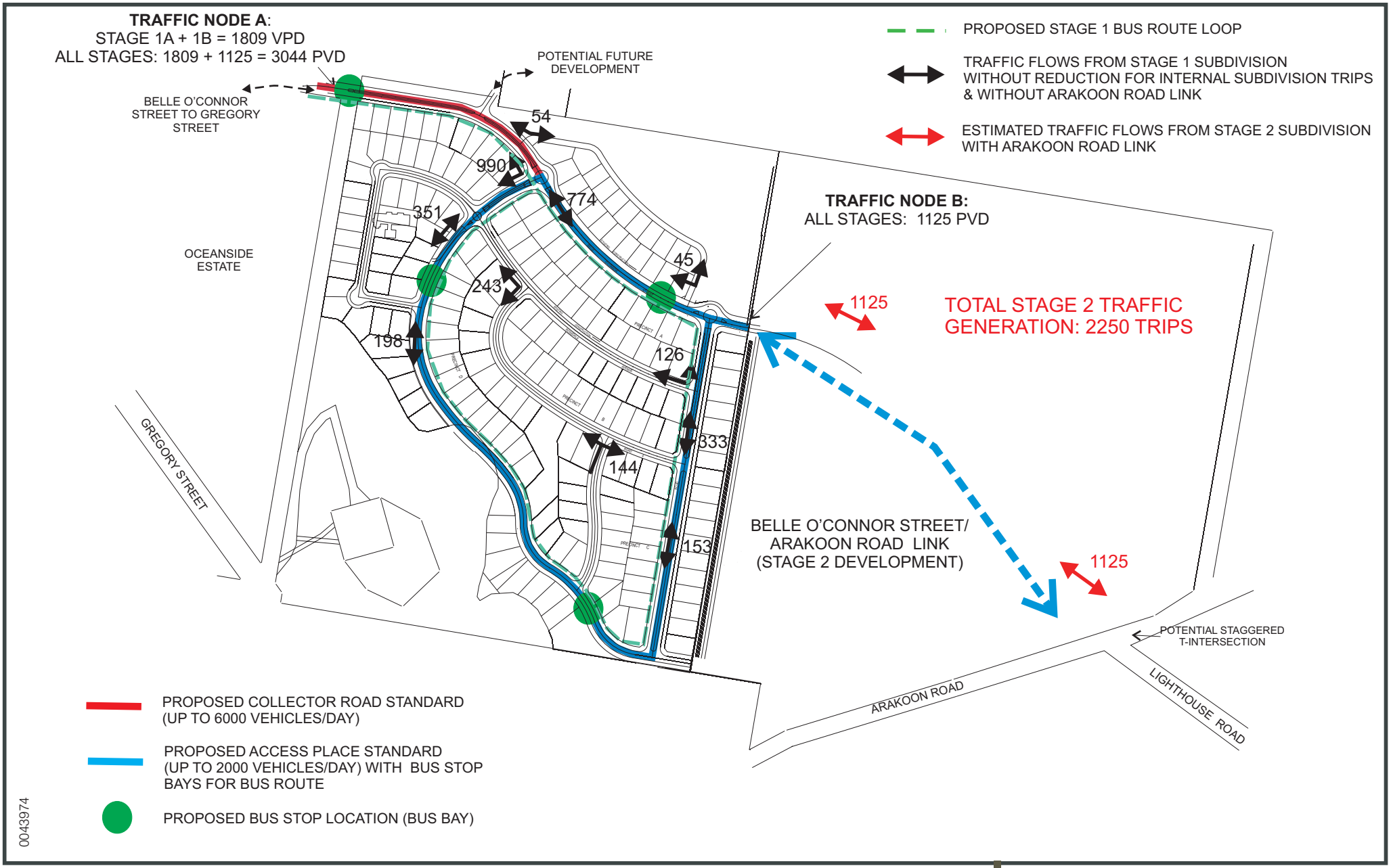

Figure 2.2 Internal Traffic Distribution with Proposed Road Hierarchy

Proposed Subdivision, Waldel Park Traffic Impact Assessment, South West Rocks for WB & ME Wall
Base Image: King & Campbell (2006)

Table 2.1 Road Volume Data and Predicted Year 2016 Flows (Vehicles/day), Base Case

Road	Location	1995 Data	2002 Data	2003 Data	2006 Estimate	2016 Estimate
Arakoon Road	East of Gregory Street	558	-	768	846[1]	1,110 [1]
Gregory Street	At Belle O'Connor Street	4,352	4,562 [3]	-	6,980[2]	9,364 [2]
Belle O'Connor Street	East of Gregory Street	-	644	-	900[2]	1,297[4]
Steve Eagleton Place	West of Gregory Street	-	-	-	300[2]	1,200[5]

(1) Estimated from Traffic Growth trends, Year 1995 to 2003
(2) Estimated from Traffic Growth trends, Year 1995 to 2004 ERM traffic count
(3) Average of two Council counts undertaken in 2002 (3,138, 5,985)
(4) Estimated for 131 dwellings in Oceanside Estate + 10% for other road users
(5) Estimated 300% growth over existing levels

2.4 *CRITICAL INTERSECTION OPERATION: BELLE O'CONNOR STREET/GREGORY STREET/STEVE EAGLETON PLACE ROUNDABOUT*

This intersection is currently arranged as a four-way roundabout with one circulating lane. It is the primary road link for residential development areas along Belle O'Connor Street and Steve Eagleton Place and forms the major access point to the proposed development.

A morning peak hour intersection traffic survey was undertaken at the roundabout on 25 August 2004. The survey identified the weekday morning peak hour as 8.30am to 9.30 am. Data for the peak hour period was utilised as the basis for year 2006 input flows, with additional loading for annual increases in traffic (*Annex A*). Heavy vehicle composition was found to be 4.8% of total traffic from all approaches, with heavy vehicles originating from Belle O'Connor Street tending to be associated with construction activities in Oceanside Estate.

Intersection operation was modelled using aaSIDRA. This modelling software calculates a Level of Service (LOS) based on the average vehicular delay for turning vehicles. The assessment criteria used to interpret the aaSIDRA model results are presented in *Table 2.2,* which indicate the relationship between the average delay and the LOS as presented in RTA (2002).

Table 2.2 Intersection Level of Service (LOS) Criteria

LOS	Average delay per vehicle (secs/veh)	Comments for Roundabouts
A	Less than 14	Good
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Near capacity
E	57 to 70	At capacity, requires other control mode

Notes: Table adapted from RTA *Guide to Traffic Generating Developments* (2002).

The above traffic data and the following parameters were adopted for use in the aaSIDRA model:

- Annual traffic growth between 2004 and 2006 for Gregory Street was estimated at those rates recorded in road data (+3.7%/year);
- the speed limit of Gregory Street is 60 km/hr, with Belle O'Connor Street Steve Eagleton Place being 50 km/hr; and
- the heavy vehicle compositions were approximated from the ERM traffic survey results (5%).

The modelling results indicated a highest average delay of 9.4 seconds for the Belle O'Connor Road approach under year 2006 conditions. The intersection was found to operate at a Level of Service 'A' for the morning peak hour (*Annex A*), with good conditions and spare capacity.

2.5 PUBLIC TRANSPORT, CYCLING AND PEDESTRIAN FACILITIES

2.5.1 Bus Routes

Existing bus routes along Gregory Street between the South West Rocks town centre and Kempsey are serviced by Cavanagh's Coaches three times daily. The nearest existing public bus stop to the site is located adjacent to the Gregory Street Shopping Centre. School buses operate along Gregory Street, with school bus stops located adjacent to the Belle O'Connor Street intersection.

2.5.2 Pedestrian and Cyclist Links

Pedestrian links near the site are located along existing roads as indicated in *Figure 2.1*. Concrete footpaths have been constructed along Belle O'Connor Street in Stage 1a of Seascape Grove. This footpath commences again near Gregory Street, linking to footpaths along Gregory Street. There are no designated pedestrian crossings in place across Gregory Street in this location. There is a break in the raised median opposite the Shopping Centre, which provides an opportunity for pedestrian refuge.

The Draft *South West Rocks Pedestrian Access Mobility Plan* (Cardno MBK 2003) classed pedestrian movements along Gregory Street in the vicinity of Belle O'Connor Street as being both school-related ('second priority') and as a Recreational Route ('lower priority'). Arakoon Road and Belle O'Connor Street are not indicated as a potential or existing pedestrian route on the plan.

The concrete footpath along the eastern side of Gregory Street acts as a combined pedestrian/cyclist path. Other cyclist movements are limited to roadways including Arakoon Road and Belle O'Connor Street.

3 PROPOSED ROAD AND ACCESS NETWORK

3.1 PLANNING CONSIDERATIONS

The following planning documents were taken into consideration in the proposed subdivision road and access design.

3.1.1 Kempsey DCP No 36 - Guidelines for Engineering and Subdivision

Kempsey Development Control Plan No 36 – Guidelines for Engineering and Subdivision provides assistance with the design and construction of engineering works associated with subdivisions and developments.

Section D1 of DCP 36 contains requirements that apply to the geometric design of roads. Clause D1.02 states that the provision of a road system within a subdivision should:

- provide convenient and safe access to all allotments for pedestrians, vehicles and cyclists;
- provide safe, logical and hierarchical transport linkages with existing street system;
- provide appropriate access for buses, emergency and service vehicles;
- provide for a quality product that minimises maintenance costs;
- provide a convenient way for public utilities;
- provide an opportunity for street landscaping,
- provide convenient parking for visitors; and
- have appropriate regard for the climate, geology, flora, fauna and topography of the area.

Table D1.5 of DCP 36 specifies minimum road reserve and carriageway widths that apply to urban roads. These minimum road widths are documented in *Table 3.1.*

Table 3.1 Typical Minimum Widths of Urban Roads, Kempsey DCP 36

Category of Road	Traffic Volume (Vehicles/day)	Carriageway Width Minimum in metres	Total Road Width including Road Reserve
Type 1: Access Place	200	7	15
Type 2: Local Street	2,000	9	16
Type 3: Collector Road	6,000	11	19
Type 5: Arterial (2 lane)	10,000	15 including median	22
Type 6: Arterial (4 lane)	>10,000	25 including median	34

Source: *Kempsey Development Control Plan No 36*

For roads catering for bus routes, additional features as provided in *Table 3.2* apply.

Table 3.2 Characteristics of Bus Routes, Kempsey DCP 36

Class of Road	Carriageway Width (m)	Bus Stop spacing (m)	Bus Stop Bay type
Collector Road	11	400	Indented
Arterial/Distributor (2 lane)	13	400	Shelters
Arterial (4 lane)	13	400	Shelters & Bays

Source: *Kempsey Development Control Plan No 36*

Section D1.19 of the DCP discusses traffic calming within subdivisions. The following points are made:

- the use of traffic calming devices including speed humps, chicanes, splitter islands should be avoided where possible by appropriate geometric design;
- where bus routes are involved, buses should be able to pass without mounting kerbs and with minimum discomfort to passengers; and
- maximum vehicle speeds can only be reduced by deviation of the travelled path, including:
  - horizontally: slow points, roundabouts and corners; and
  - vertically: humps, platform intersections, platform pedestrian crossings.

3.1.2 Coastal Design Guidelines for NSW

The *Coastal Design Guidelines for NSW* was produced in 2003 by the Coastal Council. The document is designed to provide a framework for discussion and decision making involving coastal planning, design and development proposals between all stakeholders in the context of caring for the natural beauty and amenity of coastal beaches, headlands, waterways and ecology upstream.

With regard to traffic issues, the Guidelines specify that new coastal settlements should provide a street pattern that:

- is interconnected and permeable;
- responds to the landform and view corridors;
- creates public neighbourhood centres and a main street;
- avoids privatised enclaves; and
- responds to pedestrian and cycle distances and connects to a local and regional network.

3.2 *PROPOSED ROAD NETWORK*

The proposed road network includes the following components:

Road Layout

King & Campbell Pty Ltd prepared a road layout for the site (*Figure 2.1*). The proposed layout utilises the existing Stage 1a road network.

Belle O'Connor Street would be further extended to the eastern boundary of the site. This allows a link to potential developable land to the east of the site, enabling a road link through to Arakoon Road in the medium to long term.

The proposed street layout includes a local street system that services proposed residential areas while allowing:

- landscaping opportunities;
- compatibility with the site stormwater management system;
- an allotment layout sympathetic with the topography of the site;
- a logical, permeable and flowing two-way street pattern without *culs de sac*;
- road links to potential development areas to the east and north of the site;
- the use of primarily T-intersections;
- access to the open space areas in the north of the study site; and
- links to the sewage treatment works and potentially developable land to the north of the site.

A perimeter road to serve as access for bushfire emergency use is also to be located along the rear of allotments abutting the eastern boundary of the site.

This road will extend along an easement in the adjacent allotment (Lot 22) and meet the temporary accessway to Arakoon Road. The access will be locked, for use during emergencies only.

Road Specifications

It is proposed utilise the following specifications in the road network of the site:

Table 3.3 Proposed Road Specifications, Stages 1b and 1c

Street	Estimated Road Traffic (ADT)	Road Reserve Width	Sealed Width
Belle O'Connor Street east of Stage 1a	> 2,500 + buses	22m	9m with indented bus bays
Road No.2	<1,000 + buses	25m (includes stormwater controls)	10m (divided) with indented bus bays
Burrawong Drive South of Rosedale Avenue	<1,000 + buses	19m	9m with indented bus bays
Other internal roads	<500	16m	7m

ADT – Average Daily Traffic (two way flow)

Intersections

Several intersections would be required in Stages 1b and 1c to service the subdivision and are indicated in the proposed subdivision plans (*Figure 2.1*). These include the use of T-intersections throughout the local road network to meet the Safe Intersection Sight distance for 50 km/hr zones (80 metres, RTA 1999).

Temporary Construction and Emergency Bushfire Access

A temporary gravel access road will be constructed linking the site to Arakoon Road. This road would enable construction traffic to avoid impacts to Belle O'Connor Street residences.

Following the construction phase, this road would be used as an emergency bushfire access road. The gate to Arakoon Road would be locked to prevent unauthorised use.

A perimeter road for bushfire fighting purposes will also be constructed along the eastern boundary of the development in the adjacent allotment (Lot 22 DP 1071657). Use of this perimeter road for emergency access will be formalised in an easement utilising a Section 88b planning instrument. This road would be used for emergency use only during operational stages of the development.

Pedestrian and Cyclist Access and Mobility

The design of the subdivision has allowed for pedestrian movements throughout the subdivision and in areas of open space. Formalised pedestrian pathways have been indicated in *Figure 2.1*. Cyclist access will be accommodated on the internal road network.

Existing pedestrian and cyclist access planning does not allow for the significant pedestrian and cyclist links to the site.

The residential development will generate an increased demand for public transport, pedestrian and cyclist links between the site and nearby employment and recreational facilities, particularly:

- 'The Rocks' Shopping Centre;
- the South West Rocks town centre and foreshore;
- the South West Rocks Country Club (recreational opportunities); and
- access to public transport links, primarily along Gregory Street.

Pedestrian and cyclist access to the shopping centre and public transport links along Gregory Street will be enabled along Belle O'Connor Street. The road reserve to the west of the site, linking to Gregory Street more directly, is quite steep and not considered to represent a suitable link. Additionally, there are no crossing facilities on Gregory Street near its intersection with the road reserve.

Similarly, pedestrian and cyclist pathways to the Town Centre and SWR Country Club are available along Gregory Street via Belle O'Connor Street. There is the potential for future, more direct, links along the Crown road reserve to the west of the golf course. This would be ideal in providing a direct off-road pedestrian and cyclist link between the new residential area and the South West Rocks CBD and Country Club. Access to this road reserve is able to be obtained from the proposed development via Belle O'Connor Street.

Public Transport

Existing bus routes along Gregory Street between South West Rocks town centre and Kempsey are serviced by Cavanagh's Coaches three times daily. Pedestrian links to Gregory Street are required to access such services until Belle O'Connor Street can be linked to Arakoon Road that may allow bus services to utilise Belle O'Connor Street.

The proposed development will make provision for future bus routes through the urban area via Belle O'Connor Street, Road No.2 and Burrawong Drive. This conceptual route are indicated in *Figure 3.1*.

With a bus route along these roads, the majority of the residential area is within 400 metres of the route in accordance with Kempsey DCP No 36 requirements. The road pavement along Belle O'Connor Street will be kept free from any road pavement alterations or traffic calming treatments that may inhibit bus movement. This arrangement also allows future links to potential development to the east via Belle O'Connor Street and Burrawong Drive.

4 TRAFFIC IMPACT ASSESSMENT

4.1 TRAFFIC GENERATION AND DISTRIBUTION

Notwithstanding the future potential for improved public transport access and usage, the predicted traffic generation from the proposed subdivision is based on RTA traffic guidelines (RTA 2002), which are consistent with relatively low levels of public transport usage.

Development of the entire site was considered (i.e. existing Stage 1a plus new Stages 1b and 1c) so as to allow for a maximum level of traffic generation and a conservative assessment. It is assumed Stage 1c (currently subject to concept approval) would provide a further 66 allotments. Therefore the sum of Stage 1 development would be 201 allotments.

The potential future development of land to the east was also considered as part of this traffic assessment. This is labelled as 'Stage 2' and it is estimated that this will possibly provide up to 250 low-density residential allotments. It was assumed this area would be serviced by a further extension of Belle O'Connor Street, which would link to Arakoon Road as part of Stage 2 works. The potential Arakoon Road intersection was not examined as part of this assessment.

4.1.1 *Stages 1a, 1b and 1c Residential Subdivision*

The traffic generation rates indicated in *Table 4.1* were assumed for Stages 1a, 1b and 1c of the proposed development.

Table 4.1 Adopted Traffic Generation Rates for Proposed Residential Development, Stage 1 Subdivision

Development Component	Daily Generation Rate (1)	Total Daily Generation	Weekday Peak Hour Generation	Total Peak Hour Generation
Residential Dwellings (208 lots)	9 trips/dwelling	1,872	0.85 trips/dwelling	177

Notes: (1) Based on RTA (2002)

4.1.2 *Stage 2 Development*

While details of the Stage 2 area have not been established, it is estimated that up to 250 low-density residential allotments may result from the potential subdivision of this area. Based on this estimate, the traffic generation for Stage 2 is indicated below in *Table 4.2*.

Table 4.2 ***Adopted Traffic Generation Rates for Proposed Residential Development Stage 2 Subdivision***

Development Component	Daily Generation Rate	Total Daily Generation	Weekday Peak Hour Generation	Total Peak Hour Generation
Standard (Low Density) Residential Areas (Approx 250 lots)	9 trips/dwelling	2,250	0.85 trips/dwelling	213

4.1.3 Distribution of Traffic

The proportion of internal and external site traffic generation has been assumed in accordance with NSW RTA (2002) guidelines for new residential subdivisions (25% internal/75% external).

It was assumed that:

- for development Stages 1a, 1b and 1c, all traffic would access the site from Belle O'Connor Street;
- for Stage 2, it was assumed that 50% of the traffic generated from Stage 2 would utilise Belle O'Connor Street to access Gregory Street. The balance would utilise the new road link to Arakoon Road to access the external road system.

Therefore the total generation to Belle O'Connor Street for Stage 1 of the subdivision would be 1,404 vpd. The total combined traffic to the road for Stages 1 and 2 would be 3092 vpd in total. When split between potential east/west movements in Stage 2, the total traffic generation to Gregory Street from Stages and 2 would be 2,248 vehicles per day.

Turning movements at the Gregory Street/Belle O'Connor Street roundabout were modelled to be consistent with distribution identified from traffic surveys undertaken, including:

- a 54%/46% north/south split for turns from Belle O'Connor Street; and
- a 60%/40% AM/PM peak hour split for vehicles entering and leaving Belle O'Connor Street.

4.1.4 Construction Traffic

Construction traffic would travel to and from the site over a short-term to establish the estate. These include:

- heavy vehicles importing fill;
- floating of construction plant;
- importing other materials for use; and
- light vehicles for construction personnel.

King and Campbell calculated a trip rate of 19 heavy vehicles per day based on fill requirements and the approximate construction period.

It is proposed that these trips will occur along the temporary road access from Arakoon Road. This would therefore avoid impacts to Belle O'Connor Street and Gregory Street. This temporary access road is wholly located within the proponent's land.

4.2 *ADEQUACY OF INTERNAL ROAD NETWORK*

The adequacy of the proposed internal site road network is discussed below in terms of the following:

- Belle O'Connor Street, the collector road for the development;
- local streets with widening to allow stormwater or bus route treatments;
- other local streets; and
- future traffic flows from adjacent areas with development potential.

Indicative traffic flows on the road network, based on residential traffic generation rates, are indicated in *Figure 2.2*.

4.2.1 *Belle O'Connor Street*

At the western boundary of the study area adjoining the existing carriageway (Traffic Node A), Belle O'Connor Street would be required to accommodate predicted daily traffic usage of approximately 1,404 vehicles daily for the Stage 1 subdivision. A total traffic generation of 3,092 vehicles would utilise the road upon completion of the Stage 2 subdivision, with an estimate of 2,248 vehicle trips linking to Gregory Street and 844 vehicle trips to Arakoon Road.

The extension to Belle O'Connor Street to be constructed as part of Stage 1b is likely to carry traffic flows up to 2,500 vehicles daily due to Stage 1 and 2 development (Traffic Nodes B and C). Therefore it is proposed to provide a road construction of 'local' street minimum standard with a capacity in accordance with Kempsey DCP No. 36. The Belle O'Connor Street road reserve through Stage 1b will be maintained at 22 metres width. Indented bus bays would be located along this route in accordance with Kempsey DCP 36 requirements.

Potential Road Treatments for Stage 2

It is recognised that should Belle O'Connor Street be linked to Arakoon Road in the potential future Stage 2 development, that there may be some through-traffic use between Gregory Street and Arakoon Road. This may lead to issues of:

- increased public safety risk along Belle O'Connor Street due to the speed of through traffic;
- a decrease in environmental amenity in the subdivision due to the greater number of traffic movements, including noise, air quality and public safety; and
- the need for unnecessary infrastructure investment and maintenance.

It is recommended that traffic should be encouraged to continue to utilise Arakoon Road as the primary link to Gregory Street rather than Belle O'Connor Street. This could be encouraged through:

- speed controls: retention of an 80 km/hr speed limit on Arakoon Road and the establishing of a 50 km/hr design speed limit of Belle O'Connor Street;
- implementing traffic-calming measures along Belle O'Connor Street within Stage 2, including the following:
    - use of staggered intersections or bends in alignment, while maintaining the function of bus routes; and
    - creation of a 'gateway' effect at Arakoon Road.

These measures would be examined in designs of Stage 2 road layout and are not further discussed in relation to Stage 1.

4.2.2 *Other Internal Roads*

Other internal roads in Stage 1 subdivision are expected to carry volumes of less than 1,000 vpd. To promote residential amenity and reduce unnecessary hard-paved areas to meet stormwater objectives, it is proposed to provide a 7 metre sealed carriageway and 16 metre wide road reserve.

Widening will be required for landscaping and stormwater treatments along Road No. 2. Where this is required, the road reserve width has been set to allow for indentation of bus stops and the provision of a landscaped median.

4.3 *ADEQUACY OF EXTERNAL NETWORK*

4.3.1 *Additional Traffic on External Road Network*

The predicted increases in daily traffic flows external to the site are indicated in *Table* 4.3. Estimates of generation will provide an increased total of 2,248 vehicles per day to Gregory Street following Stage 2 development.

Table 4.3 Additional Daily Traffic Volumes, Year 2016 including Stage 1 and 2 Development

Road	Location	Year 2006 Estimate	Year 2016 Estimate	Year 2016 Additional Development Traffic	% Increase Due to Additional Development
Gregory Street	North of Belle O'Connor Street	6,980	9,364	+1,214	12.96
	South of Belle O'Connor Street	6,980	9,364	+1,034	11.04
Belle O'Connor Street	East of Gregory Street	900	1,125	+2,248	199.8
	West of Gregory Street	300	1,200	0	0

In percentage terms, the future traffic increase in comparison to the base year 2016 traffic volumes will be noticeable (typically over five percent) on Gregory Street and Belle O'Connor Street. The implications of these traffic increases are discussed in the following section.

4.4 *INTERSECTION OPERATION AND CAPACITY*

4.4.1 *Belle O'Connor Street/Gregory Street Roundabout*

Future intersection performance was assessed using the aaSIDRA traffic modelling software. Analysis was undertaken on four scenarios:

- year 2006 (existing) traffic volumes, based on projections from ERM traffic surveys and recent Council ADT data;
- year 2016 (base case) traffic volumes, projected from Council data;
- year 2016 traffic volumes, with Stage 1 development traffic added; and
- year 2016 traffic volumes, with Stages 1 and 2 development traffic added.

Traffic model input and output values for each scenario under morning (AM) peak hour conditions are provided in *Annex A*. Heavy vehicle composition was conservatively estimated at 5 percent of total traffic flows on all roads.

The intersection analysis results are summarised in terms of degree of saturation, average vehicular delay and level of service for each intersection in *Table 4.4*. In all cases the roundabout will operate at a Level of Service A with minimal delays.

A sensitivity analysis was undertaken on the 2016 base case and with both stages of development added to account for additional traffic flows on the arterial road network during peak traffic periods. An increase in traffic flows of 20% on Gregory Street increased worst case average delay at the intersection by only 0.7 seconds for both the 2016 base case and with development flows. Under both tests the delays remained well below the 15 second threshold for Level of Service B.

Table 4.4 Intersection Performance with Proposed Development

Scenario	Degree of Saturation	Level of Service	Average Delay(s)
Year 2006 AM peak (Current Conditions)	0.235	A	9.4
Year 2016 AM peak (Base case)	0.350	A	10.4
Year 2016 AM Peak + Stage 1 development	0.390	A	10.9
Year 2016 AM peak + Stage 1 & 2 development	0.423	A	11.2

4.5 PUBLIC TRANSPORT, CYCLIST AND PEDESTRIAN FACILITIES

The proposed development will make provision for future bus routes through the urban area via Belle O'Connor Street, Road No.2 and Burrawong Drive. With a bus route along these roads, the majority of the residential area is within 400 metres of the route in accordance with Kempsey DCP No 36 requirements.

Pedestrian facilities are proposed throughout the estate and will compliment the existing footpath constructed as part of Stage 1a work. Direct links to Gregory Street via the unformed road reserve to the south are limited due to steep topography and lack of suitable crossing opportunities on Gregory Street at that location.

5 *CONCLUSION*

The traffic generation from the proposed Seascape Grove residential development is predicted to result in a maximum of 1,404 additional daily vehicle movements to Gregory Street via Belle O'Connor Street for Stage 1 of the estate. It was estimated that a further 2,248 vpd would utilise the Belle O'Connor Street to access Gregory Street once Stage 2 is completed. There would be a partial distribution of Stage 2 traffic flows towards Arakoon Road when Belle O'Connor Street is extended through to Arakoon Road as part of Stage 2 works.

In percentage terms, the future traffic increase in comparison to the base year 2016 traffic volumes will be noticeable (typically over five percent) on roads in the vicinity of the site, including Gregory Street and Belle O'Connor Street.

Traffic modelling results indicate the existing Belle O'Connor Street/Gregory Street/Steve Eagleton Place roundabout could cater for year 2016 base case traffic at a Level of Service 'A' with minimal delays and spare capacity. The proposed development would not alter this Level of Service.

The internal road network has been established with regard to Council design standards and the aim to maintain residential amenity and allow integrated stormwater treatment systems. It makes provision for future bus routes along the internal road network.

Designated pedestrian pathways are to be provided throughout the development. Cyclists will be accommodated within the proposed road network.

A perimeter emergency access road network would be constructed in accordance with NSW RFS requirements. This includes a road along an easement located to the east of the common boundary with Lot 22. A temporary access road would be created from Arakoon Road for use during the construction phase. This would continue to be used during the operational phase as an emergency vehicle access only.

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Coastal Council (2003) **Coastal Design Guidelines for NSW**

ERM (2004) **Waldel Park Master Plan**, report prepared for WB & ME Walls.

Kempsey Council (2003) **Future Infrastructure Planning for South West Rocks**, discussion paper.

RTA (2002) **Guide to Traffic Generating Developments**, Roads & Traffic Authority of New South Wales.

RTA (1999) **Road Design Guide**, Roads & Traffic Authority of New South Wales.

Annex A

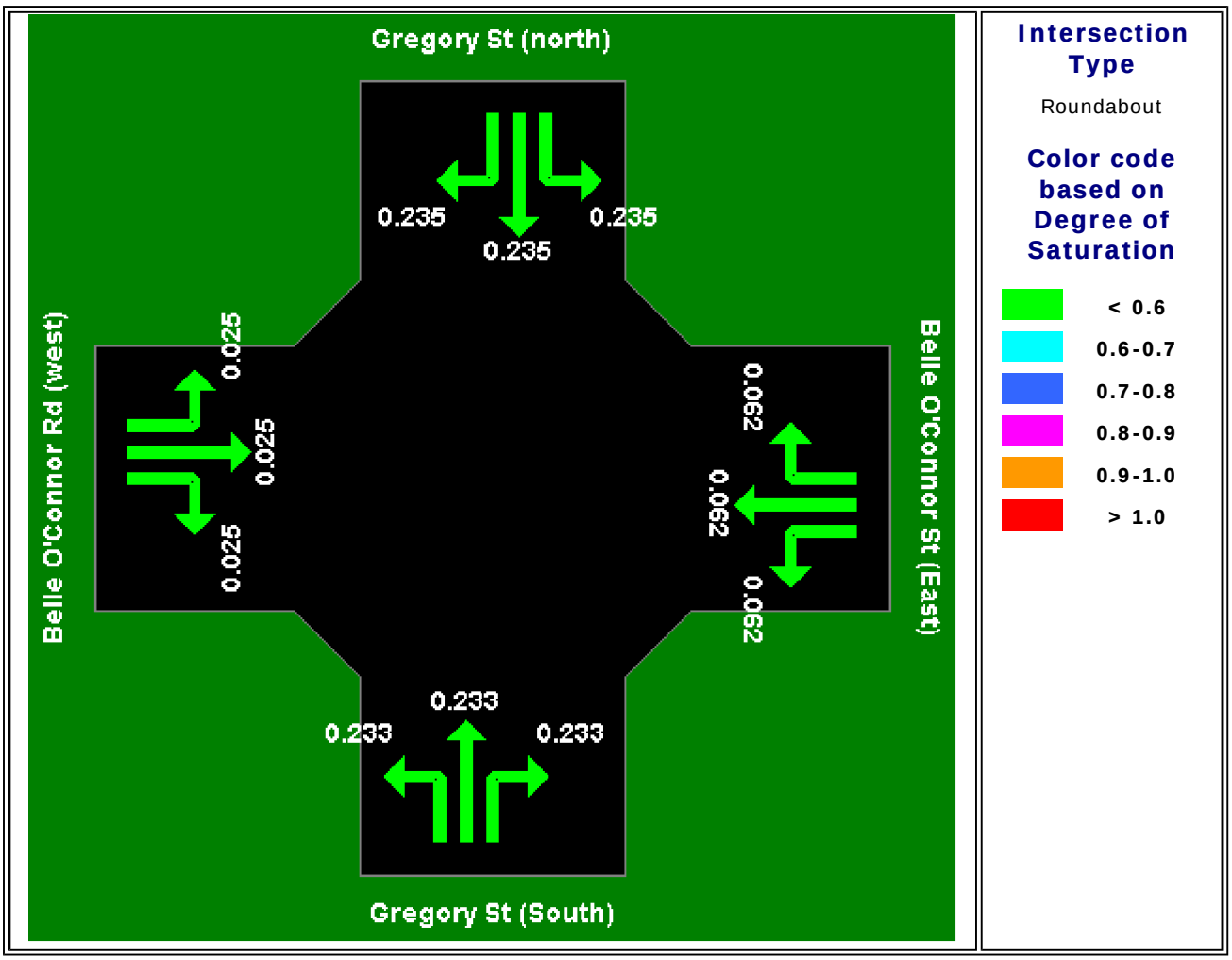
Traffic Model Results

Degree of Saturation

Demand Volume / Capacity (v/c) ratio

Gregory St/Belle O'Connor Rd Roundabout

2006 AM Peak



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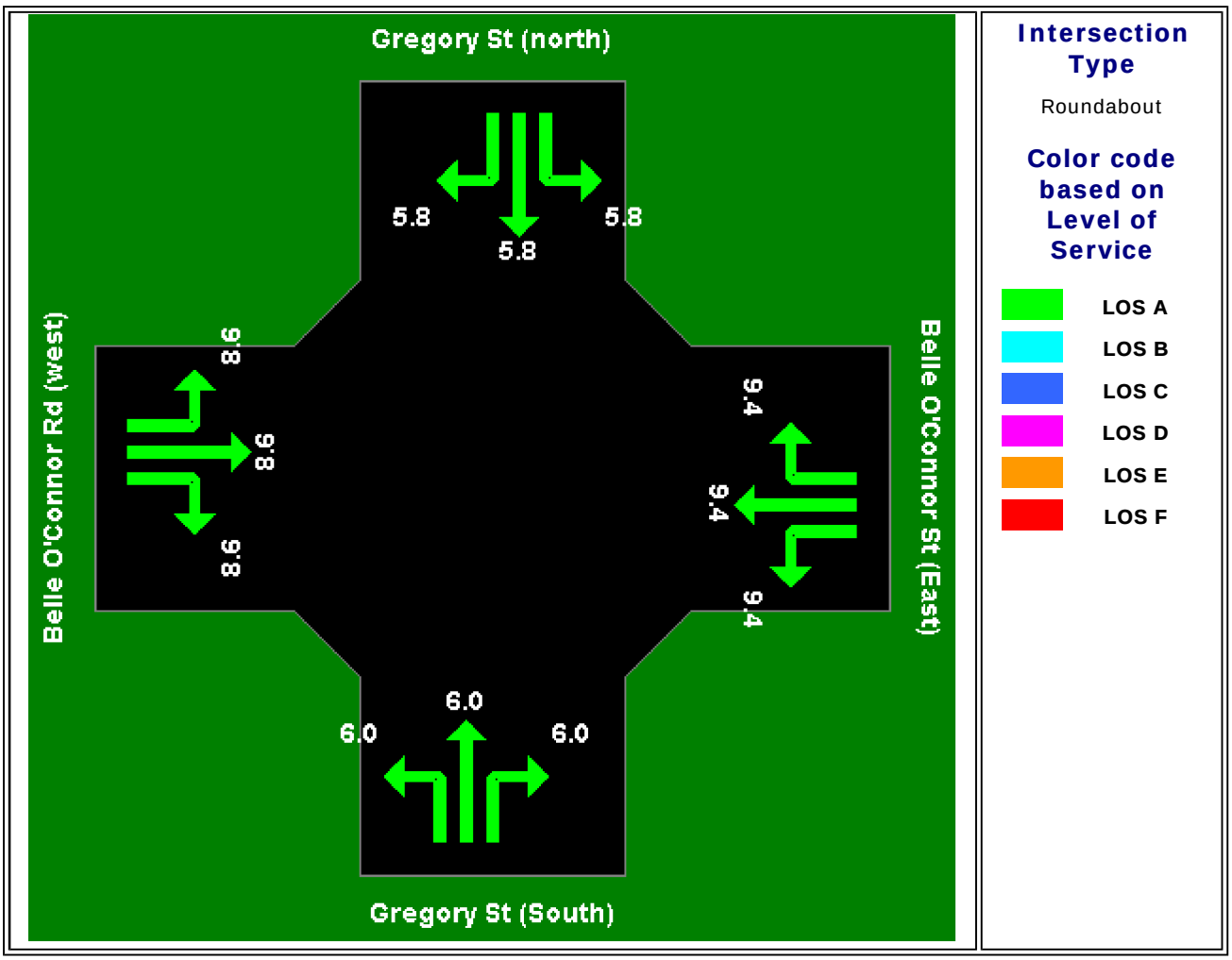
Control Delay (Average)

Average control delay per vehicle (seconds)

Gregory St / Belle O'Connor Rd Roundabout

2006 AM Peak



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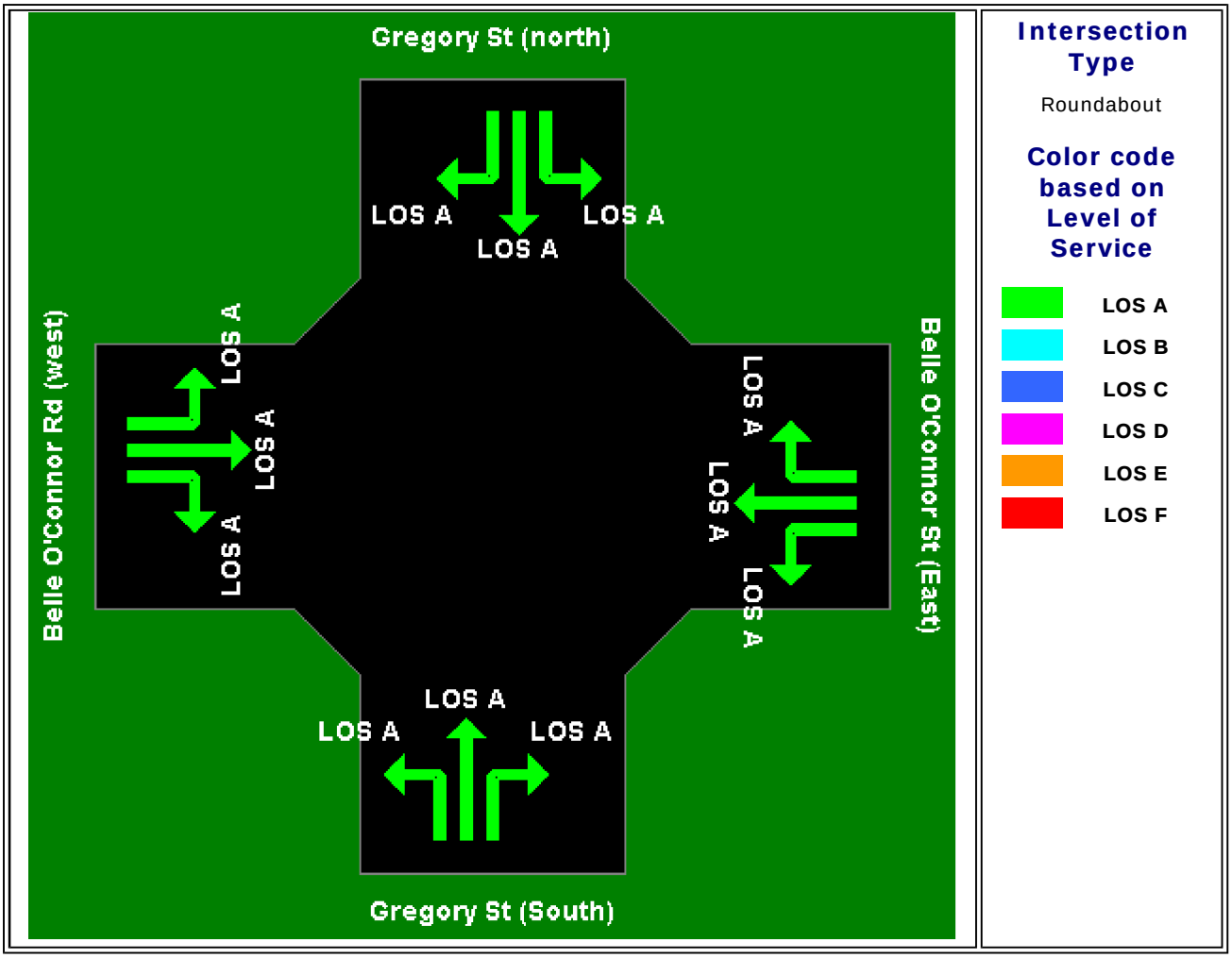
Level of Service

Based on Delay (HCM method)

Gregory St / Belle O'Connor Rd Roundabout

2006 AM Peak



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Degree of Saturation

Demand Volume / Capacity (v/c) ratio

Gregory St/Belle O'Connor Rd Roundabout 2016 AM peak

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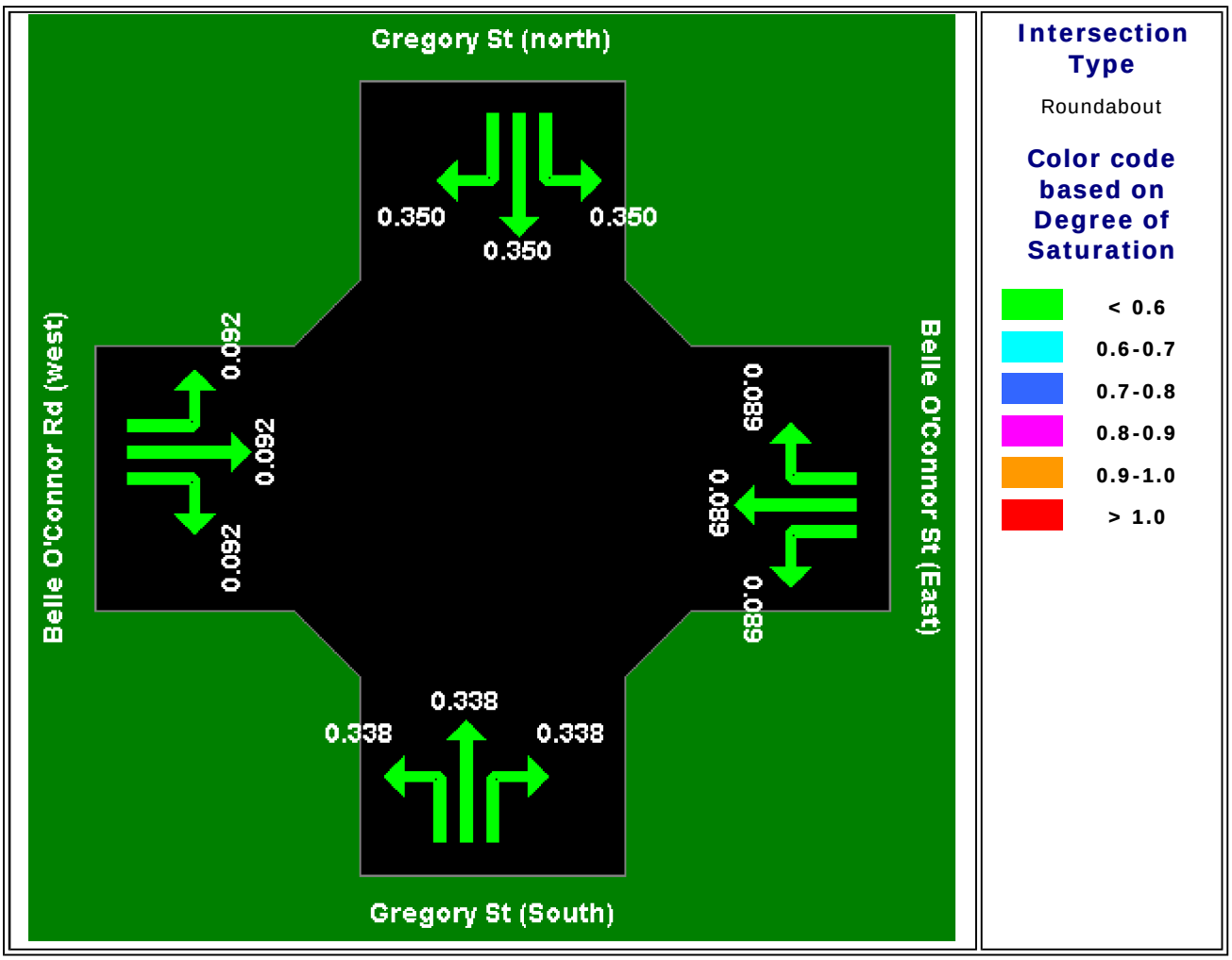

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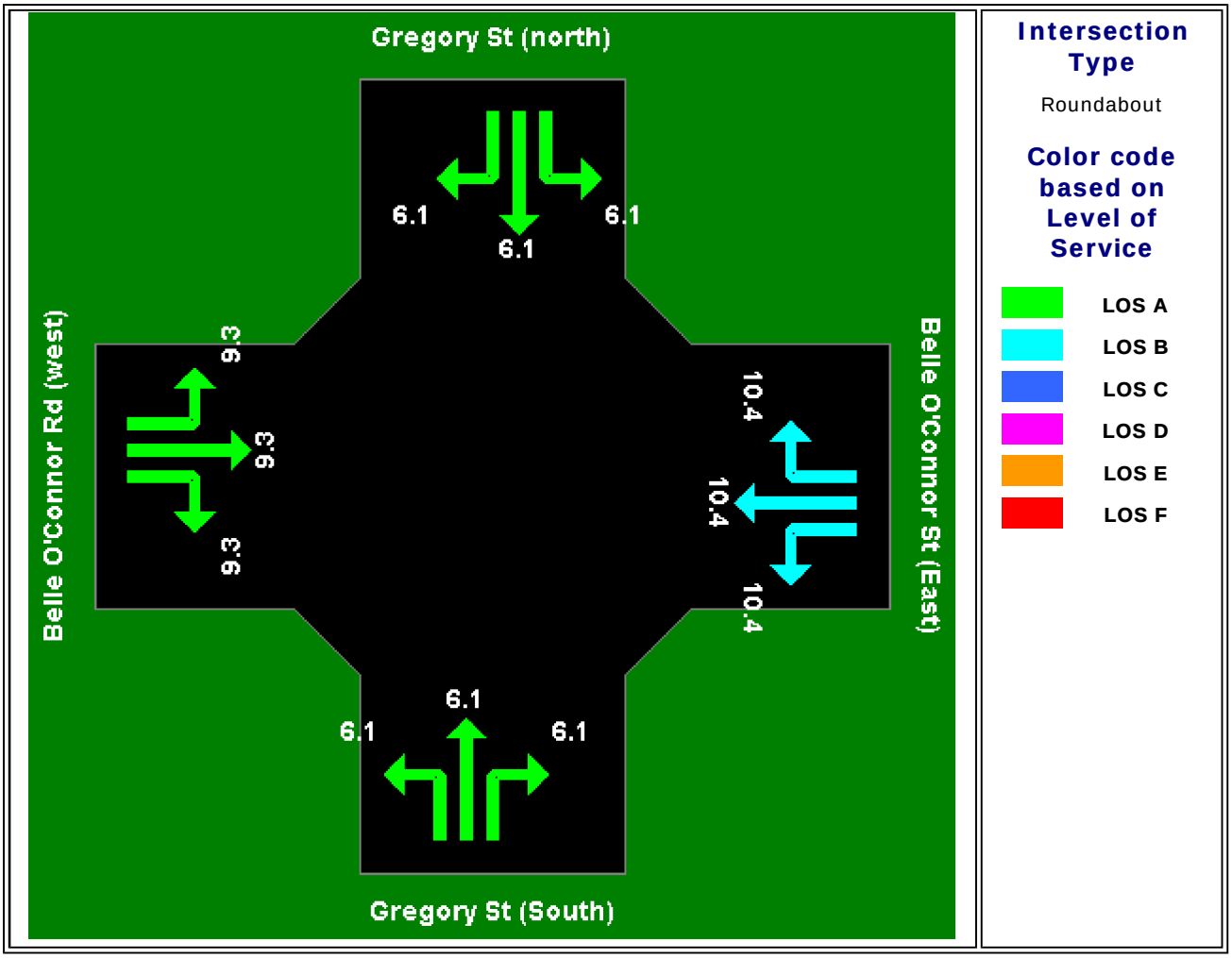
Control Delay (Average)

Average control delay per vehicle (seconds)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak

Subtitle



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Level of Service

Based on Delay (HCM method)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak

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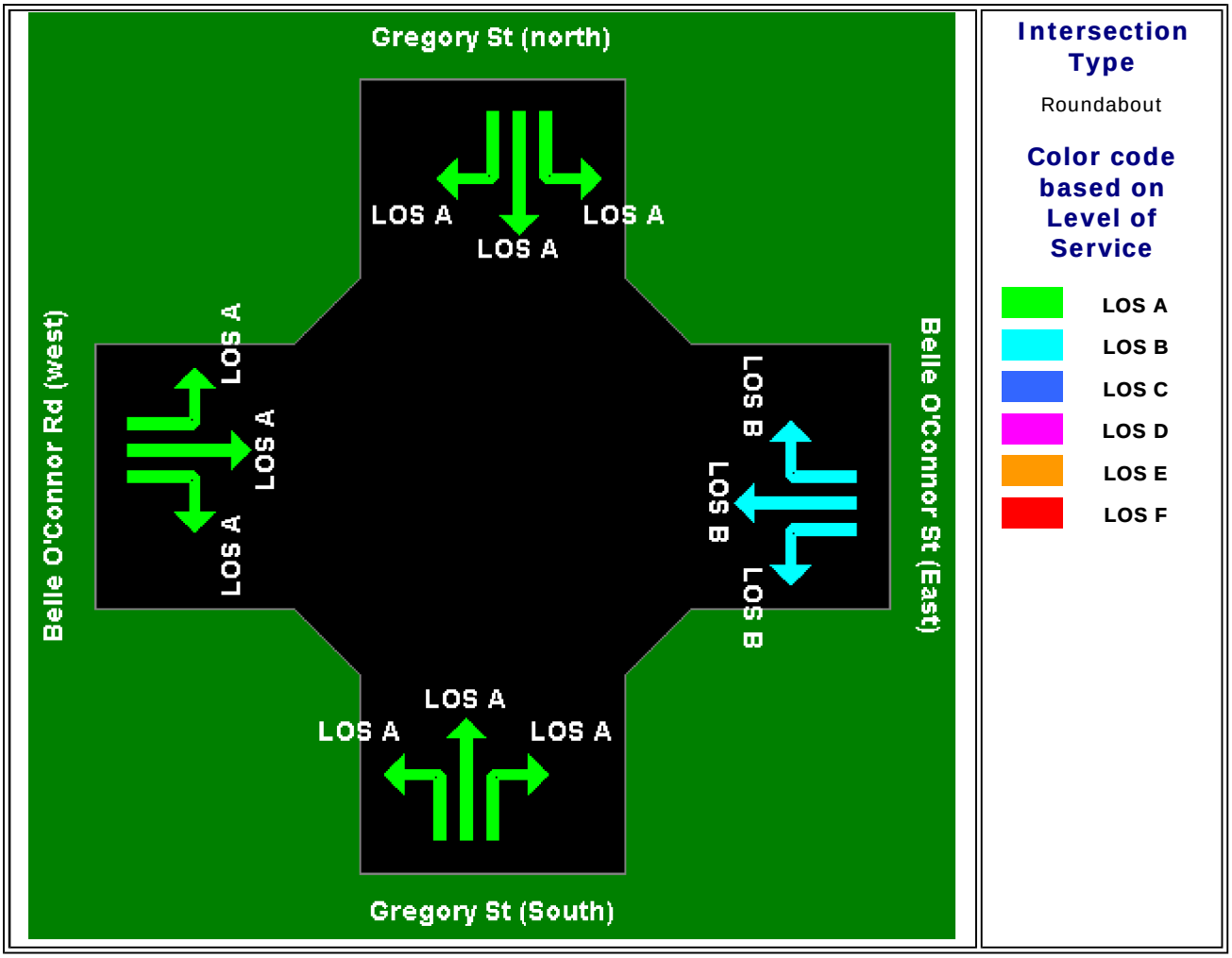

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Degree of Saturation

Demand Volume / Capacity (v/c) ratio

Gregory St/Belle O'Connor Rd Roundabout 2016 AM peak+ Stage 1

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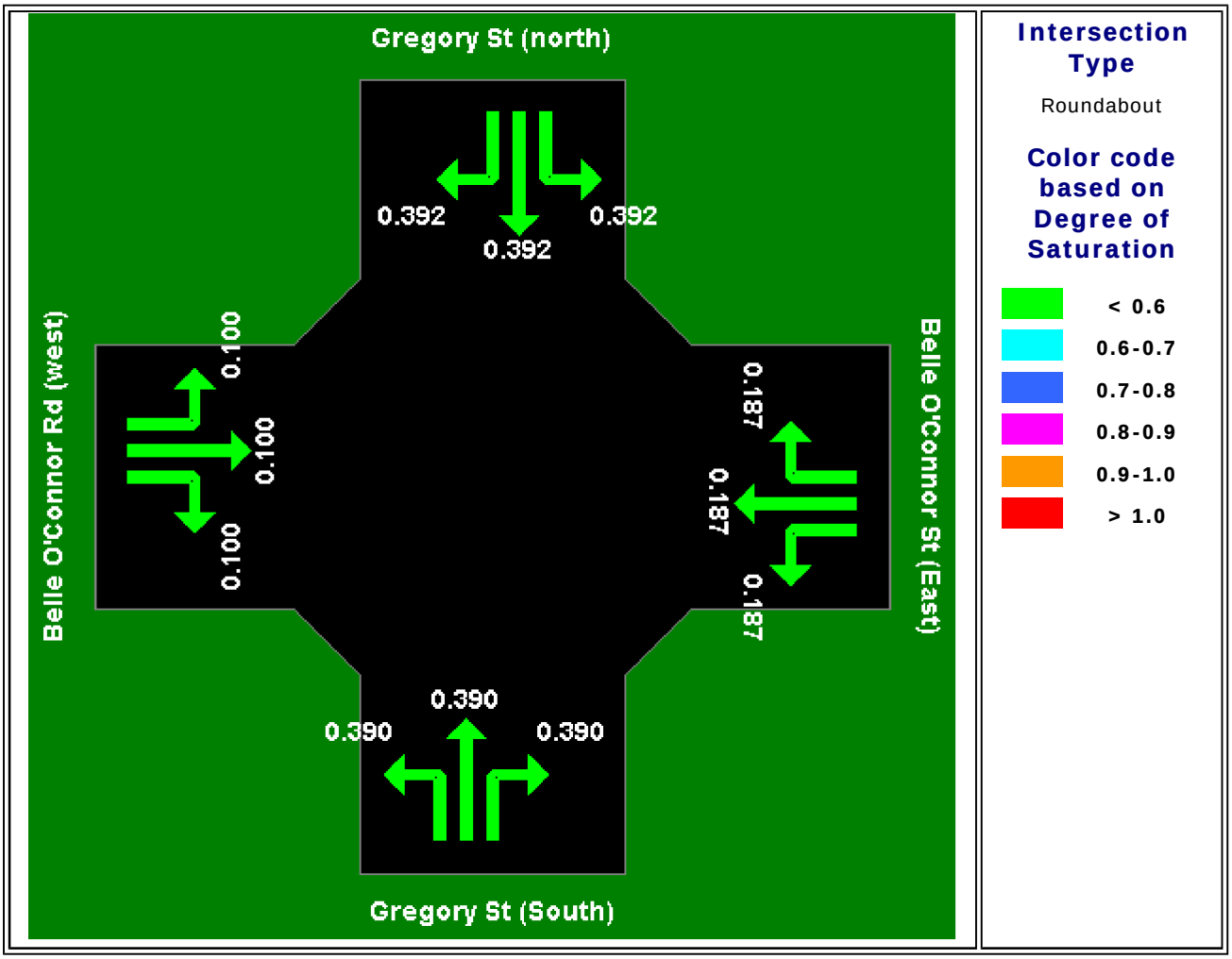

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Control Delay (Average)

Average control delay per vehicle (seconds)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak+ Stage 1

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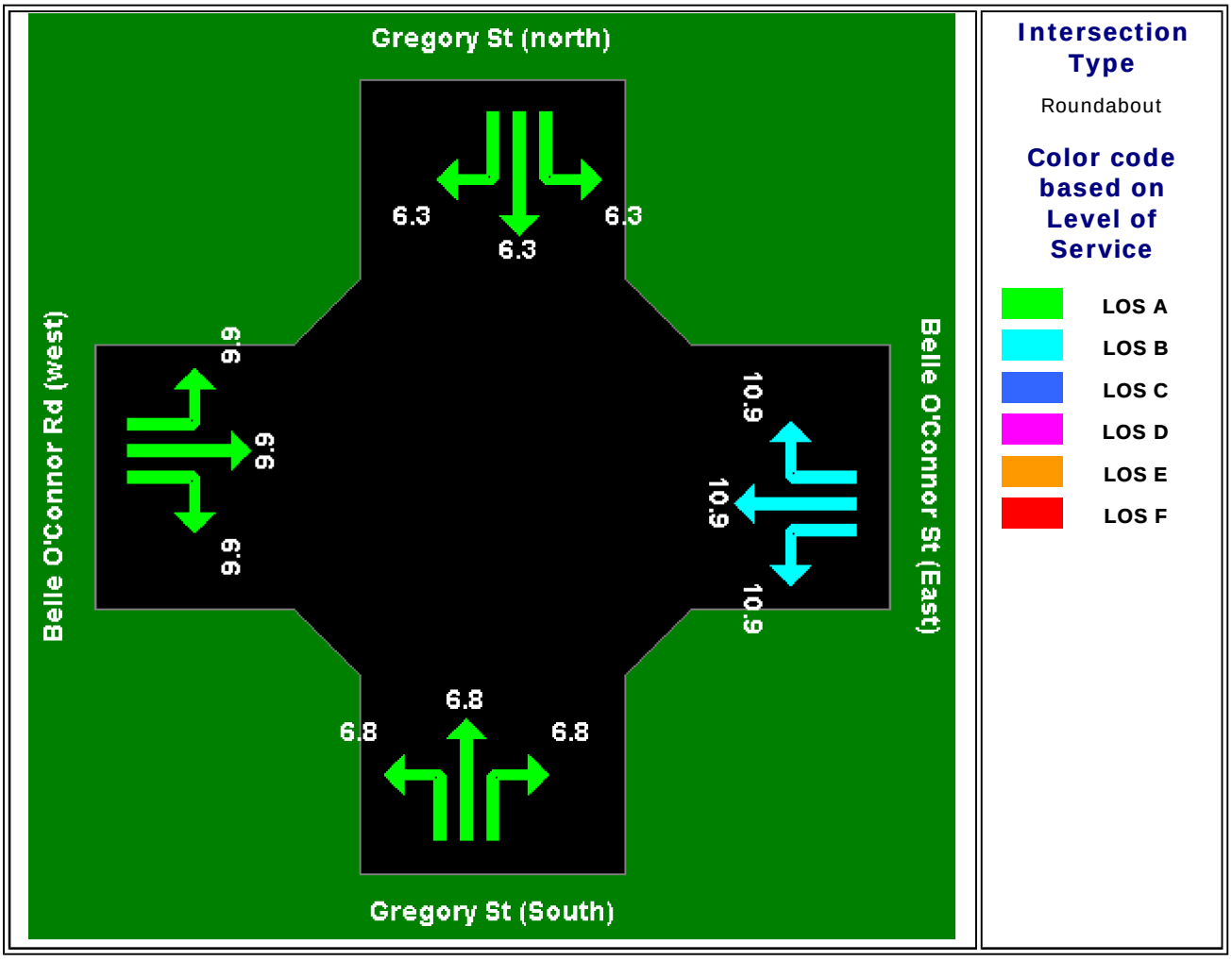

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Level of Service

Based on Delay (HCM method)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak+ Stage 1

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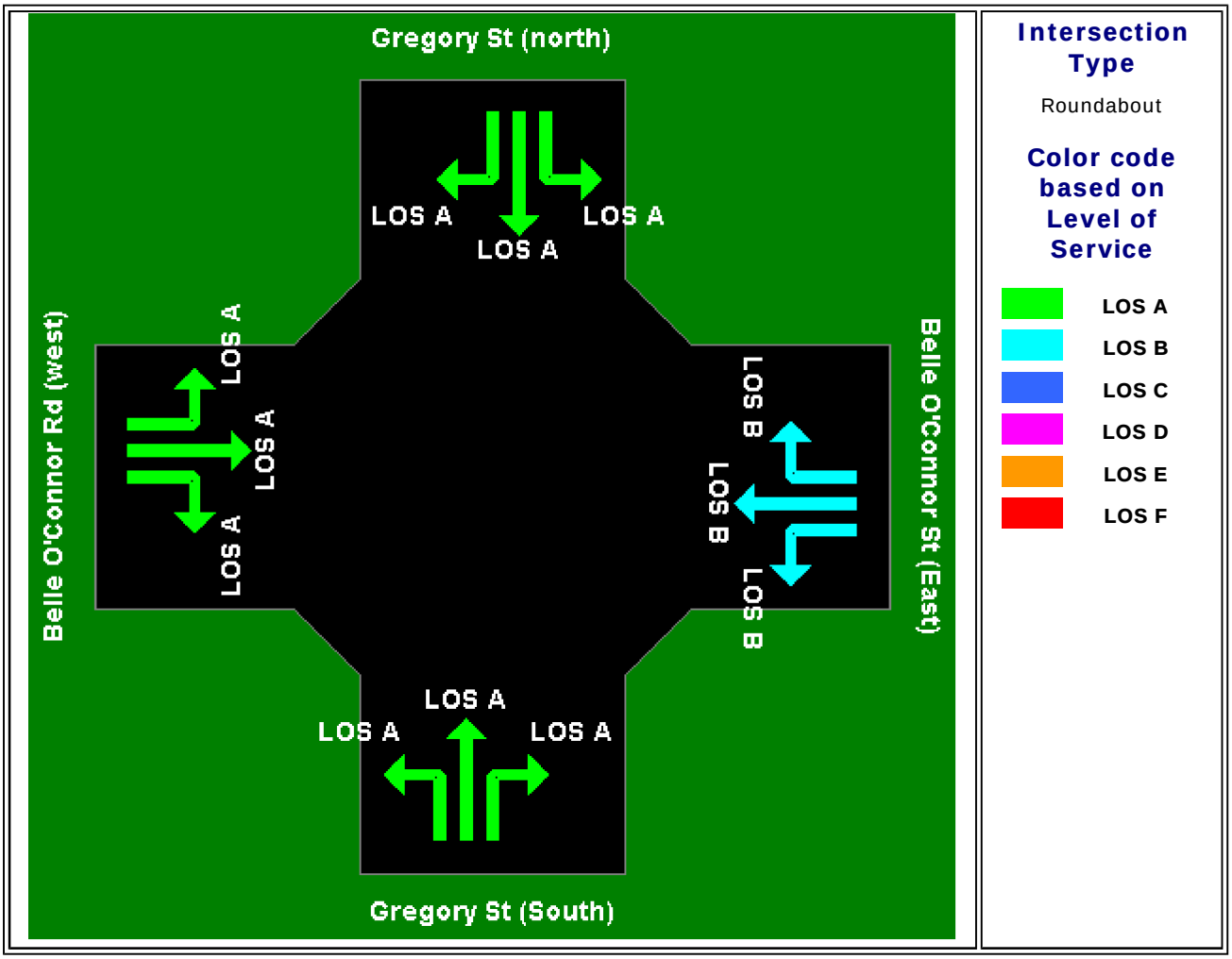

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Degree of Saturation

Demand Volume / Capacity (v/c) ratio

Gregory St/Belle O'Connor Rd Roundabout 2016 AM peak+ Stages1&2

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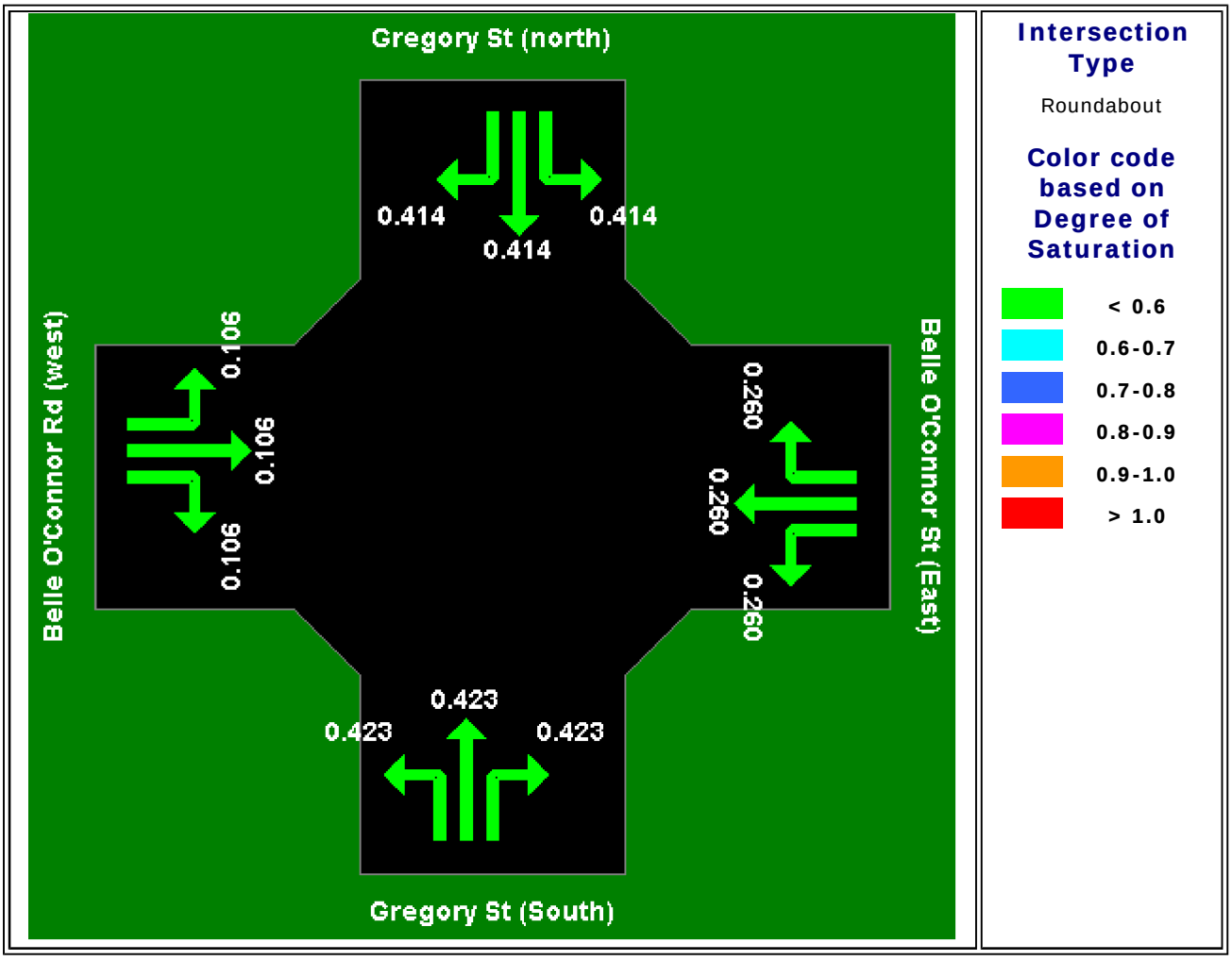

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Control Delay (Average)

Average control delay per vehicle (seconds)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak+ Stages1&2

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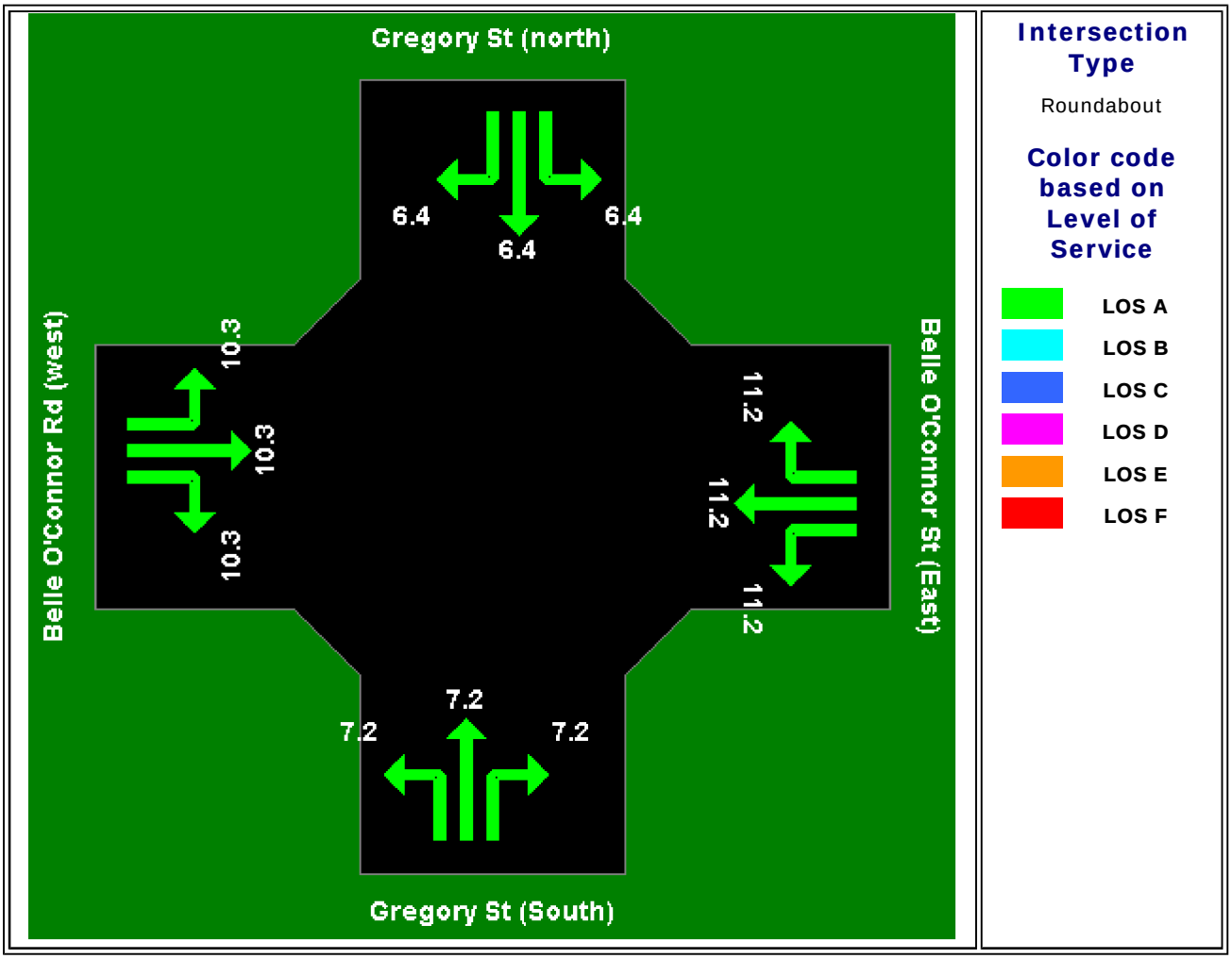

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Level of Service

Based on Delay (RTA NSW)

Gregory St / Belle O'Connor Rd Roundabout 2016 AM peak+ Stages1&2

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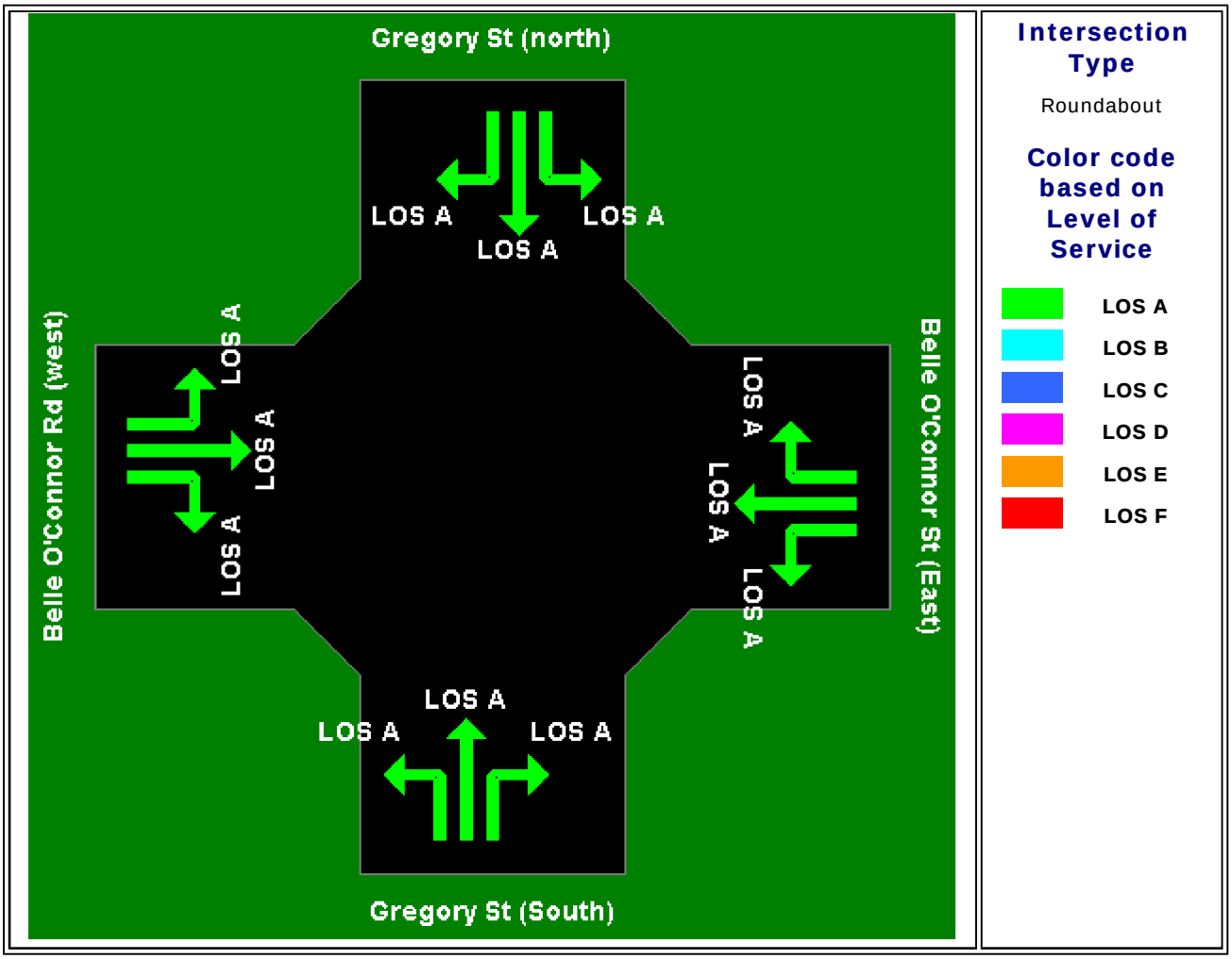

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