CLIENTS | PEOPLE | PERFORMANCE

Goodman International

Bungarribee Industrial Estate

Traffic Impact Assessment

September 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Study Purpose

GHD has been commissioned by Goodman to undertake a traffic impact assessment for the proposed Bungarribee Industrial Estate (Huntingwood West) as part of a Part 3A Project Plan Application to the Department of Planning (DoP).

Due to the size and nature of the proposed development and the proposed vehicular access off the Great Western Highway (a classified state road), the Project Plan Application will require referral to the Roads and Traffic Authority (and Blacktown City Council) under the State Environmental Planning Policy (SEPP) Infrastructure 2007 and the Roads Act 1993, for advisory comments and recommended consent conditions.

The traffic impact assessment has therefore been carried out in accordance with the RTA's *Guide to Traffic Generating Developments*, and the requirements of SEPP (Infrastructure) 2007.

1.2 Background

The Bungarribee Industrial Estate is part of the Western Sydney Employment Hub, a State Significant Site (SSS) identified as part of the NSW Government's Metropolitan Strategy.

In May 2007, the Bungarribee Industrial Estate (then referred to as Huntingwood West Precinct) was gazetted as a State Significant Site. Under the Major Projects SEPP the site was rezoned as IN1 General Industrial to promote employment generating land uses.

The Planning Minister approved a Part 3A Concept Plan (MP 06_0203) for subdivision of the Industrial Estate into 47 lots to accommodate future employment uses, associated services and infrastructure in December 2006.

In June 2008 a Project Application was approved that proposed to subdivide the Estate into 6 super lots for employment generating land uses.

The approved Concept Plan imposed a contribution of $75,500 per developable hectare for regional road improvements and a number of traffic related improvement measures identified in the Huntingwood West Transport Management and Accessibility Plan (TMAP) to minimise the traffic impact of the development. These conditions are discussed and addressed in this report.

The Project Planning Application and associated traffic assessment will therefore build on the Part 3A Concept Plan Approval and associated TMAP.

The report is structured as follows:

Section 2: Site Details

Section 3: Description of the Proposed Development

Section 4: Existing Traffic Conditions

2. Development Site Details

2.1 Site Details, Location and Zoning

The development site is bounded by the Great Western Highway to the north, the M4 Motorway to the south, Brabham Drive to the east and Eastern Creek to the west.

The site is opposite the proposed Bungarribee Precinct (residential and Parkland development) north of the Great Western Highway (GWH) and west of the existing Huntingwood Industrial precinct.

The development site in the context of the Western Sydney Employment Hub (WSEH) is as shown in Figure 1.

Figure 2 shows a locality sketch of the development site and the local road network.

Previously the site was used for agriculture purposes including grazing, paddocks and livestock. In 2007, these uses were discontinued. The site is currently vacant and open grassland.

Figure 1 – Bungarribee Industrial Estate in relation to the Western Sydney Employment Hub

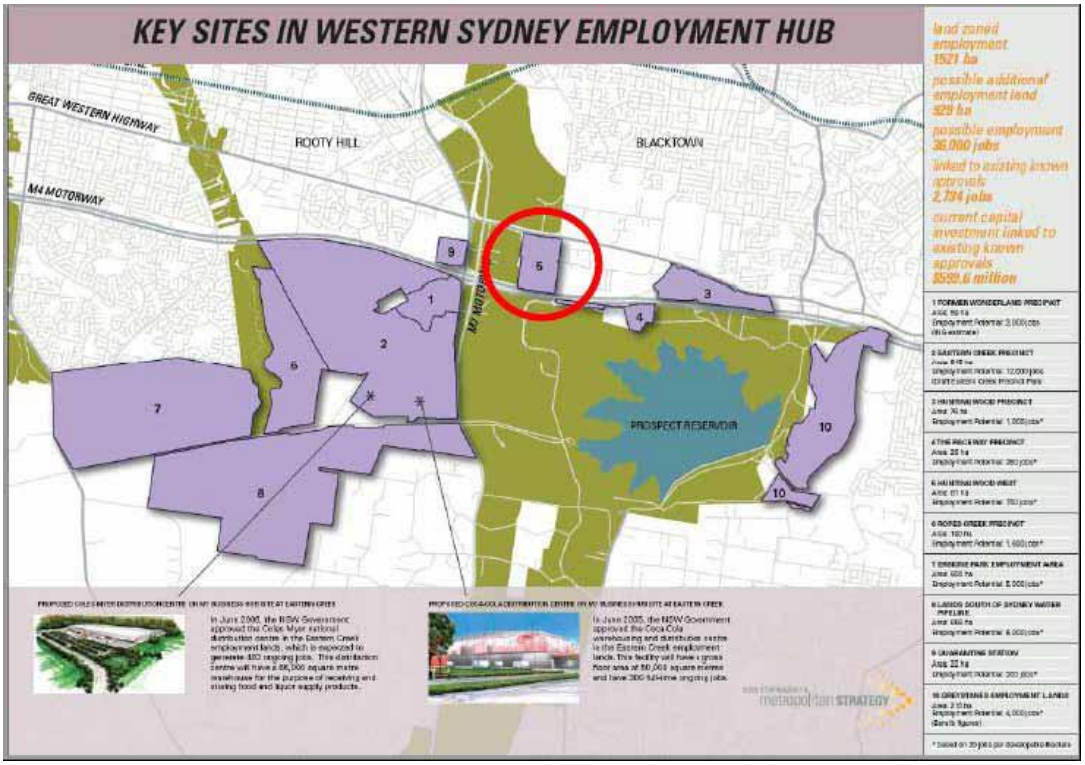
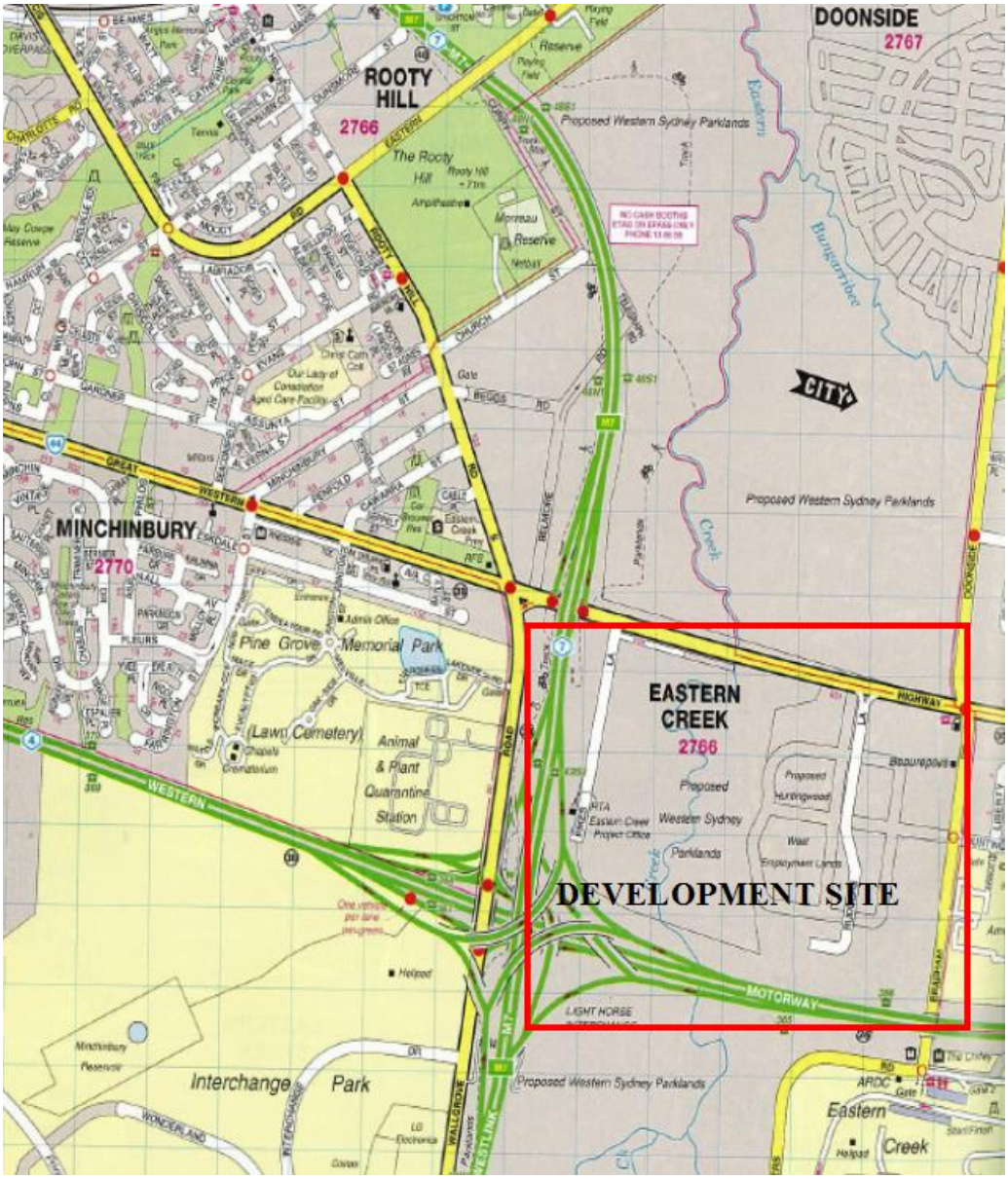


Figure 2 – Locality Sketch



3. Development Proposal

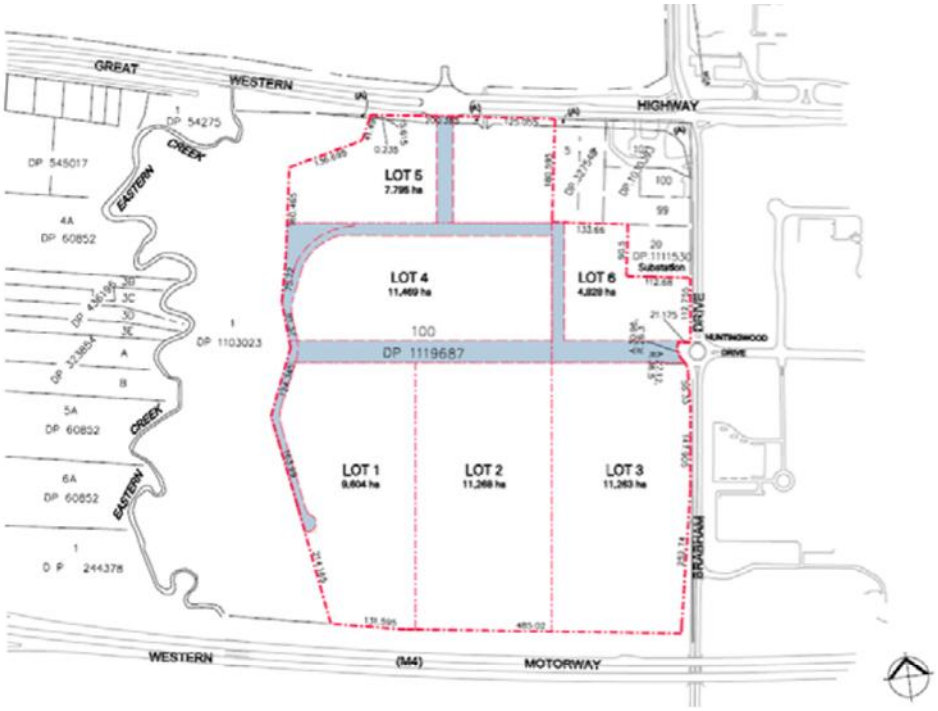
3.1 Description of the Proposed Development

The proposed development involves the subdivision and development of the site including associated infrastructure and services to create 6 super industrial lots.

The approved masterplan layout submitted as part of the original Part 3A Concept Plan that rezoned and approved the subdivision of the development site into 47 lots is shown in Figure 3. The subsequent approved Project Plan Application masterplan layout that consolidated the 47 lots into 6 super-lots is shown in Figure 4.

Figure 3 – Approved Subdivision Layout for 47 lots (2006)

Figure 4 – Approved Subdivision Layout for 6 super-lots (2008)



The proposed layout with an internal road layout similar to that approved in the 2008 Project Plan Application is shown in Figure 5.

Figure 5 – Proposed Subdivision Layout

3.2 Proposed Vehicular Access Arrangements

The development site currently has a vehicular access off the Great Western Highway from the intersection with Rudders Lane. The access is to be closed as part of the proposed development and a new access provided approximately 70m to the west of Rudders Lane.

The 2006 and 2008 DoP approvals did not specify the intersection configuration of the proposed access point off the Great Western Highway. However, since these approvals, the RTA has approved (in-principle) a 4-way signalised intersection at the proposed access point off the Great Western Highway. The intersection has been approved to provide vehicular access for both the Bungarribee Industrial Estate and the proposed Bungarribee Precinct Parklands development north of the Great Western Highway.

The proposed signalised intersection will be designed to permit all turning movements at the intersection. The RTA has advised that it would prefer for the proposed signalised intersection to have appropriate turning bays and to ensure that the intersection does not adversely affect traffic efficiency along the Great Western Highway.

As indicated in the approved Concept Plans, a second vehicular access into the development is proposed via a fourth leg off the existing Brabham Drive/Huntingwood Drive roundabout.

An intersection performance analysis (using SIDRA) has been carried out to identify an appropriate intersection layout for the proposed intersection with the Great Western Highway in consultation with the RTA. The performance of the existing Brabham Drive/Huntingwood Drive roundabout after connecting a fourth leg has also been modelled. The recommended intersection configurations are discussed in the Section 5.5.

3.3 Proposed Internal Layout

The proposed masterplan as shown in Figure 5 differs to the previously approved Concept Plan (Figure 3) by providing an indirect link between Brabham Drive and Great Western Highway.

This arrangement has been proposed with a view to discourage through traffic via the development site. The internal link road will be designed and constructed to accommodate B-double vehicles in accordance to Blacktown City Council's Industrial Subdivision Guidelines.

The proposed internal road classification and configuration to achieve this objective is discussed in Section 5.6.

4. Existing Traffic Conditions

4.1 Existing Road Network

The public road network surrounding the development site includes the Great Western Highway, the M4 Motorway, Doonside Road and Brabham Drive (Refer to Figure 2 – Locality Sketch). A description and function of these roads are as follows.

The **M4 Motorway** is a major east-west road between Strathfield and Penrith and forms part of a key link between the Sydney CBD and Sydney's western suburbs. It is a classified State Road. The section close to the development site is a six lane divided road with a signposted speed limit of 100km/hr.

It is currently carrying a daily traffic volume of over 70,000 vehicles/day (AADT 2006).

The **Great Western Highway** is the other key east-west link between the Sydney Central Business District and western suburbs. It is a classified State Road.

The section fronting the development site is a 4 lane divided road with a signposted speed limit of 80 km/h. Close to the development site, the Great Western Highway is currently carrying a daily traffic volume of over 30,000 vehicles.

Brabham Drive is a north-south road, between the Great Western Highway and Ferrers Road. It is classified as a regional road. It has 4 lanes and is currently carrying a traffic volume of over 18,000 AADT. It is sign posted with a speed limit of 60 km/h.

Doonside Road is an extension of Brabham Drive, north of the Great Western Highway to Bungarribee Road. It forms the eastern boundary of the Western Sydney Parklands and Doonside residential release area. It is classified as a regional road and is a divided 4 lane road. It is currently carrying a traffic volume of over 24,000 veh/day. It is signposted with a speed limit of 60 km/h.

4.2 Results of Recent Traffic Count

To assess traffic conditions and performance of the surrounding local roads, a morning and afternoon peak hour (AM/PM) traffic count was carried out at the Great Western Highway/Brabham Drive intersection on 26 November 2008.

The results indicate that the Great Western Highway is carrying a traffic volume of 2,450 veh/hr eastbound and 622 westbound during the AM peak, and 901 veh/hr eastbound and 2,008 veh/hr westbound during the PM peak.

The results also indicate that at the intersection with the Great Western Highway, Doonside Road is carrying 427 veh/hr northbound and 1081 veh/hr southbound during the AM peak and 980 veh/hr northbound and 901 veh/hr southbound during the PM peak period.

The results of the traffic counts are as shown in Appendix A.

5. Traffic Generation and Impact

5.1 Overview

The DoP's approval of the Part 3A Concept Plan for the development site has imposed a number of traffic related conditions and specified that the traffic impact of the proposed development is to be addressed in future Project Plan applications.

This section of the report reviews and details the traffic impact of the proposed development and provides solutions for minimising or accommodating the traffic impact.

As part of the environmental assessment accompanying the Part 3A Concept Plan, a Huntingwood TMAP was prepared. The TMAP recommended a package of measures to minimise the traffic impacts of the development. The package of measures and options for implementation are discussed in Section 6.

5.2 Traffic Generation Potential

An indication of the traffic generation potential of the proposed development is provided by the Roads and Traffic Authority's *Guide to Traffic Generating Developments, Section 3 – Land use Traffic Generation (October 2002).*

The Guide specifies that for factory developments where the number of employees and the proposed floor area is not known (such as at the strategic planning stage for large industrial developments), an indicative employment density of 28 employees per hectare and corresponding traffic generation rate of 0.318 trips per employee and 0.365 per employee in the AM and PM peaks respectively can be used. This equates to 8.9 trips per hectare in the AM and 10.22 trips in the PM.

Recent traffic impact assessments of large industrial estates in the Blacktown and Penrith Local Government Areas by the RTA have identified a traffic generation potential of 15 trips per developable hectare. Hence, in the last five year the Authority has been recommending that this rate should be used in the assessment of all large industrial developments. This rate was used in the Huntingwood West TMAP.

With a total land area of 56.23 Ha and a developable area of 54.19Ha, the development site is expected to generate approximately 813 veh/hr during the AM and PM peak.

The TMAP prepared for the site proposed measures to increase public transport usage by 10%. In the long term, after the public transport measures have been successfully implemented, the traffic generation could be reduced by approximately 10%, decreasing the generated volume to 732 trips/hr.

However, the assessment of the traffic conditions in the short to medium term has been carried out with a traffic generation potential of 813 during the AM and PM peaks to address projected worst traffic conditions.

5.3 Traffic Distribution

Journey to work data has been analysed from the Transport Data Centre (TDC) for the Travel Zone close to the development site. Travel Zone (TZ) 06 2116 includes the existing Huntingwood industrial development and it was considered that the proposed Bungarribee industrial development could generate the similar travel patterns for the journey to work.

The "car as driver" for TZ06 2116 was extracted and converted to the percentage of the total car trips for Statistical Local Area (SLA). The SLA's with significant number of car trips is shown in Table 1.

Table 1 2006 Journey to work by Car for TZ06 2116 (major SLA contributors)

SLA name	Car as Driver	Percentage of Total
Penrith - East	391	11.4%
Blacktown - South-West	381	11.1%
Blacktown - South-East	338	9.8%
Penrith - West	317	9.2%
Blacktown - North	285	8.3%
Holroyd	182	5.3%
Blue Mountains	165	4.8%
Baulkham Hills - Central	151	4.4%
Fairfield - East	138	4.0%
Fairfield - West	134	3.9%
Liverpool - West	116	3.4%
Baulkham Hills - North	105	3.1%
Hawkesbury	104	3.0%
Camden	73	2.1%
Liverpool - East	70	2.0%
Campbelltown - North	66	1.9%
Auburn	62	1.8%
Parramatta - Inner	61	1.8%
Parramatta - North-West	57	1.7%
Campbelltown - South	55	1.6%
Baulkham Hills - South	52	1.5%
Hornsby - North	49	1.4%
Bankstown - North-West	48	1.4%
Canterbury	42	1.2%

SLA name	Car as Driver	Percentage of Total
Total	4150 (for all SLA's)	85.3% (for included SLA's)

Source: Journey to Work data, 2006

5.4 Traffic Impact

5.4.1 Projected Traffic Conditions

Distributing the traffic generation potential on the local external road network, i.e. the Great Western Highway and the Doonside Road/Brabham Drive using the above traffic distribution pattern gives the traffic flows as shown below in Table 2:

Table 2 AM Peak Traffic Forecasts

Location	Lane	2008[(i)] Existing	Forecast 2016 Flows Without Traffic from the Development [(ii)]	Forecast 2016 Flows with Traffic from the Development [(iii)]
Great Western Highway 100m West of the Great Western Highway/new Access road intersection	WB	622	969	1017
	EB	2492	3078	3351
Great Western Highway 100m East of the Great Western Highway/Brabham Dr intersection	WB	543	818	1024
	EB	1889	2558	2598
Brabham Drive 100m south of Great Western Highway/Brabham Dr intersection	NB	430	518	557
	SB	1220	1632	1835

(i) From AM and PM Traffic Count on 26th November 2008,

(ii) Forecast volume based on 1% growth per annum plus other surrounding committed developments without Huntingwood West Development (The committed development includes: Eastern Creek Precinct, Erskine Park Employment Area, East Huntingwood Precinct, Investa Raceway Site, Bungarribee Precinct Land Uses, and Doonside Residential Development, Western Sydney Parklands

(iii) The above volumes indicate that by 2016, with the proposed development (as well as the other commitment developments in the local area), the section of the GREAT WESTERN HIGHWAY fronting the development east and west of the New Intersection would exceed its four-lane road capacity.

The RTA has also identified similar traffic impacts for a cumulative impact assessment of the industrial development sites in the local area, including the SEPP 59 lands, Huntingwood industrial areas and the proposed Huntingwood West industrial areas.

To minimise and accommodate this impact the RTA has previously identified that the four-lane section of the Great Western Highway between Minchinbury and the Huntingwood West industrial area would need to be widened to six lanes in the medium to long term.

The need for the road widening is due partly to background traffic growth and partly to the traffic impact from proposed industrial developments in the local area.

Hence, in consultation with the DoP, the RTA has recommended that the proposed industrial developments should be required to make a developer contribution $75,500 per developable hectare towards the road widening for regional roads and public transport improvements in the local area.

Transport Deeds entered into between the RTA and industrial developers in the local area in last three years have therefore included this regional contribution rate.

Following discussion with the RTA, the Authority has agreed in-principle that part of the regional contribution from the Bungarribee Industrial Estate could be used to carry out work-in-kind on the section of the Great Western Highway. The two potential works-in-kind projects identified are:

1. A third eastbound lane along the Great Western Highway, as a continuation of the third lane at the Great Western Highway/Brabham Drive intersection, to 100 metres west of the new signalised intersection into the development site.
2. Construction of a second right turn bay for right turn movements from the Great Western Highway into Doonside Road.

The agreed monetary contribution or works-in-kind would minimise the traffic impact of the proposed development to an acceptable level.

5.4.2 Impact on Existing Local Intersections

The key intersections near the development site include the following:

Signalised Intersections

- Great Western Highway/Doonside Road/Brabham Drive
- Great Western Highway/Wallgrove Road/Rooty Hill Road
- Great Western Highway/Huntingwood Drive intersection
- Doonside Road/Douglas Road

Roundabouts

- Brabham Drive/Huntingwood Drive
- Doonside Road/Bungarribee Road

Previous traffic modelling and intersection performance analysis carried out as part of the Huntingwood West TMAP and assessments undertaken by the RTA have identified that with the exception of the Great Western Highway/Doonside Road/Brabham Drive

intersection, the other intersections in the local area are operating with acceptable Level of Service (LoS).

The intersection performance analysis carried out as part of the Huntingwood West TMAP identified that the Great Western Highway/Doonside Road/Brabham Drive intersection is operating with LoS E and C during the AM and PM peaks respectively with the degrees of saturation and average delay as indicated below in Table 3.

Table 3 2006 Great Western Highway / Doonside Road (Signalised intersection)

Peak Time	Degree of Saturation	Average Delay (sec/veh)	Level of Service
AM	1.0	61.0	E
PM	0.8	41.0	C

The RTA has investigated options to improve the performance of the intersection. The identified improvements include the conversion of the signals to a Double Diamond signal phasing and the provision of dual right turn lanes from the Great Western Highway into Brabham Drive and from Doonside Road onto the Great Western Highway.

Local major developers are being required to make a monetary contribution towards these required improvements or carry out part of the required improvements as works-in-kind, in-lieu of regional developer contributions.

5.5 Proposed Intersection Layout

5.5.1 Great Western Highway/Huntingwood West Access Road

As indicated in Section 3.2, the RTA has approved (in-principle) a signalised 4-Way intersection on the Great Western Highway, on the section fronting to the development site, to provide vehicular access to both the Bungarribee Industrial Estate and the proposed Bungarribee Precinct development north of the Highway.

SIDRA modelling carried out as part of the intersection performance analysis (Refer to Appendix B) has identified that an intersection configuration as shown in Figure 5 and Appendix C, with of a third eastbound lane as discussed in Section 5.4, would be expected to operate with an acceptable LoS – C, during the AM peak.

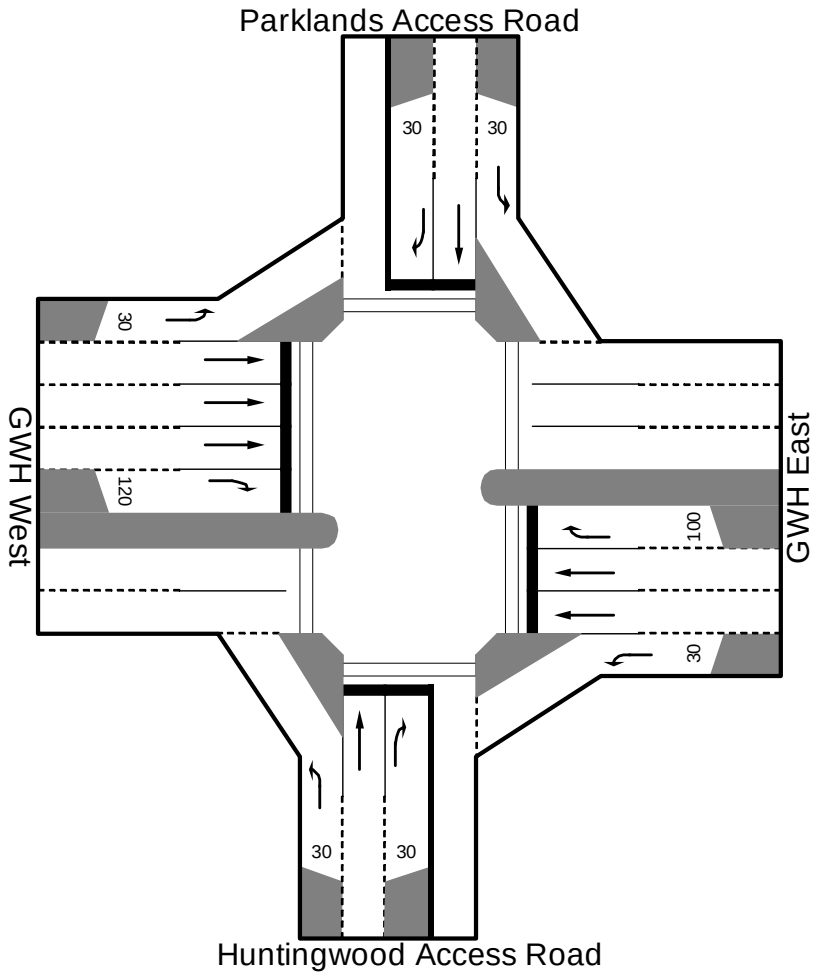


Figure 5 – Great Western Highway/New Access Road Intersection Configuration

5.5.2 Brabham Drive/Huntingwood Drive Intersection

The existing Brabham Drive/Huntingwood Drive intersection is a two lane roundabout with two circulation lanes. SIDRA analysis indicates that the intersection is currently operating with LoS - A during the AM and PM peaks.

Table 4 Brabham Drive / Huntingwood Drive (roundabout)

Peak Time	Degree of Saturation	Average Delay (sec/veh)	Level of Service
AM	0.5	8.2	A
PM	0.6	9.5	A

Further intersection analysis indicates that after the connection of the proposed four leg to the roundabout, with a configuration as shown in Figure 6 below, the intersection would be expected to operate with a LoS - A.

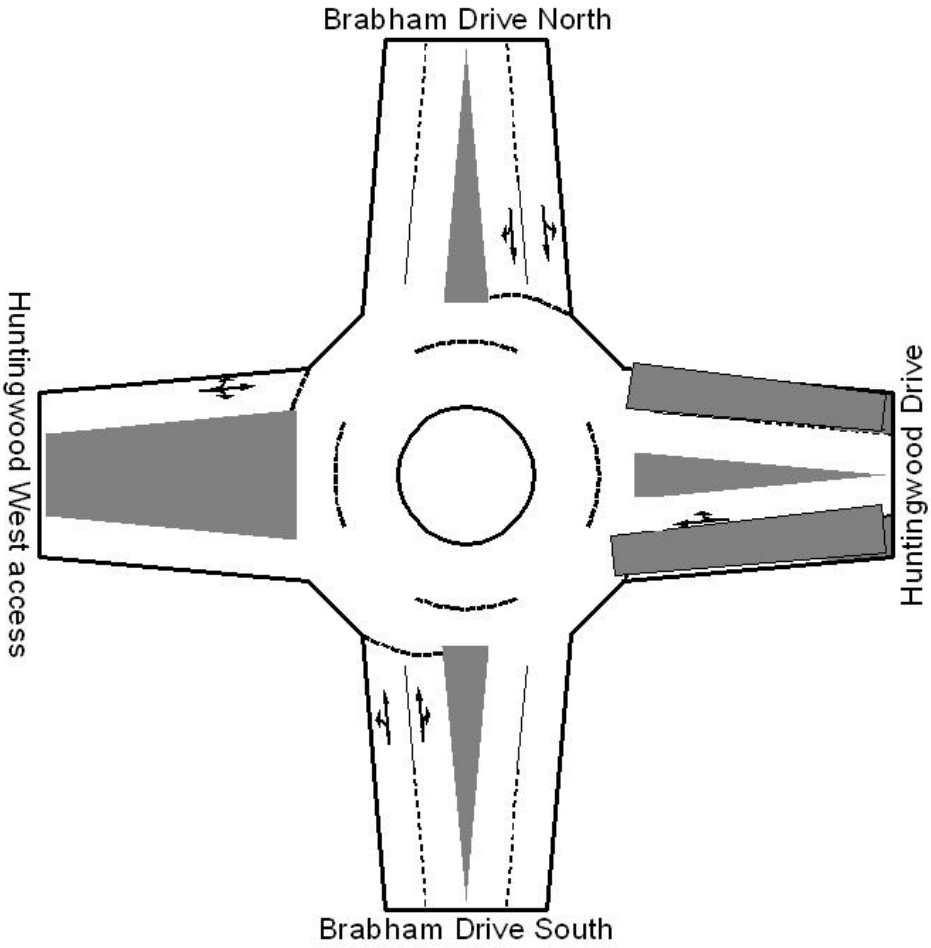


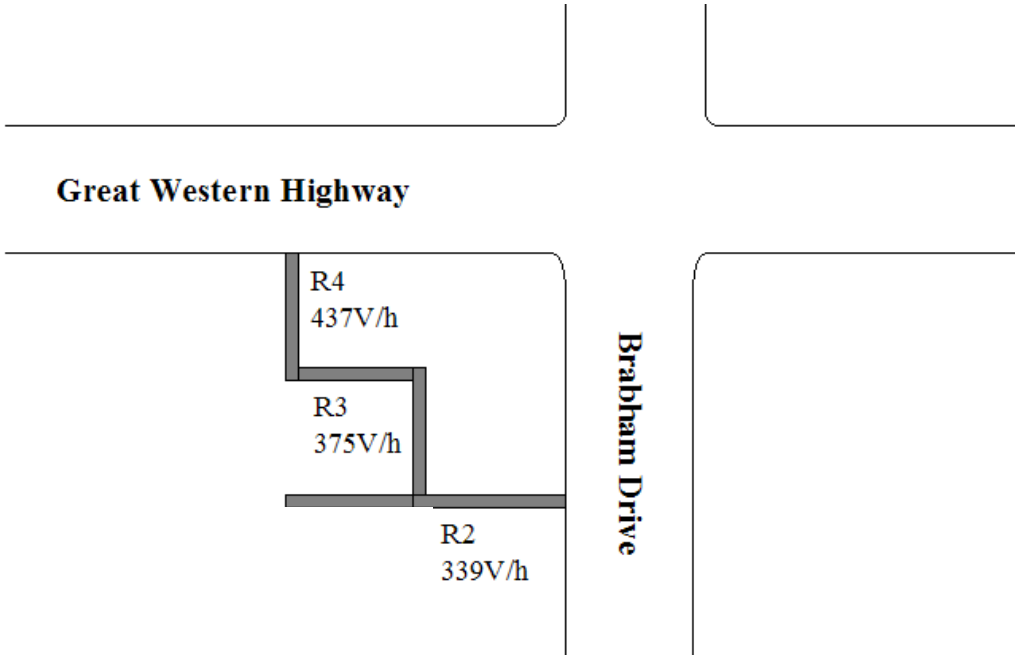
Figure 6 – Brabham Drive/Huntingwood Drive/New Access Intersection Configuration

5.6 Internal Road Layout

To determine projected traffic volumes on the internal road network, the traffic generation potential has been distributed onto the internal road network.

During the AM peak, assuming 80% of trips enter the site with the remaining 20% leaving the site, traffic flows on the internal road links would be as shown below. Forecast peak traffic volumes on the internal roads are as shown in Figure 7.

Figure 7 – Projected Traffic Flow (AM Peak)



Discussions have been held with Blacktown City Council with regards to the forecasted local traffic volumes and the function of the internal road links. Council has agreed in-principle that the internal road network could be made up of a combination of a collector and local streets. The north – south road off the Great Western Highway (R4) and the east - west road off Brabham Drive (R2) would be classified as Collector road due to their relatively higher traffic volumes and function of collecting/distributing traffic to the external road network. The other internal road links (R3) would be designated as a local roads due to the function of connecting collector roads.

The internal road layout will be designed and constructed in accordance with Council's Industrial Subdivision Guidelines to provide appropriate on street parking. Due to the forecast low traffic volumes and flat terrain, traffic signals would not be warranted.

It is recommended that the internal intersections be signposted with appropriate "Give Way" or "Stop" sign controls.

The 90^{o} bend in road R3 is to be designed with a central median island to accommodate B-doubles.

6. Implementation of Huntingwood West TMAP Recommendations

The Huntingwood West TMAP prepared as part of the Part 3A concept plan outlined a package of measures to moderate traffic growth and to help achieve a 10% increase in the public transport use to/from the development site.

The package of measures include:

- Workplace Transport Plans measures such as car pooling, marketing of public transport options or discounts to cyclist;
- Infrastructure improvements to provide easy pedestrian and cyclist access to Doonside via a share path and connection to the existing share paths along the M7 cycleway;
- Public transport infrastructure with a minimum provision of a bus stop on Braham Drive;
- Transport service improvements include the potential to divert a bus routes past the development site;
- Access to the site via the existing roundabout at Brabbham Drive and a new access intersection at the Great Western Highway; and
- Intersection improvement at the key intersections.

GHD has reviewed the package of measures and recommends that the package be implemented as part of the development as outlined in Sections 6.1 and 6.2 following.

6.1 Workplace Transport Plan and Public Transport

Developments within the site are to include options for the preparation and implementation of the Workplace Transport Plans (with measures such car pooling, discount public transport tickets, showers facilities and bicycle parking bays).

For public transport improvements the following options are recommended:

Short term: A bus stop provided for the existing 724 bus service operating with a 30 minute service frequency from Blacktown Rail station near the Brabham Drive/Huntingwood Drive roundabout to serve the proposed development.

The existing bus route and the proposed bus stops are as shown in Figure 8.

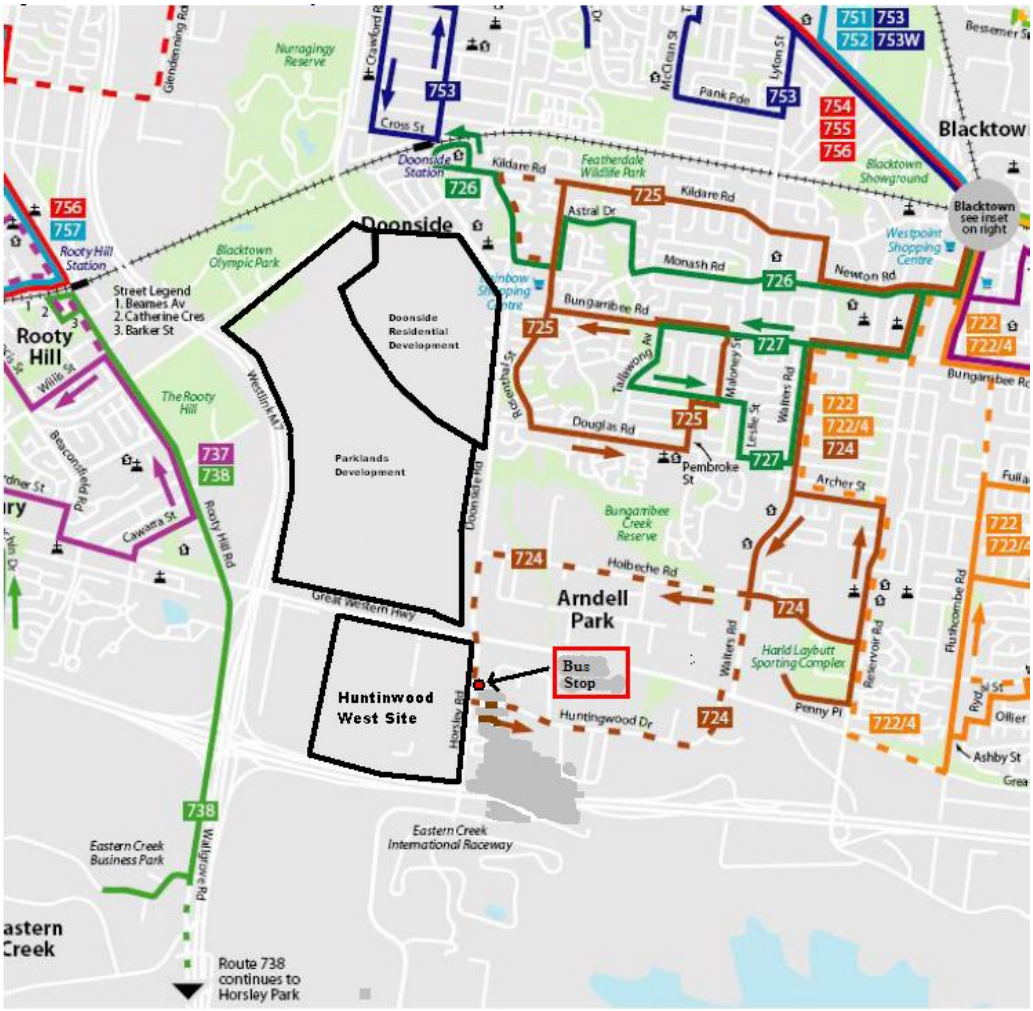
Medium/long term: Once the development is completed the existing bus route 724 could be diverted through the development site.

GHD understands that the Ministry of Transport (MoT) is reviewing bus routes and services to the Western Sydney Employment Hubs. Bus services to the Bungarribee Industrial Estate could be considered as part of this review.

The RTA has been advised in the Transport Deeds for the regional transport improvement in the Local Area that 18% of the total contribution be allocated for public transport. Part of this contribution could be used to facilitate the extension of the bus

service to the development as well as the construction of a bus shelter on Brabham Drive to serve the development.

Figure 8 – Existing Bus Route

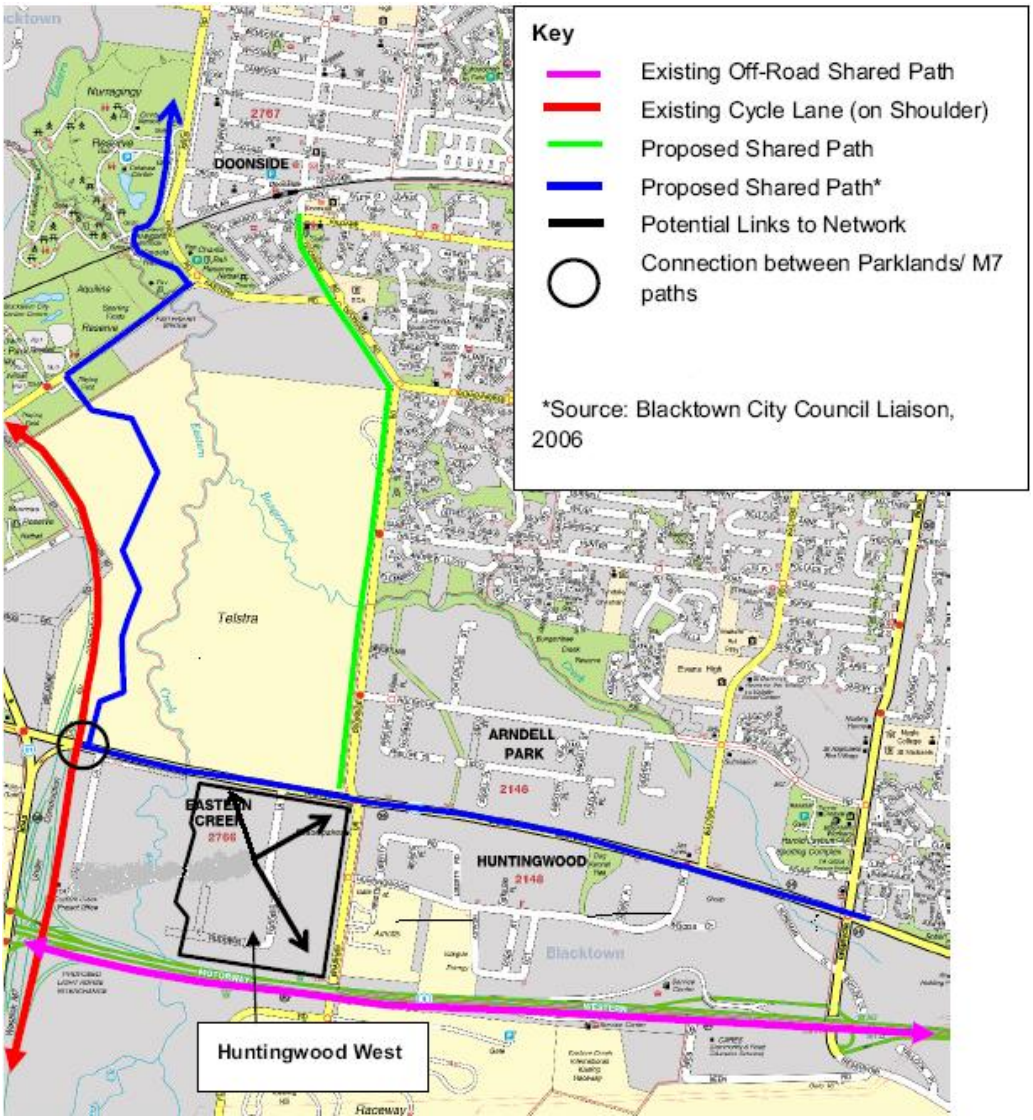


6.2 Pedestrian and Cycle Paths

Existing and proposed pedestrian and cycle facilities in the local area are as shown in Figure 9. These links would provide appropriate pedestrian and cycle paths into the local area.

As part of the proposed new signalised intersection on the Great Western Highway it is recommended that, a shared pedestrian and cycle path be constructed along the northern side of the Highway as part of the regional contribution works.

Figure 9 – Cycle Network



7. Findings and Recommendations

- The traffic and transport impact of the proposed industrial development has been assessed in the accordance with the RTA's *Guide to Traffic Generating Developments.*
- The assessment indicates that the cumulative traffic impact of the proposed development along with other committed developments in the local area would require road widening of the four-lane section of the Great Western Highway between Minchinbury and Huntingwood.
- The RTA has previously identified this impact and is imposing conditions for developer contributions to be made for the road widening.
- Goodman will be making the agreed contribution of $75,500.00 (excl. GST) per developable hectare, to minimise the traffic impacts of the development or works-in-kind.
- The RTA has approved in-principle a signalised intersection off the Great Western Highway to provide vehicular access the development site. An appropriate intersection treatment as shown in Appendix C has been modelled and discussed with the RTA. The intersection treatment in Appendix C is the preliminary intersection layout can be used for further discussion in preparation of a Works Authorisation Deed for the intersection treatment.
- Blacktown City Council and the RTA support a second access off Brabham Drive/Huntingwood Drive roundabout.
- Options for the implementation of the package of measures identified in the Huntingwood West TMAP have been recommended.

The traffic generated from the proposed development can be accommodated on the surrounding road network and is not expected to have adverse impacts on the traffic conditions in the local area.

Appendix A

Traffic Count of 26 November 2008

austraffic

NSW | VIC | QLD | SA | WA | NT | ACT | TAS

3669 - Blacktown Intersection Survey

Nov-08

JOB NUMBER	3669
JOB NAME	Blacktown Intersection Survey
CLIENT	GHD
SURVEY LOCATIONS	1. Great Western Highway, Brabham Drive and Doonside Road 2. Brabham Drive and Huntingwood Drive
SURVEY TYPE	Intersection Counts
SURVEY DATE	Wednesday, 26 November 2008

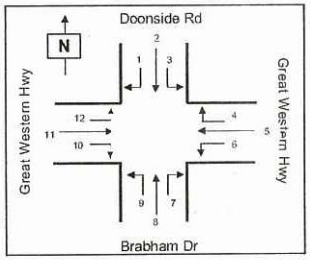
Austraffic (NSW) - 2/33 Daking Street, North Parramatta, NSW 2151 - Ph: (02) 9683 3444- Fax: (02) 9683 3466

Intersection of Great Western Hwy, Brabham Dr and Doonside Rd

Wednesday, 26 November 2008

Austraffic

Survey Start	7:00 AM 16:00 PM
Intersection Type	Cross Junction
Intersection No.	1
North Approach	Doonside Rd
East Approach	Great Western Hwy
South Approach	Brabham Dr
West Approach	Great Western Hwy
Date	26/11/08
Classfication	Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																																	GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
7:00 - 7:15	36	7	43	82	11	93	86	5	91	29	4	33	61	10	71	8	1	9	14	4	18	58	4	62	10	6	16	92	12	104	359	26	385	73	8	81	908	98	1006
7:15 - 7:30	34	8	42	166	10	176	95	3	98	48	2	50	68	7	75	18	3	21	17	6	23	48	6	54	12	8	20	102	12	114	363	16	379	98	10	108	1069	91	1160
7:30 - 7:45	52	7	59	145	12	157	100	1	101	28	1	29	77	10	87	4	3	7	19	3	22	66	6	72	12	12	24	119	7	126	309	17	326	100	9	109	1031	88	1119
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8:15 - 8:30	53	6	59	116	9	125	80	5	85	48	5	53	82	10	92	16	2	18	25	3	28	72	13	85	8	9	17	98	11	109	270	16	286	128	14	142	996	103	1099
8:30 - 8:45	53	14	67	118	13	131	74	8	82	30	3	33	75	6	81	11	0	11	14	7	21	39	5	44	10	9	19	104	14	118	180	8	188	91	11	102	799	98	897
8:45 - 9:00	50	3	53	108	7	115	47	2	49	32	5	37	109	10	119	10	0	10	19	3	22	55	5	60	18	6	24	68	8	76	195	16	211	97	10	107	808	75	883
Σ	376	69	445	1051	86	1137	632	33	666	293	23	316	615	70	685	95	14	109	158	35	193	453	47	500	90	63	153	838	94	932	2360	137	2497	895	77	972	7856	748	8604

TIME PERIOD	VEHICLE MOVEMENT																																	GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
16:00 - 16:15	139	6	145	92	6	98	52	4	56	105	5	110	273	9	282	19	0	19	27	1	28	126	4	130	58	3	61	67	12	79	102	9	111	42	5	47	1102	64	1166
16:15 - 16:30	83	8	91	58	10	68	49	1	50	87	4	91	254	17	271	6	3	9	23	5	28	152	7	159	57	6	63	29	6	35	121	15	136	50	6	56	969	88	1057
16:30 - 16:45	135	5	140	69	7	76	43	3	46	101	5	106	252	4	256	6	1	7	21	1	22	154	2	156	86	6	92	22	15	37	101	6	107	51	6	57	1041	61	1102
16:45 - 17:00	84	9	93	66	8	74	43	8	51	133	10	143	281	12	293	17	2	19	31	4	35	165	4	169	82	2	84	23	6	29	103	4	107	53	14	67	1081	83	1164
17:00 - 17:15	127	5	132	74	5	79	36	1	37	95	4	99	275	10	285	14	0	14	23	2	25	142	7	149	141	4	145	21	5	26	109	5	114	50	1	51	1107	49	1156
17:15 - 17:30	124	8	132	98	5	103	41	3	44	70	1	71	233	8	241	12	1	13	25	0	25	181	5	186	102	7	109	28	3	31	96	2	98	61	7	68	1071	50	1121
17:30 - 17:45	64	8	72	64	7	71	38	4	42	152	2	154	362	8	370	11	1	12	16	2	18	133	1	134	47	5	52	15	4	19	134	6	140	46	5	51	1082	53	1135
17:45 - 18:00	70	3	73	70	2	72	44	0	44	153	3	156	215	10	225	15	0	15	16	1	17	151	1	152	61	7	68	17	8	25	103	2	105	49	0	49	964	37	1001
Σ	826	52	878	591	50	641	346	24	370	896	34	930	2145	78	2223	100	8	108	182	16	198	1204	31	1235	634	40	674	222	59	281	869	49	918	402	44	446	8417	485	8902

HOURLY FLOW

TIME PERIOD	VEHICLE MOVEMENT																																	GRAND TOTAL			
	1			2			3			4			5			6			7			8			9			10			11			12						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	
7:00 - 8:00	166	34	200	553	46	599	357	10	367	149	9	158	275	34	309	40	8	48	65	17	82	239	20	259	43	35	78	419	44	463	1413	77	1490	424	34	458	4143	368	4511	
7:15 - 8:15	184	39	223	627	46	673	345	13	358	154	6	160	288	34	322	50	11	61	86	18	104	229	20	249	44	33	77	476	49	525	1356	71	1427	506	34	540	4345	374	4719	Peak
7:30 - 8:30	203	37	240	577	45	622	330	15	345	154	9	163	302	37	339	48	10	58	94	15	109	253	27	280	40	34	74	472	48	520	1263	71	1334	536	38	574	4272	386	4658	
7:45 - 8:45	204	44	248	550	46	596	304	22	326	156	11	167	300	33	333	55	7	62	89	19	108	226	26	252	38	31	69	457	55	512	1134	62	1196	527	40	567	4040	396	4436	
8:00 - 9:00	210	35	245	498	40	538	275	23	298	144	14	158	340	36	376	55	6	61	93	18	111	214	27	241	47	28	75	419	50	469	947	60	1007	471	43	514	3713	380	4093	

TIME PERIOD	VEHICLE MOVEMENT																																	GRAND TOTAL			
	1			2			3			4			5			6			7			8			9			10			11			12						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	
16:00 - 17:00	441	28	469	285	31	316	187	16	203	426	24	450	1060	42	1102	48	6	54	102	11	113	597	17	614	283	17	300	141	39	180	427	34	461	196	31	227	4193	296	4489	
16:15 - 17:15	429	27	456	267	30	297	171	13	184	416	23	439	1062	43	1105	43	6	49	98	12	110	613	20	633	366	18	384	95	32	127	434	30	464	204	27	231	4198	281	4479	
16:30 - 17:30	470	27	497	307	25	332	163	15	178	399	20	419	1041	34	1075	49	4	53	100	7	107	642	18	660	411	19	430	94	29	123	409	17	426	215	28	243	4300	243	4543	
16:45 - 17:45	399	30	429	302	25	327	158	16	174	450	17	467	1151	38	1189	54	4	58	95	8	103	621	17	638	372	18	390	87	18	105	442	17	459	210	27	237	4341	235	4576	Peak
17:00 - 18:00	385	24	409	306	19	325	159	8	167	470	10	480	1085	36	1121	52	2	54	80	5	85	607	14	621	351	23	374	81	20	101	442	15	457	206	13	219	4224	189	4413	

Intersection of Brabham Dr and Huntingwood Dr

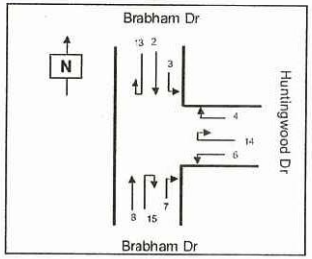
Wednesday, 26 November 2008

Austraffic

Survey Start 7:00 AM 16:00 PM
Intersection Type T Junction
Intersection No. 2
North Approach Brabham Dr
East Approach Huntingwood Dr
South Approach Brabham Dr
West Approach

Date 26/11/08

Classfication Light . Heavy



TIME PERIOD	VEHICLE MOVEMENT																														GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			13			14			15					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
7:00 - 7:15				110	13	123	62	10	72	30	7	37				48	5	53	37	4	41	69	12	81				2	0	2	0	0	0	0	0	0	358	51	409
7:15 - 7:30				144	7	151	106	17	123	14	14	28				21	4	25	50	2	52	57	5	62				1	2	3	0	0	0	0	0	0	393	51	444
7:30 - 7:45				164	10	174	125	9	134	12	9	21				27	4	31	60	8	68	79	9	88				1	2	3	1	0	1	0	0	0	469	51	520
7:45 - 8:00				152	12	164	132	8	140	23	13	36				28	7	35	75	6	81	77	7	84				3	3	6	0	0	0	1	0	1	491	56	547
8:00 - 8:15				191	15	206	146	7	153	19	7	26				30	9	39	82	3	85	80	12	92				0	0	0	0	1	1	1	0	1	549	54	603
8:15 - 8:30				87	16	103	127	7	134	14	9	23				26	4	30	89	7	96	82	11	93				1	2	3	0	1	1	0	0	0	426	57	483
8:30 - 8:45				120	15	135	114	17	131	14	4	18				21	6	27	49	3	52	50	5	55				0	2	2	1	0	1	0	0	0	369	52	421
8:45 - 9:00				101	8	109	110	8	118	10	9	19				15	2	17	49	6	55	57	13	70				2	0	2	0	0	0	0	0	0	344	46	390
Σ				1069	96	1165	922	83	1005	136	72	208				216	41	257	491	39	530	561	74	625				10	11	21	2	2	4	2	0	2	3399	418	3817

TIME PERIOD	VEHICLE MOVEMENT																														GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			13			14			15					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
16:00 - 16:15				97	3	100	23	11	34	117	6	123				58	10	68	46	4	50	159	6	165				0	2	2	0	0	0	0	0	0	500	42	542
16:15 - 16:30				82	9	91	25	8	33	84	7	91				52	4	56	34	5	39	176	10	186				1	1	2	1	0	1	0	0	0	455	44	499
16:30 - 16:45				96	10	106	19	14	33	105	2	107				56	4	60	33	3	36	162	10	172				0	3	3	0	0	0	0	0	0	471	46	517
16:45 - 17:00				89	5	94	19	11	30	100	6	106				59	6	65	31	6	37	151	0	151				1	0	1	0	0	0	0	0	0	450	34	484
17:00 - 17:15				102	1	103	15	8	23	202	7	209				87	6	93	27	2	29	150	6	156				0	0	0	0	0	0	0	0	0	583	30	613
17:15 - 17:30				108	5	113	11	3	14	99	8	107				62	6	68	34	4	38	179	5	184				1	1	2	0	0	0	0	0	0	494	32	526
17:30 - 17:45				80	2	82	19	10	29	72	6	78				64	6	70	28	5	33	125	2	127				1	0	1	0	0	0	0	0	0	389	31	420
17:45 - 18:00				85	3	88	16	9	25	75	5	80				58	7	65	23	4	27	114	2	116				2	0	2	0	0	0	0	0	0	373	30	403
Σ				739	38	777	147	74	221	854	47	901				496	49	545	256	33	289	1216	41	1257				6	7	13	1	0	1	0	0	0	3715	289	4004

HOURLY FLOW

TIME PERIOD	VEHICLE MOVEMENT																														GRAND TOTAL			
	1			2			3			4			5			6			7			8			9			13			14			15						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	
7:00 - 8:00	0	0	0	570	42	612	425	44	469	79	43	122	0	0	0	124	20	144	222	20	242	282	33	315	0	0	0	7	7	14	1	0	1	1	0	1	1711	209	1920	
7:15 - 8:15	0	0	0	651	44	695	509	41	550	68	43	111	0	0	0	106	24	130	267	19	286	293	33	326	0	0	0	5	7	12	1	1	2	2	0	2	1902	212	2114	
7:30 - 8:30	0	0	0	594	53	647	530	31	561	68	38	106	0	0	0	111	24	135	306	24	330	318	39	357	0	0	0	5	7	12	1	2	3	2	0	2	1935	218	2153	Peak
7:45 - 8:45	0	0	0	550	58	608	519	39	558	70	33	103	0	0	0	105	26	131	295	19	314	289	35	324	0	0	0	4	7	11	1	2	3	2	0	2	1835	219	2054	
8:00 - 9:00	0	0	0	499	54	553	497	39	536	57	29	86	0	0	0	92	21	113	269	19	288	269	41	310	0	0	0	3	4	7	1	2	3	1	0	1	1688	209	1897	

TIME PERIOD	VEHICLE MOVEMENT																														GRAND TOTAL			
	1			2			3			4			5			6			7			8			9			13			14			15						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	
16:00 - 17:00	0	0	0	364	27	391	86	44	130	406	21	427	0	0	0	225	24	249	144	18	162	648	26	674	0	0	0	2	6	8	1	0	1	0	0	0	1876	166	2042	
16:15 - 17:15	0	0	0	369	25	394	78	41	119	491	22	513	0	0	0	254	20	274	125	16	141	639	26	665	0	0	0	2	4	6	1	0	1	0	0	0	1969	154	2113	
16:30 - 17:30	0	0	0	395	21	416	64	36	100	506	23	529	0	0	0	264	22	286	125	15	140	642	21	663	0	0	0	2	4	6	0	0	0	0	0	0	1998	142	2140	Peak
16:45 - 17:45	0	0	0	379	13	392	64	32	96	473	27	500	0	0	0	272	24	296	120	17	137	605	13	618	0	0	0	3	1	4	0	0	0	0	0	0	1916	127	2043	
17:00 - 18:00	0	0	0	375	11	386	61	30	91	448	26	474	0	0	0	271	25	296	112	15	127	568	15	583	0	0	0	4	1	5	0	0	0	0	0	0	1839	123	1962	

Appendix B

Results of SIDRA Modelling

SIDRA INTERSECTION

Movement Summary

Brabham Dr / Huntingwood West access Rd

Round-a-bout

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)
Brabham Drive South										
1	L	29	10.3	0.387	8.0	LOS A	22	0.57	0.67	48.0
2	T	399	10.0	0.386	6.5	LOS A	22	0.57	0.57	49.1
3	R	355	10.1	0.386	13.6	LOS A	22	0.58	0.77	44.2
Approach		**784**	**10.1**	**0.386**	**9.8**	**LOS A**	**22**	**0.58**	**0.66**	**46.6**
Huntingwood Drive										
4	L	136	10.3	0.227	9.7	LOS A	11	0.75	0.83	47.2
5	T	20	10.0	0.187	7.7	LOS A	10	0.74	0.68	47.9
6	R	118	10.2	0.187	14.5	LOS B	10	0.74	0.87	43.6
Approach		**274**	**10.2**	**0.227**	**11.7**	**LOS A**	**11**	**0.74**	**0.84**	**45.5**
Brabham Drive North										
7	L	615	9.9	0.740	10.6	LOS A	80	0.82	0.86	46.7
8	T	723	10.0	0.741	9.9	LOS A	80	0.83	0.88	47.3
9	R	223	9.9	0.741	17.0	LOS B	78	0.84	0.94	42.1
Approach		**1561**	**9.9**	**0.740**	**11.2**	**LOS A**	**80**	**0.83**	**0.88**	**46.2**
Huntingwood West access										
10	L	39	10.3	0.075	7.4	LOS A	3	0.61	0.70	43.3
11	T	5	16.7	0.075	6.3	LOS A	3	0.61	0.62	43.9
12	R	5	16.7	0.075	13.3	LOS A	3	0.61	0.77	40.3
Approach		**51**	**11.8**	**0.075**	**7.9**	**LOS A**	**3**	**0.61**	**0.70**	**43.0**
All Vehicles		**2670**	**10.0**	**0.741**	**10.8**	**LOS A**	**80**	**0.74**	**0.81**	**46.2**

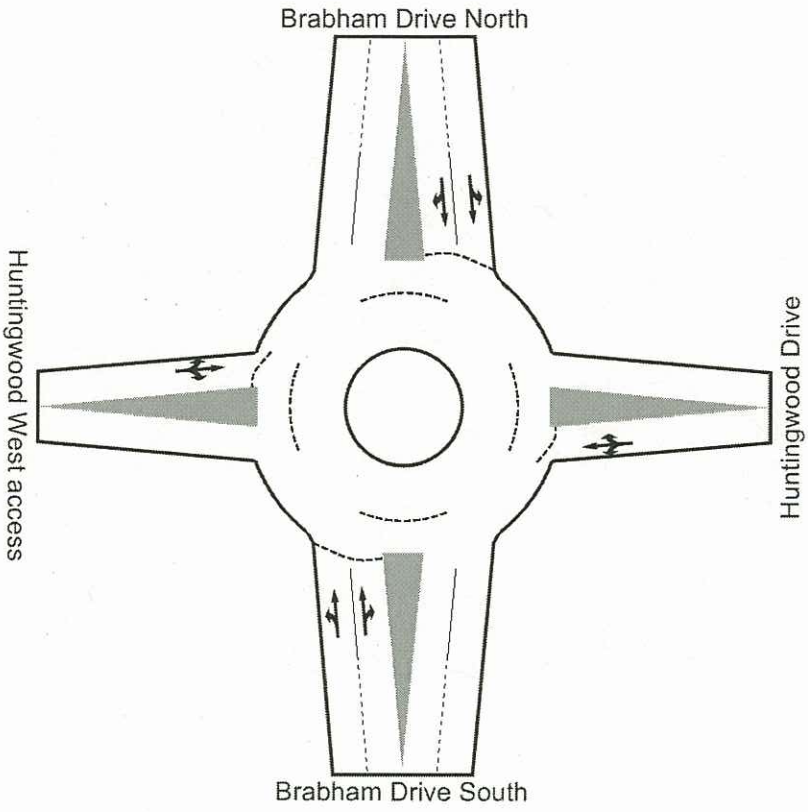
Symbols which may appear in this table:

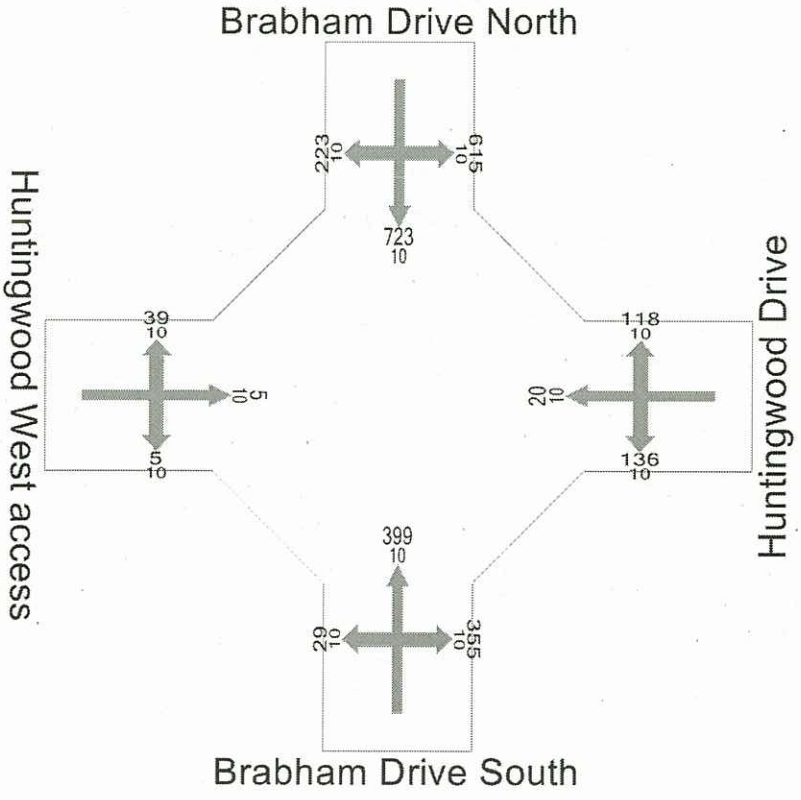
Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS


Brabham Drive North
Huntingwood West access
Huntingwood Drive
Brabham Drive South


Brabham Drive North
223
10
615
10
723
10
Huntingwood West access
39
10
5
10
5
10
118
10
20
10
136
10
Huntingwood Drive
399
10
29
10
355
10
Brabham Drive South

SIDRA INTERSECTION

Movement Summary

Great Western Highway / Huntingwood Access Road

2016 Existing condition (AM peak) - 3 Thru Lanes

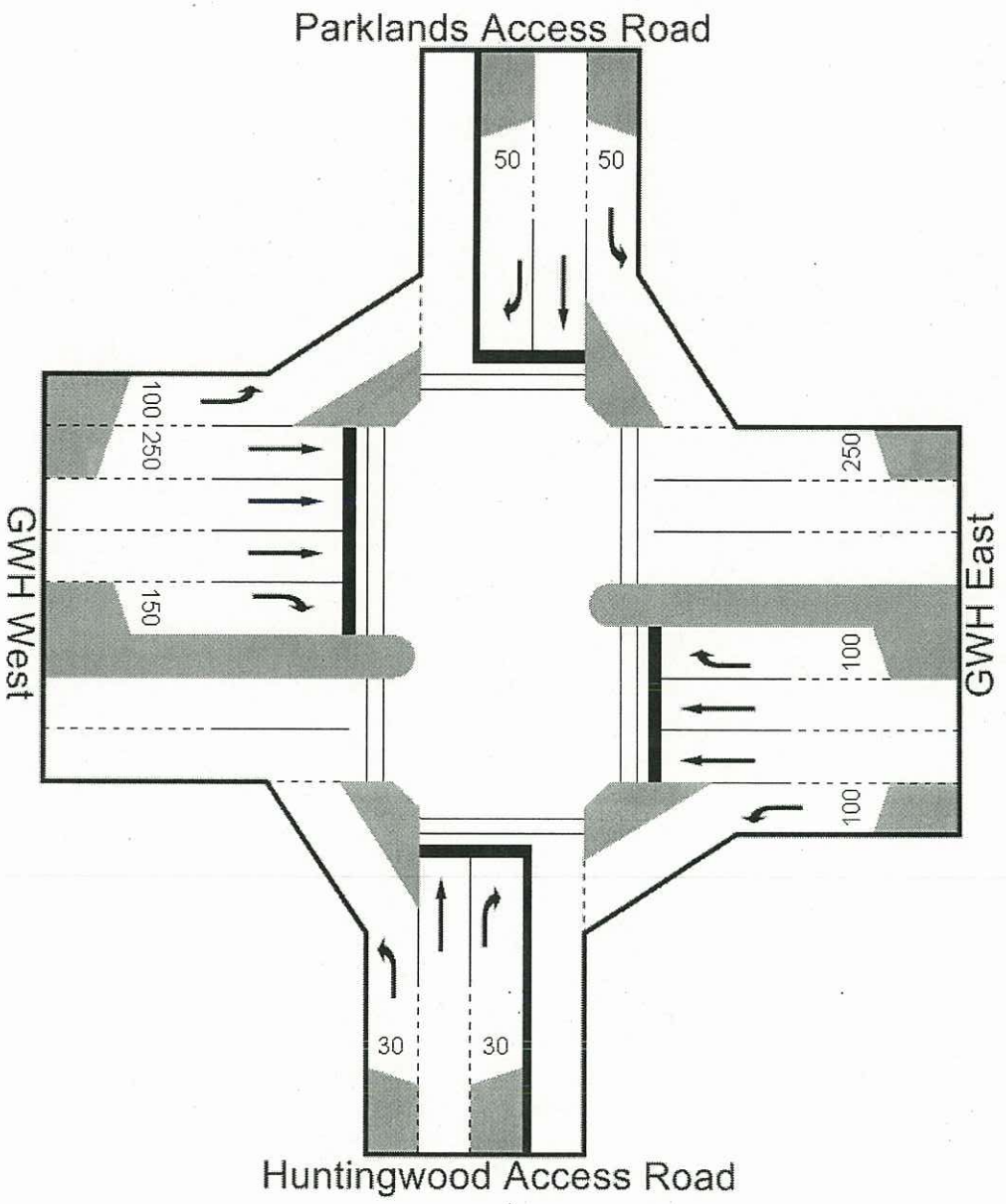
Signalised - Fixed time **Cycle Time = 140 seconds**

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)
Huntingwood Access Road										
1	L	48	10.4	0.138	9.7	LOS A	2	0.10	0.66	51.0
2	T	5	16.7	0.016	46.8	LOS D	4	0.82	0.55	26.2
3	R	34	8.8	0.308	58.1	LOS E	21	0.85	0.73	25.5
Approach		**88**	**10.2**	**0.308**	**30.9**	**LOS C**	**21**	**0.44**	**0.68**	**35.2**
GWH East										
4	L	193	9.8	0.179	10.8	LOS B	6	0.06	0.67	56.5
5	T	964	10.0	0.635	30.5	LOS C	174	0.74	0.66	40.4
6	R	5	16.7	0.084	83.3	LOS F	5	0.97	0.66	19.8
Approach		**1163**	**10.0**	**0.635**	**27.5**	**LOS C**	**174**	**0.63**	**0.66**	**42.0**
Parklands Access Road										
7	L	5	16.7	0.025	10.0	LOS A	0	0.13	0.65	50.7
8	T	5	16.7	0.016	46.8	LOS D	4	0.82	0.55	26.2
9	R	5	16.7	0.036	56.6	LOS E	4	0.82	0.67	26.0
Approach		**18**	**16.7**	**0.036**	**37.8**	**LOS D**	**4**	**0.59**	**0.62**	**31.4**
GWH West										
10	L	5	16.7	0.005	10.3	LOS B	0	0.05	0.66	57.2
11	T	3103	10.0	0.919	23.6	LOS C	440	0.81	0.82	45.6
12	R	270	10.0	0.623	60.6	LOS E	127	0.90	0.83	24.8
Approach		**3379**	**10.0**	**0.919**	**26.5**	**LOS C**	**440**	**0.81**	**0.82**	**43.0**
All Vehicles		**4648**	**10.0**	**0.919**	**26.9**	**LOS C**	**440**	**0.76**	**0.78**	**42.5**

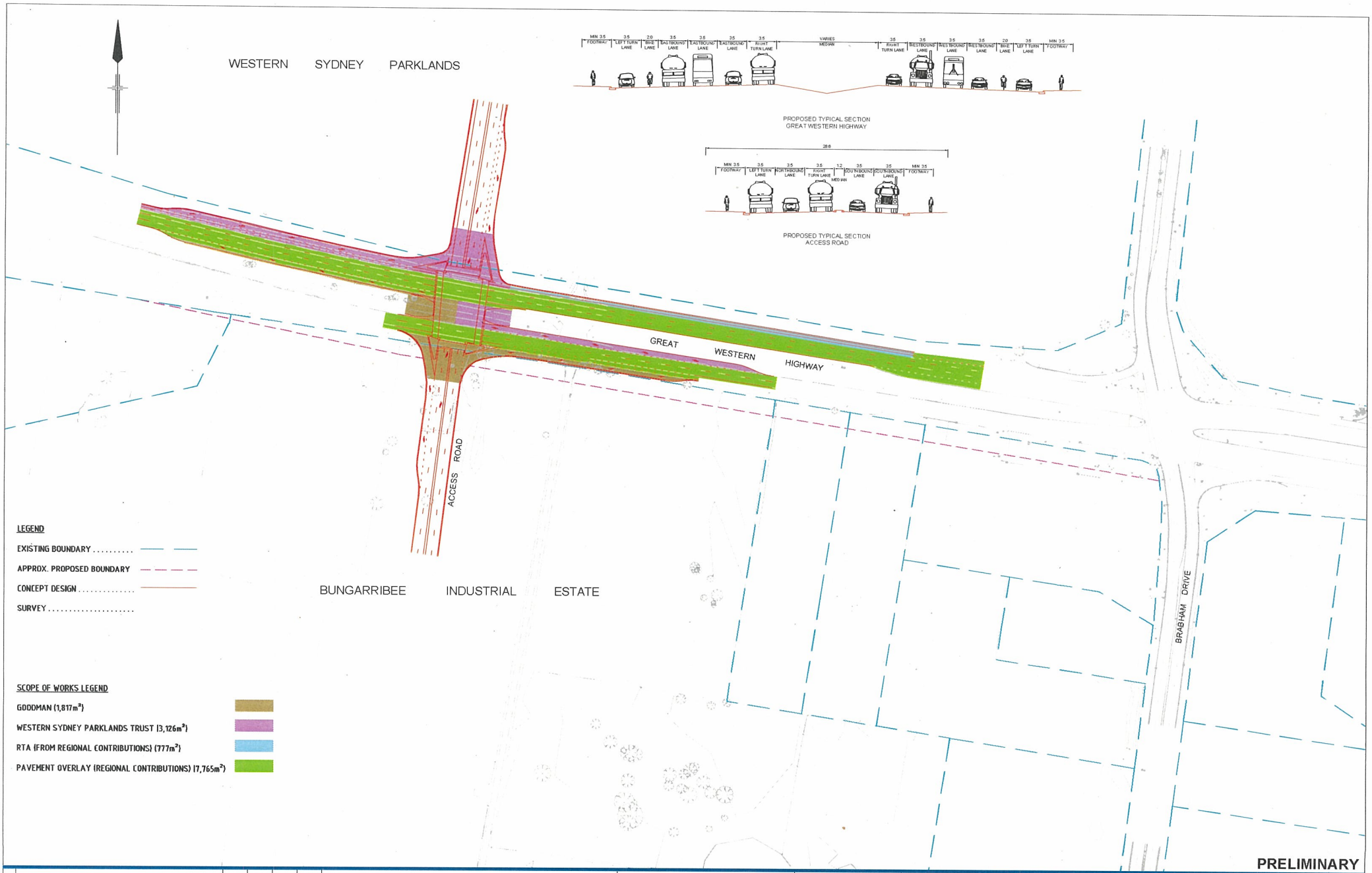
Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	20	27.7	LOS C	0	0.63	0.63
P3	20	64.1	LOS F	0	0.96	0.96
P5	20	12.4	LOS B	0	0.42	0.42
P7	20	64.1	LOS F	0	0.96	0.96
All Peds	**80**	**42.1**	**LOS E**	**0**	**0.74**	**0.74**


Parklands Access Road
50
50
100
250
250
GWH West
150
GWH East
100
100
30
30
Huntingwood Access Road

Appendix C

Preliminary Layout of the Proposed Great Western Highway/Bungarribee Industrial Estate Access Intersection



PRELIMINARY

No	Revision	Drawn	Checked	Approved	Date
B	SCOPE OF WORK AREAS ADDED	CG			19.12.08
A	PRELIMINARY - FOR DISCUSSION ONLY	CG			18.12.08

Note * indicates signatures on original issue of drawing or last revision of drawing

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE
PLAN

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE
TYPICAL SECTIONS

Goodman

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Drawn	C GRAZIANI	Designed	C GRAZIANI
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client GOODMAN
Project BUNGARRIBEE ESTATE - HUNTINGWOOD WEST
Title GWH / BUNGARRIBEE ACCESS RD INTERSECTION GENERAL ARRANGEMENT PLAN

Original Size A1 Drawing No: 21-18115-SK001 Rev: B

Plot Date: 29 October 2009 - 4:47 PM Plotted by: Cam Graziani, Sydney (Castlereagh) Cad File No: G:\21\18115\CADD\Drawings\21-18115-SK001.dwg

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C. Wiafe	F. Carrozza		C. McDougall		20/2/09
B	C. Wiafe	F. Carrozza		C Wiafe		20/11/09
C	C. Wiafe	F. Carrozza	On file	C. McDougall	On file	20/09/10