Coal and Allied

Lower Hunter Land Development

Northern Estate-Minmi/Link Road

Traffic and Transport

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1 Introduction

1.1 Background

Coal and Allied (C&A) has seven separate holdings in the Lower Hunter totalling 4,187 hectares. Four are located in the northern area comprising of Minmi (including land north and south of Newcastle Link Road), Black Hill Tank Paddock and Stockrington. Three are located in the southern area comprising Catherine Hill Bay (Middle Camp), Nords Wharf and Gwandalan. The sites are not required for future mining or other operational purposes.

In October 2006, the NSW Department of Planning released the final Lower Hunter Regional Strategy (LHRS) and signed a Memorandum of Understanding (MoU) with four major land holders in the Lower Hunter, including C&A. The MoU's provide the framework of offset arrangements with the major landowners whereby significant conservation areas will be transferred to the Government as an offset for development rights, both residential and employment, on other areas. The MoU between C&A and government contains provisions for the transfer of 3,322 hectares (80 percent) of C&A land for conservation corridors upon receipt of development rights on 849 hectares (20 percent). Residential development is proposed on 665 hectares of that area and employment on 183 hectares.

This traffic and transport report details impact from the residential development in the northern area comprising Minmi, Newcastle Link Road north and south. All of the Tank Paddock and Stockrington sites will be dedicated to NSW government for conservation. All three sites in the northern area have a combined development potential of 520 hectares (ha). At Minmi there is urban development potential of 260ha, there are 159 hectares (ha) north of the Newcastle Link Road (referred to as 'Link Road North'), and 101ha south of the Newcastle Link Road (referred to as 'Link Road South'). These fall across the boundary of the Lake Macquarie and Newcastle local government areas (LGA). Together, the three sites are the subject of this report, and will hereafter be referred to as the subject site Northern Estate –Minmi/Link Road.

The land is currently low density residential or greenfield sites, but has the potential for further residential development based on the development goals outlined in the LHRS. A Concept Plan for the subject site has been developed containing approximately 3,300 dwelling units which are planned to release over the next 25 years.

1.2 Director General's Requirements

In April 2008, the Director-General's Requirements (DGRs) for the subject land were issued. These required the preparation of a Traffic and Transport report in accordance with the Roads and Traffic Authority of New South Wales (RTA) 'Guide to Traffic Generating Development,' that addresses the following:

a) *Impacts on regional road networks during construction and operation;*
b) *Opportunities to minimise traffic on sensitive road frontages during construction and operation;*
c) *Efficiency of emergency vehicle access/egress;*
d) *Proposed access from the wider road network as well as the opportunities and constraints of alternative vehicular access points;*
e) *Measures to introduce and promote public transport usage and mode share;*

f) *Proposed pedestrian and cycle access within and to the site that connects to all relevant transport services and key off-site locations;*

g) *Traffic signal and intersection upgrades underpinned by an intersection analysis and micro-simulation model; and*

h) *Road design that is responsive to the proposed land use and associated urban form including proposed transport linkages between the subject land and surrounding key destination points such as existing centres, recreational areas and employment/industrial centres.*

C&A commissioned the Hyder Consulting Pty Ltd (Hyder) to carry out the traffic study that will address the above DGR's requirements and examine the traffic and transport issues associated with the concept plan of the subject site. Hyder has consulted the various state and local government planning policies and instruments that may apply for this study. In summary, Hyder has prepared this traffic and transport report to respond to key issues associated with the C&A Concept Plan for approximately 3300 dwelling units development.

1.3 Study Area

The northern lands are located approximately 20 kilometres west of Newcastle. The subject site Northern Estate- Minmi/Link Road is located in both Newcastle and Lake Macquarie local government areas. Figure 1-1 shows regional road network that provides access to the Northern lands including Minmi/Link Road and Black Hill sites. The Minmi/Link Road site adjoins the existing Minmi Township and is close to the emerging Glendale centre and Glendale/Cardiff renewal corridor identified in the LHRS. The subject sites are adjacent to the Blue Gum Hills Regional Park and Hexham Swamp.

Due to the large size of residential development, we anticipate that potential traffic impacts from this development will not be limited to immediate access points with the Minmi Road and the Newcastle Link Road, but will extend to the wider road network connecting the F3 Sydney Newcastle Freeway and Newcastle Link Road. Figure 1-2 shows the subject area and the surrounding road network that is predicted to be affected by the proposed residential development.

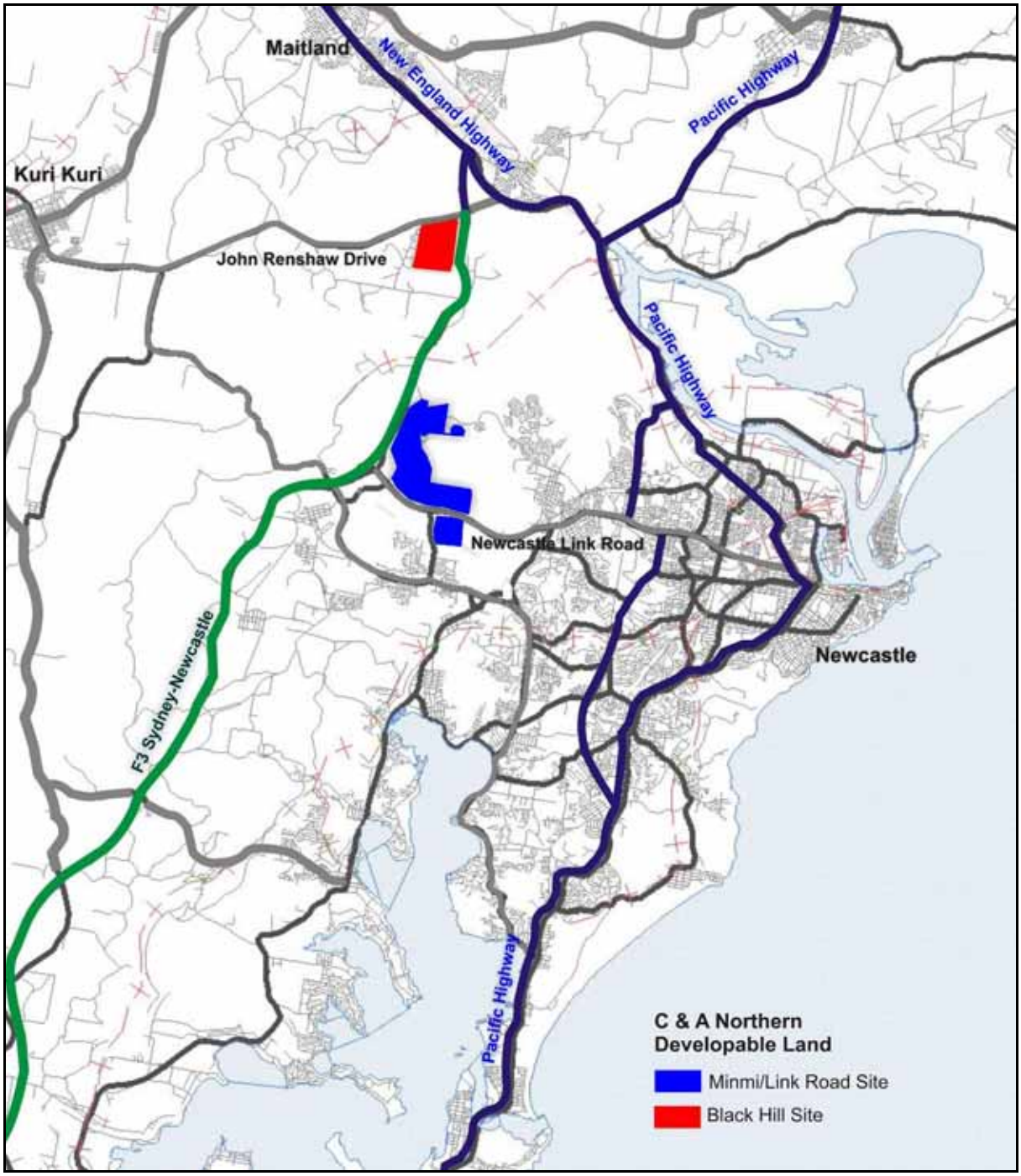

Figure 1-1 Regional road network in the context of Coal & Allied Northern developable land

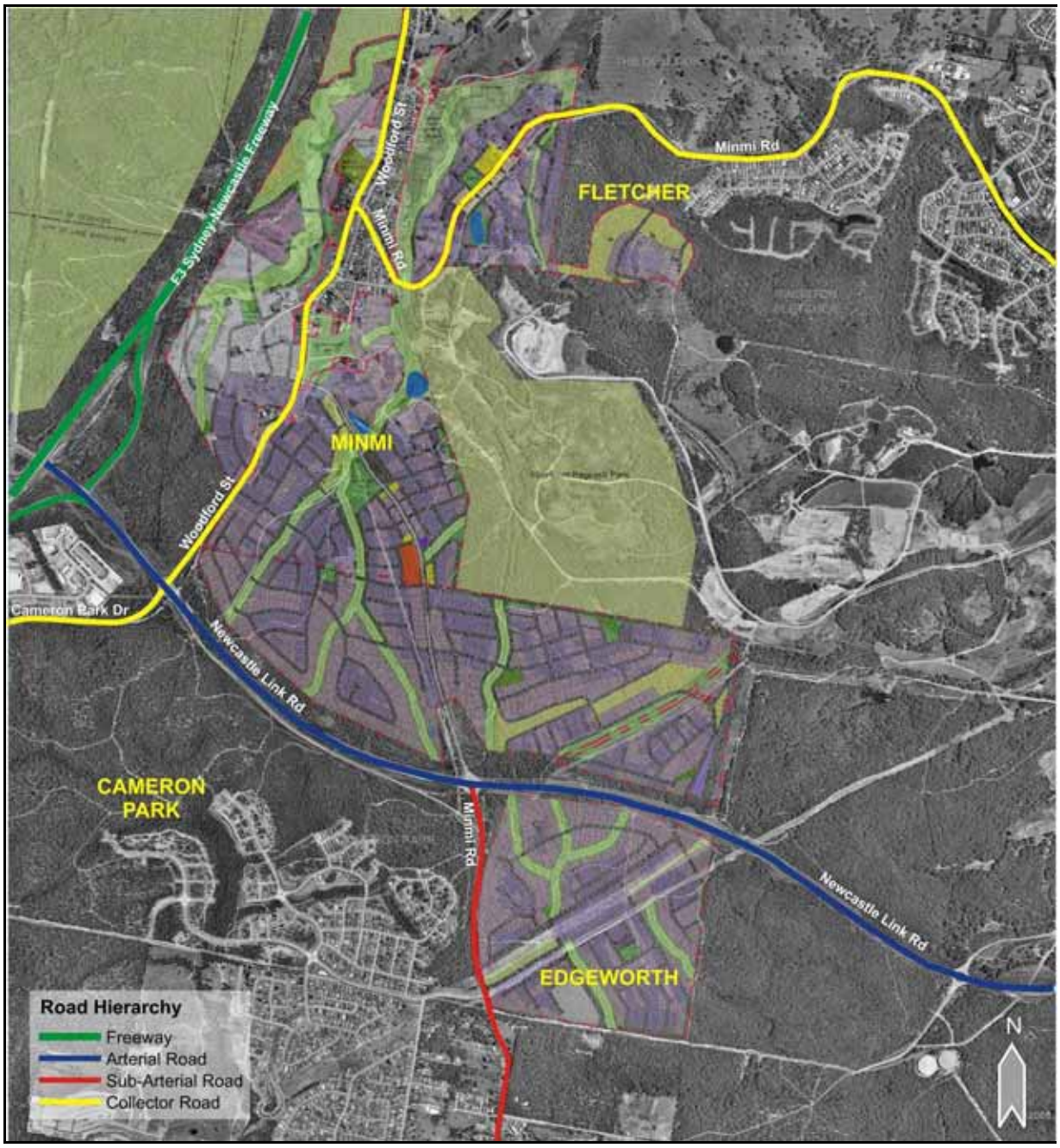

Figure 1-2 Road hierarchy in the context of Minmi/Link Road development proposal

1.4 Study Objectives

The purpose of a traffic study is to assess existing traffic patterns, undertake traffic projections for the study area and to conduct an evaluation of the traffic implications of the proposed Minmi/Link Road development on the road network over the next 25 years up to 2031. Key specific purposes were to:

- Address the Director-General's Requirements (DGRs) specifically for Traffic and Transport;

- Assess the overall impact of the proposed residential developments on the road network considering current traffic counts at all relevant vehicular traffic routes and intersections;
- Identify key access points of the proposed development considering the existing constraints and opportunities from both traffic and road safety perspectives;
- Identify the capacity of key intersections providing access & egress for the proposed development;
- Review existing constraints of non-car transport modes, and the opportunities to develop better public transport, pedestrian and cyclist facilities which can promote a long term public transport strategy;
- Assess existing travel patterns and predicted future patterns based on the LHRS land use;
- Predict and assess the additional traffic generated from the proposed development, based on RTA's *Guide to Traffic Generating Developments (2002*) and recent trip generation survey data obtained in the Lower Hunter;
- Update and or calibrate local study area network based on RTA's Lower Hunter Transport Model (LHTM). Assess impact on key intersections on the Newcastle Link Road, Minmi Road for future years if full development potential is achieved;
- Analyse the cumulative traffic impact considering other proposed developments assumed in RTA's LHTM models where possible; and
- A network improvement plan for staged and full Minmi/Link Road development that could form the basis for the traffic aspects of the developer contribution and next level of detailed intersection design and costing analysis.

1.5 Approach to Traffic Investigation

Future traffic conditions on the regional road network in the vicinity of C&A Northern lands (including Minmi/Link Road and Black Hill sites) will be determined by a number of complex driving factors. They are:

- Lower Hunter Regional Strategy which forecasts a population increase of about 160,000 and an additional 66,000 jobs over a 25 year planning horizon between 2006 and 2031. This land use change provided a key input to RTA's LHTM model;
- Key transport corridor involving Newcastle Link Road, F3 and John Renshaw Drive will carry a significant volume of regional traffic. In the future the predicted population and employment growth will have significant impact on traffic operations on these roads and associated intersections. This means that the cumulative impact will have implications for the access strategy adopted for C&A Northern lands;
- RTA has been investigating two longer term infrastructure projects in this corridor-F3 to Branxton Link (F32B) and F3 to Raymond Terrace Link (F32R). Both projects will have significant traffic impacts on this corridor. At present, RTA considers both schemes to be long-term projects, with neither having a detailed funding plan from the Federal Government. This means any impact from C&A Northern lands should be tested via a range of scenarios with or without these projects; and
- The current road network in and around the C&A Northern lands provide a number of route choices or alternative accesses, which implies that motorists will have a number of options on how they will access to C&A development. Due to

the complexity of future travel patterns within the corridor, we used RTA's LHTM model assessing C&A traffic impact on the wider road network.

In considering the above, Hyder developed a robust traffic methodology ensuring that cumulative impact was quantified accurately. This ensures that any contributions required for the proposed upgrading works to the Newcastle Link Road, John Renshaw Drive and/or other local roads are fair and transparent. Broadly we developed a five phase methodology to address issues described above.

- *Phase A* – Evaluate the LHTM[1] model;
- *Phase B* – Augment the base LHTM model in and around the C&A Northern lands including Minmi/Link Road and Black Hill;
- *Phase C* – Augment the future LHTM model by incorporating yield assumptions obtained from Northern Lands concept plans;
- *Phase D* – Carry out an impact assessment of Northern Lands with and without two planned major infrastructure projects. This also includes the cumulative impact of other proposed land developments in the Newcastle Link Road, F3 and John Renshaw Drive corridors; and
- *Phase E* – Reporting.

To supplement our methodology we used data from the following sources:

- Charette report produced by C&A ('Lower Hunter Lands. Conservation and Development – Northern Estates Charette Report,' 22 November 2007), which details the process undertaken to gather input and recommendations for the future concept plan; and
- Parsons Brinckerhoff (PB) undertook preliminary traffic data analysis including aaSIDRA modelling for Northern lands including Minmi/Link Road and Black Hill. Traffic counts (2007) data and aaSIDRA models were made available to Hyder by C&A, and have been used where applicable in this traffic study.

Figure 1-3 shows details methodology adopted for C&A Northern Lands.

[1] Lower Hunter Traffic Model (LHTM) was developed by using TransCAD software. Hyder developed the latest version of the V12r01 model for the RTA. Hyder obtained a model licensing agreement from the RTA which allows us to use traffic data for this study.

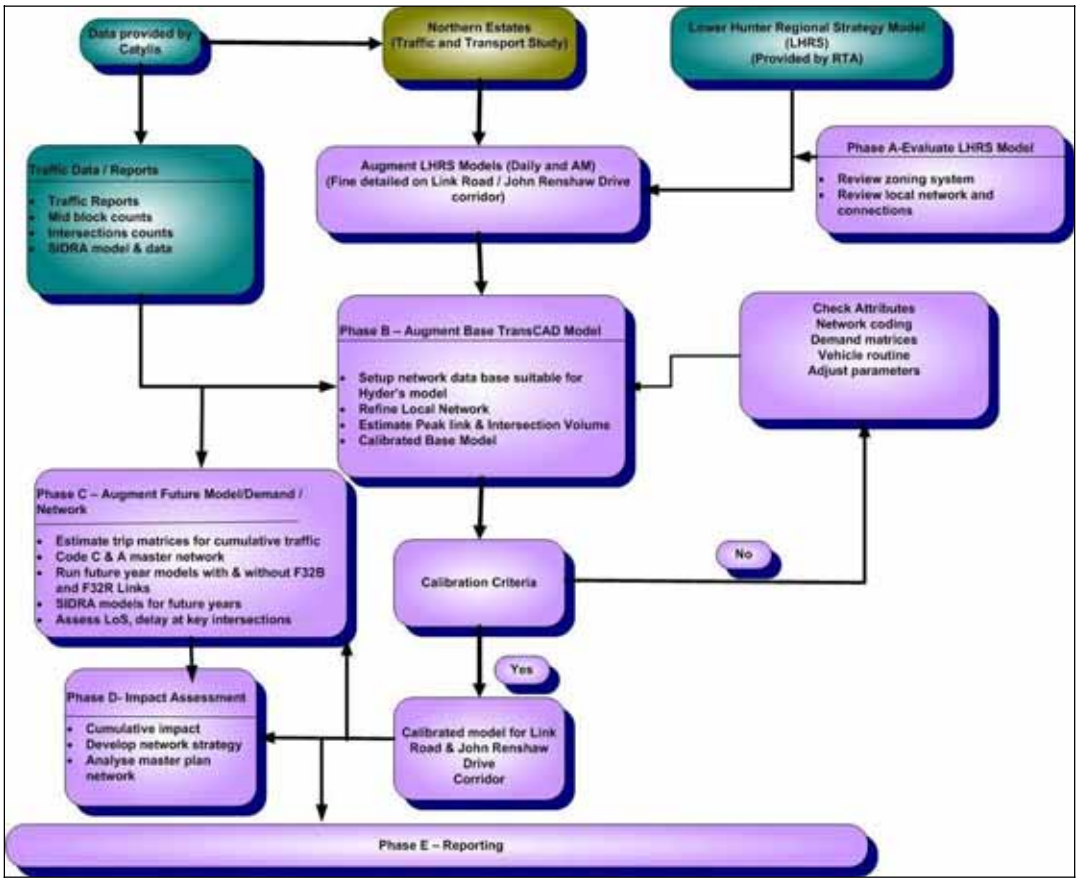

Figure 1-3 Traffic and transport approach

1.6 Report Structure

This report has the following structure:

- Chapter 1: Introduction – background to the study, outlining the subject area, study objectives and the approach used for traffic investigation;
- Chapter 2: Regional and Local Transport Context – overview of the existing conditions regarding the road network, land use, demographics, public transport, non-car modes, and traffic growth;
- Chapter 3: Traffic Data Service and Results – details the extensive traffic surveying undertaken, what this data shows, and how this was used to assess current network performance;
- Chapter 4: Traffic Forecasting Process – the modelling methodology and data used in assessing the C&A Northern lands. The section also outlines model development and the calibration process and results;
- Chapter 5: Impact Assessment – presents the outcomes of the modelling undertaken for mid-block flows and intersections, detailing what these results show regarding the impact of the Minmi/Link Road development. Includes expected traffic impacts at each development stage, proposed road and intersection changes;
- Chapter 6: Non Car Modes Strategy – presents non-car modes strategy. This section outlines public transport, pedestrian and cyclist requirements for the site; and

- Chapter 7: Summary of Findings – the summary of findings from the investigations, modelling and analysis. Includes referencing to Director General's requirements.

2 Regional and Local Transport Context

2.1 Road Hierarchy and Network

The RTA Road Design Guide defines the functional road hierarchy in an urban area to establish a consistent basis for traffic management. There are four levels of road and their functions are stated as below:

- Arterial roads – predominantly carry through traffic from one region to another, forming principal avenues of communication for urban traffic movements;
- Sub Arterial Roads – connect the arterial road to areas of development and carry traffic directly from one part of a region to another. They may also relieve traffic on arterial roads in some circumstances;
- Collector Roads – connect the sub-arterial roads to the local road system in developed areas; and
- Local Roads – are the sub-divisional roads within a particular developed area. These are used solely as local access roads.

Figure 1-2 shows the existing road hierarchy around the Minmi/Link Road proposed development site. The key roads and associated junctions of the proposed development are summarised in Table 2-1 and Table 2-2 respectively. Figure 2-1 shows key intersections which will be affected from proposed Minmi/Link Road development.

Table 2-1 Existing road network characteristics

Road Names	Road Hierarchy	Speed Limit (kph)	Characteristics
Sydney-Newcastle Freeway (F3)	Arterial	110	The Sydney-Newcastle Freeway (F3) is the main traffic route in the vicinity of the site. There are two lanes north and two lanes south with a median. An interchange to Newcastle Link Road is located 800m northwest of the Woodford Street Intersection, which is to the south-west of the subject site. F3 is a State Road under the care and control of the Roads and Traffic Authority of New South Wales (RTA). Sydney-Newcastle Freeway is an important link in the state's highway network and is classified as an arterial road.
Newcastle Link Road	Arterial	90	Newcastle Link Road is the main traffic route from the F3 to Newcastle through Minmi and Edgeworth. It is classified as an arterial road and has four lanes in the vicinity of the site, two lanes west and two lanes east.
Minmi Road (Minmi)	Sub-arterial	70/80	There are two roads called Minmi Road in the vicinity of the site. One is located in Minmi and the other one is located in Edgeworth, to the south of Newcastle Link Road. Although they are both within the study area, they are not connected to each other. Minmi Road (Minmi) is a two lane undivided road (one each direction) and is classified as a sub-arterial road under Council's road hierarchy. It provides an east-west link between Minmi and Maryland. Minmi Road (Minmi) joins Woodford Street at a signalised T-junction near the Minmi development site.
Minmi Road (Edgeworth)	Sub-arterial	70/60	Minmi Road (Edgeworth) forms the western boundary of the proposed Link Road South site. It is a two lane undivided road (one each direction) and is classified as a sub-arterial road in terms of Council's road hierarchy. It provides a north-south link between Edgeworth and Minmi. It joins Newcastle Link Road at the north end as a roundabout close to the Link Road South site. The speed limit along Minmi Road (Edgeworth) from Newcastle Link Road intersection is 70 km/h and decreases to 60 km/h when approaching to Northlakes Drive One lane each way
Woodford Street	Collector	80/60 50/40	Woodford Street is a two lane undivided road (one each direction) and is classified as a collector road under Council's road hierarchy. It provides a north-south link between Minmi and West Wallsend. It joins Newcastle Link Road / Cameron Park Drive at the south end as a roundabout and Lenaghans Drive at the north end. The speed limit along Woodford Street in the rural section 80km/h, before the Minmi township 60km/h, in the Minmi township are, an50km/h respectively. It further decreases to 40km/h in the school zone of the Minmi Primary School.

Table 2-2 Key intersections

ID	Intersection	Control Type and Characteristics
I-01	Newcastle Link Rd/Woodford St/Cameron Park Dr	Intersection is an existing four-way roundabout
I-02	Newcastle Link Rd/Minmi Rd (Edgeworth)	This intersection currently operates as a roundabout. The northern leg for the proposed new road into the development is constructed for approximately 20m and blocked by concrete barriers at present
I-03	Minmi Rd (Minmi) /Woodford St	This intersection is currently a signalised T-junction and permits all turning movements.

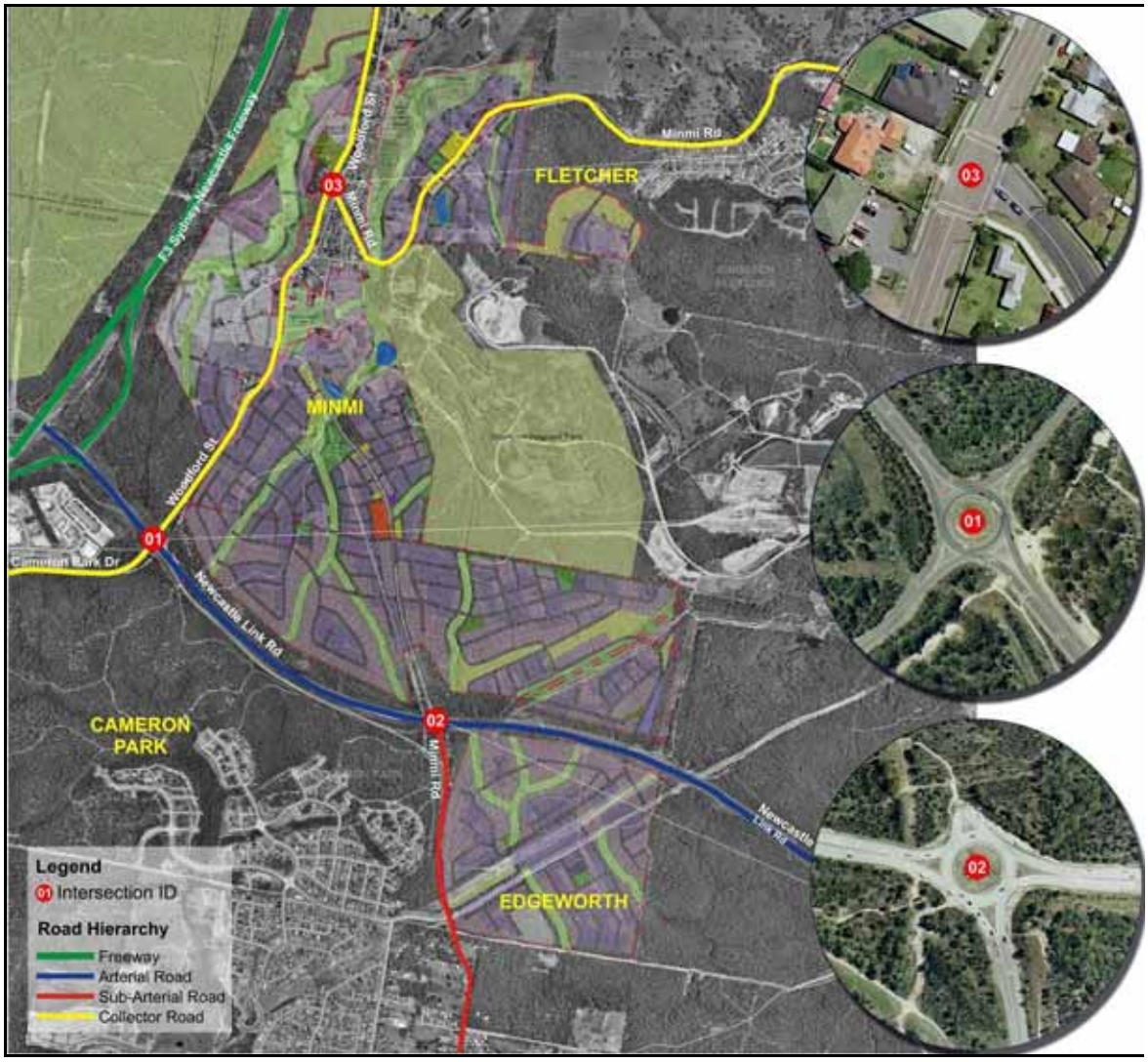

Figure 2-1 Key intersections- locations and configurations

2.2 Land Use

Minmi/Link Road study area contains one established settlement, this being Minmi Village. The C&A Charette report highlighted that Minmi's layout, landscape and industrial, social, built and archaeological heritage are significant in the context of NSW's history. Minmi Village only occupies a small proportion of the total land in the study area, with the majority of land currently used for mining purposes or occupied by forest and open green space. The concept plan shows that the majority of the land in the subject site will be developed for residential purposes, with a mix of plot sizes and housing styles, complemented by some retail and mixed-use development. The concept plan also provides for land to be used for community facilities and various green and open spaces.

2.3 Demographics

Minmi is currently a community of 732 inhabitants (ABS 2006 census) located on the edge of the Newcastle local government area (LGA). Proposed Mimi/Link Road sites are located across the two LGA's of Newcastle and Lake Macquarie. A review of the car ownership and average household income statistics for the Newcastle and Lake Macquarie LGAs has been analysed and results are presented in Table 2-3.

Table 2-3 LGA Car Ownership (ABS Census 2006)

LGA	0 vehicle	1 vehicle	2 vehicles	3 vehicles	4 or + vehicles
Newcastle	15.1%	41.9%	32.6%	7.8%	2.7%
Lake Macquarie	9%	37.9%	37.3%	11%	4.8%

It can be seen from the table above that the majority of households have one or two vehicles. It is noted that the population living around the proposed development, being in the fringe of the urban area, are more affluent than those living in the urban area and are therefore more likely to have higher car ownership. The high proportion of households with no vehicle in Newcastle can be explained by the fact that it is a highly urbanised area with fairly good access to public transport. Lake Macquarie, on the other hand, has a more scattered urbanisation with limited public transport services causing a higher reliance on private vehicles. Figure 2-2 illustrates the car ownership data in the vicinity of the study area.

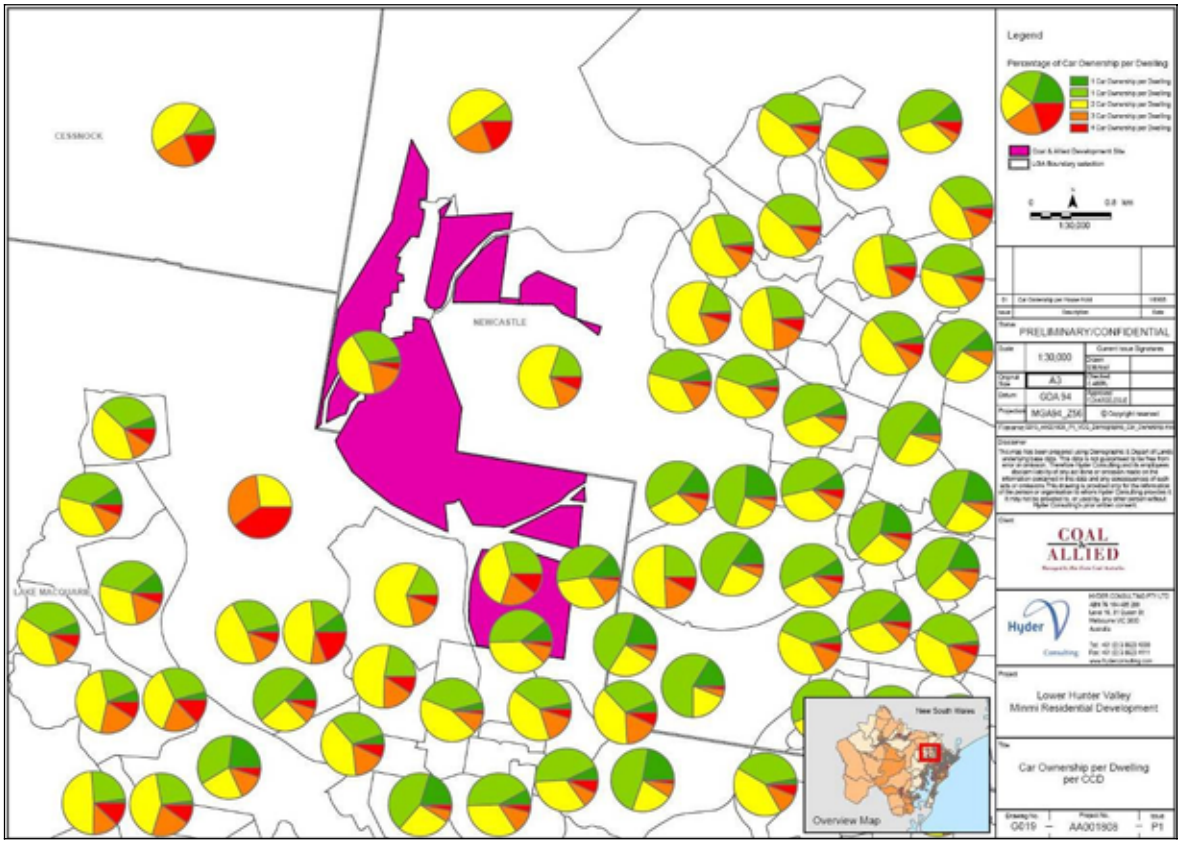

Figure 2-2 Car ownership around the study area (2006 ABS Census)

2.4 Journey to Work Analysis

An analysis of the 2006 Census Journey to Work (JTW) data shows that around 78% of work trips for those working and living in Newcastle and Lake Macquarie LGA's are undertaken by private vehicle. The private car usage for Minmi will be higher than average LGA figure. At the time of writing this report JTW data at travel zone level was not available from Transport Data Centre, nevertheless LGA data provides sufficient indication of car dependency of Lower Hunter region. The residential development at Minmi is located across two SLAs:

- Newcastle – Outer West; and
- Lake Macquarie – North.

The data analysis has been made for the two combined SLAs and the results are shown in Table 2-4.

Table 2-4 Travel to work data-Newcastle Outer West and Lake Macquarie North

Place of Work	Car	Public Transport	Other	Total
Newcastle	19,150	705	4,060	23,915
Lake Macquarie	11,379	231	3,860	15,470
Cessnock	577	3	98	678
Port Stephens	1,474	7	197	1,678
Maitland	1,515	33	201	1,749
Central Coast	492	32	89	613
Sydney	447	118	180	745
Other – NSW	2,562	57	520	3,139
Other States	73	14	60	147
Total	**37,669**	**1,200**	**9,265**	**48,134**
Percentage	**78.3%**	**2.5%**	**19.2%**	**100%**

The table above shows that only 2.5% of trips within the study area were undertaken by public transport (train and buses) and 78% by private car (both as drivers or passengers). That demonstrates the population's high reliance on private vehicles for commuting. The usual place of work for people, in the study area, is within the LGA of Newcastle and Lake Macquarie (82%) and to a lesser extent towards the Maitland and Port Stephens areas. Figure 2-3 illustrates the travel to work data from Newcastle Outer West SLA; Figure 2-4 illustrates the travel to work data from Lake Macquarie North.

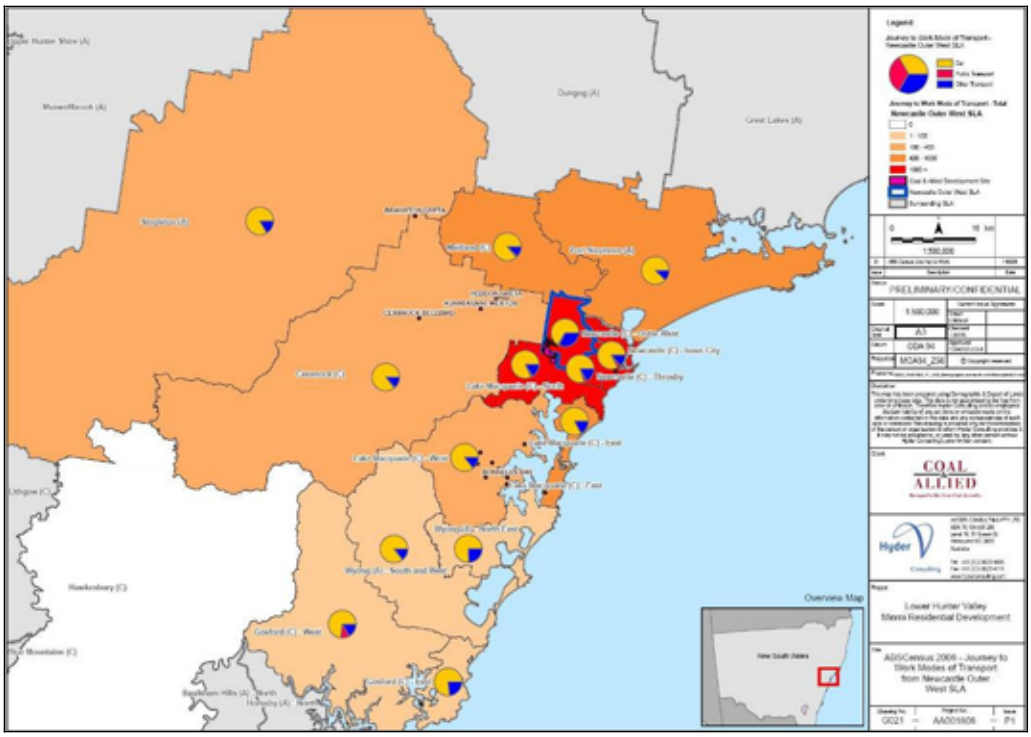

Figure 2-3 Travel to work from Newcastle Outer West

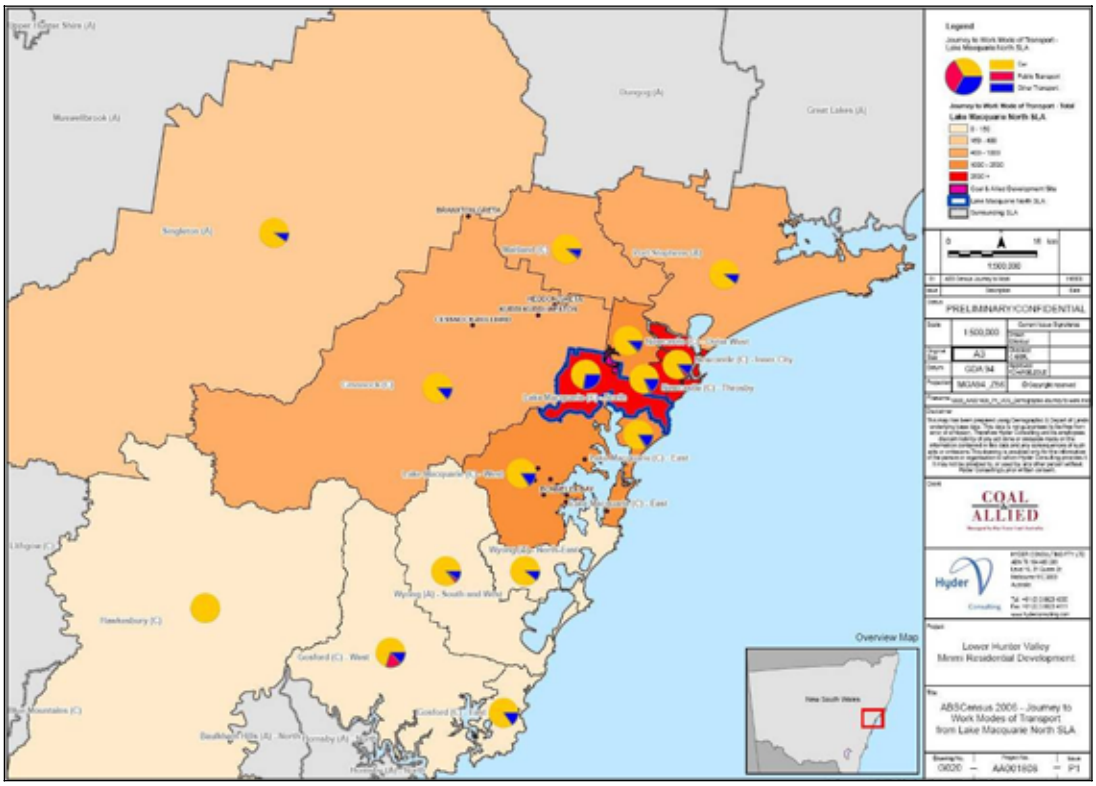

Figure 2-4 Travel to work from Lake Macquarie North

2.5 Public Transport Network and Use

The public transport network in the vicinity of the Minmi/Link Road development site comprises buses and train services, running within a few kilometres of the development site. As described in the previous section, the use of public transport for commuting has only a 2.5% mode share. The trips are mainly made towards places located in the City of Newcastle and the City of Lake Macquarie.

2.5.1 Bus Services

Minmi Township is part of the Lower Hunter bus network. Currently, two bus services are running in the vicinity of the proposed development site:

- Route 260 Minmi – Maryland – Wallsend; and
- Route 265/266 Cameron Park – Glendale – Charlestown – Newcastle University.

The frequency and hours of service for the routes are summarised in Table 2-5.

Table 2-5 Bus Services Frequency

Route	No of services weekday (2-way)	No of services weekends (2-way)	Span of hours weekday
260	15	6	6am – 8:45pm
265/266	14	4 on Saturdays/no service Sundays	7am – 7pm

The bus network around Minmi is mapped at Figure 2-5. Route 260 is operated by Hunter Valley Buses and links Minmi Township with Fletcher, Maryland and Wallsend Interchange. It runs along Minmi Road to the north of the study area.

Sugar Valley Coachlines operates routes 265 and 266 which connect Seahampton and Cameron Park to Glendale, Charlestown and Newcastle University. The bus routes run through Cameron Park, just south of the proposed development site. In light of an integrated public transport network (promoted by the Transport taskforce of Lake Macquarie Combined Chambers), these services allow access to Glendale interchange and Cardiff Railway Station.

Figure 2-5 illustrates the current bus network in the vicinity of the study area.

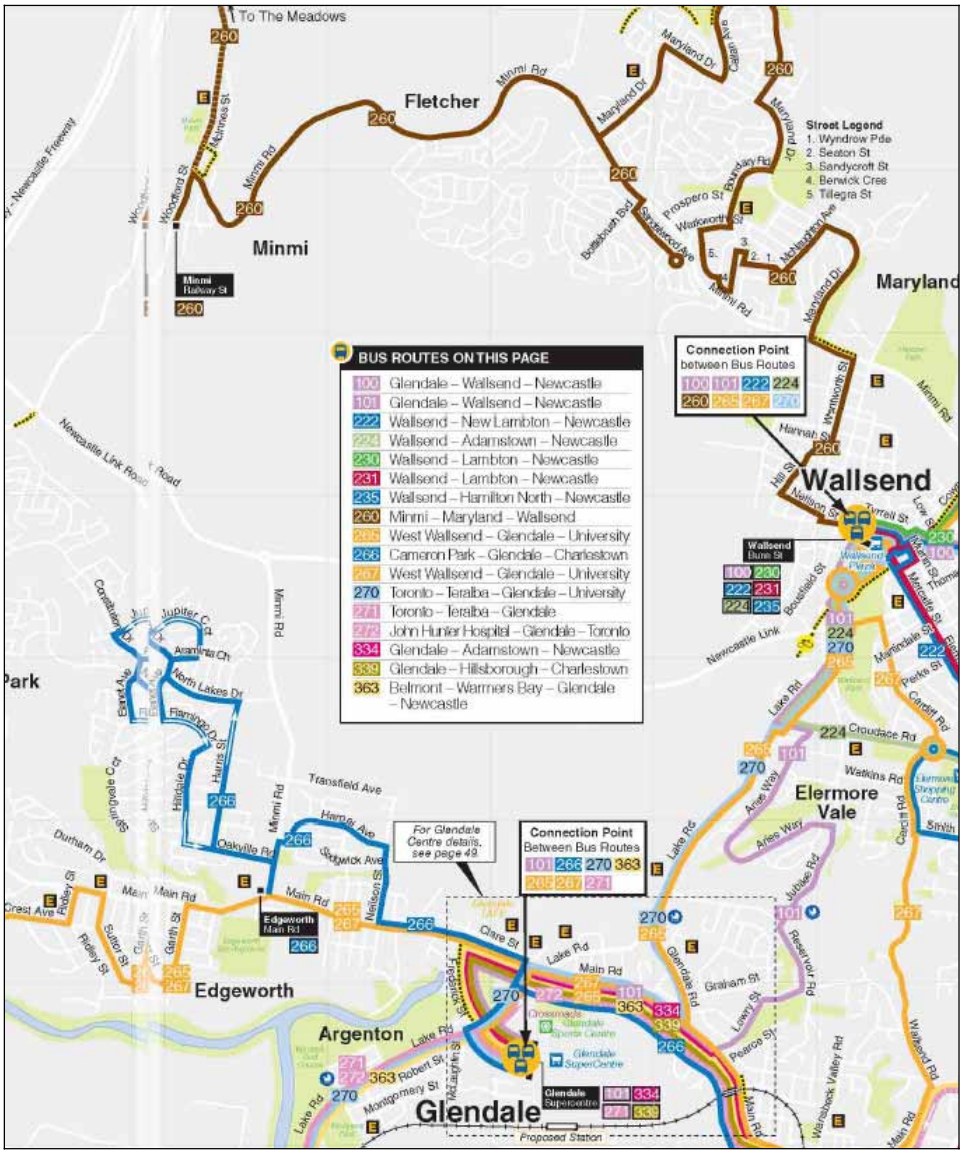

Figure 2-5 2008 bus network (Lower Hunter Public Transport Network)

2.5.2 Rail Services

The nearest train station to the proposed residential development is Cardiff Railway Station located eight kilometres to the southeast.

Cardiff Station is serviced by frequent train services on the City Rail line between Sydney and Newcastle. The frequency of services during weekdays, towards Newcastle, Central Coast and Sydney, is every 20-30 minutes and an hourly service runs at weekends.

Access to the station can be made by public transport from Minmi (with transfers from bus route 260 at Wallsend interchange) and from Cameron Park (direct from bus route 265/266).

Other train services currently operating in the area and include:

- Sydney – Brisbane Country Link services at Broadmeadow Station; and
- Newcastle – Maitland – Dungog – Scone City Rail services at Sandgate or Beresfield Stations.

Figure 2-6 illustrates the rail network in the vicinity of the study area.

Figure 2-6 Rail network in the vicinity of the study area (www.railmaps.com.au)

2.6 Pedestrian and Cyclist Network

The current pedestrian and cycle network at Minmi has been developed and managed by the Newcastle and Lake Macquarie City Councils. All local streets are designated as shared cycling and pedestrian zones. Regional arterials, such as the Newcastle Link Road, are also designated as shared vehicular and cycling routes. Currently, only a small section of off-road cycle path is located in the centre of Minmi Township, along Woodford Street. As Minmi has a current low level of development, cyclists and walkers in this area would expect to have only occasional interaction with car traffic.

2.7 Parking

Currently no parking restrictions are in place on either side of Woodford Street. No parking is allowed on the Newcastle Link Road between F3 and Lake Road.

2.8 Historical Traffic Growth

Historical traffic growth data was obtained from the RTA on Newcastle Link Road and Minmi Road (at Edgeworth). We have shown 2007 survey data on both roads, but not exactly at the same RTA locations. Care should be taken while interpreting two data sources from Table 2-6. Survey data shows average weekday data measured in vehicles, but RTA data shows annual average daily traffic (AADT) measured in axle pairs. Nevertheless historical data shows a reasonably good notional traffic growth in the Newcastle Link Road corridor.

Table 2-6 AADT data, RTA traffic count sites

Station	Road	1995	1998	2001	2004	2007 (survey)
05.496	Newcastle Link Road, W of Minmi Road *	N/A	N/A	17,631	20,407	22,400
05.945	Minmi Road, Edgeworth – S of Link Road to F3	8,168	9,287	10,522	11,553	14,000

***Note**: C & A Mid-block survey location, M2-Newcastle Link Rd East of Minmi Rd (Edgeworth)

In 2004 RTA counted about 20500 vehicles on the Newcastle Link Road (NLR). In 2007, traffic on the NLR was counted about 22400 per day. On average a notional growth between 2% and 3% was observed on NLR.

2.9 Crashes

The RTA has provided reported accident data for the six years from January 2002 to December 2007 with preliminary data from the December Quarter 2007 onwards. This crash data is for accidents on the existing road network close to the Minmi/Link Road site. The data covers crashes reported to the Police, which include all fatal, injury or vehicle damage only accidents. A total of 283 accidents were recorded for the last six years. Of these, two crashes resulted in fatalities and 128 in injuries. Fatal crashes

occurred on the F3 and Cameron Park Drive. Table 2-7 details number of crashes recorded on key roads. The crash location on F3 is shown in Figure 2-7.

Table 2-7 Crash Data between 2002 and 2008

Location	Fatal	Injury	Tow-away	Total Crashes
F3, between Cedar Hill Dr and Ladysmith Rd	1	29	30	60
Newcastle Link Rd, between F3 and Transfield Ave	0	34	55	89
Minmi Rd, between Boundary Rd and Newcastle Link Rd	0	35	33	68
Minmi Rd, between Newcastle Link Rd and Transfield Ave	0	13	11	24
Lenaghans Dr-Woodford St, between Dog Hole Rd and Minmi Rd	0	3	1	4
Cameron Park Dr, between Newcastle Link Rd and George Booth Dr	1	14	23	38
Total	**2**	**128**	**153**	**283**
Percentage	**1%**	**45%**	**54%**	**100%**

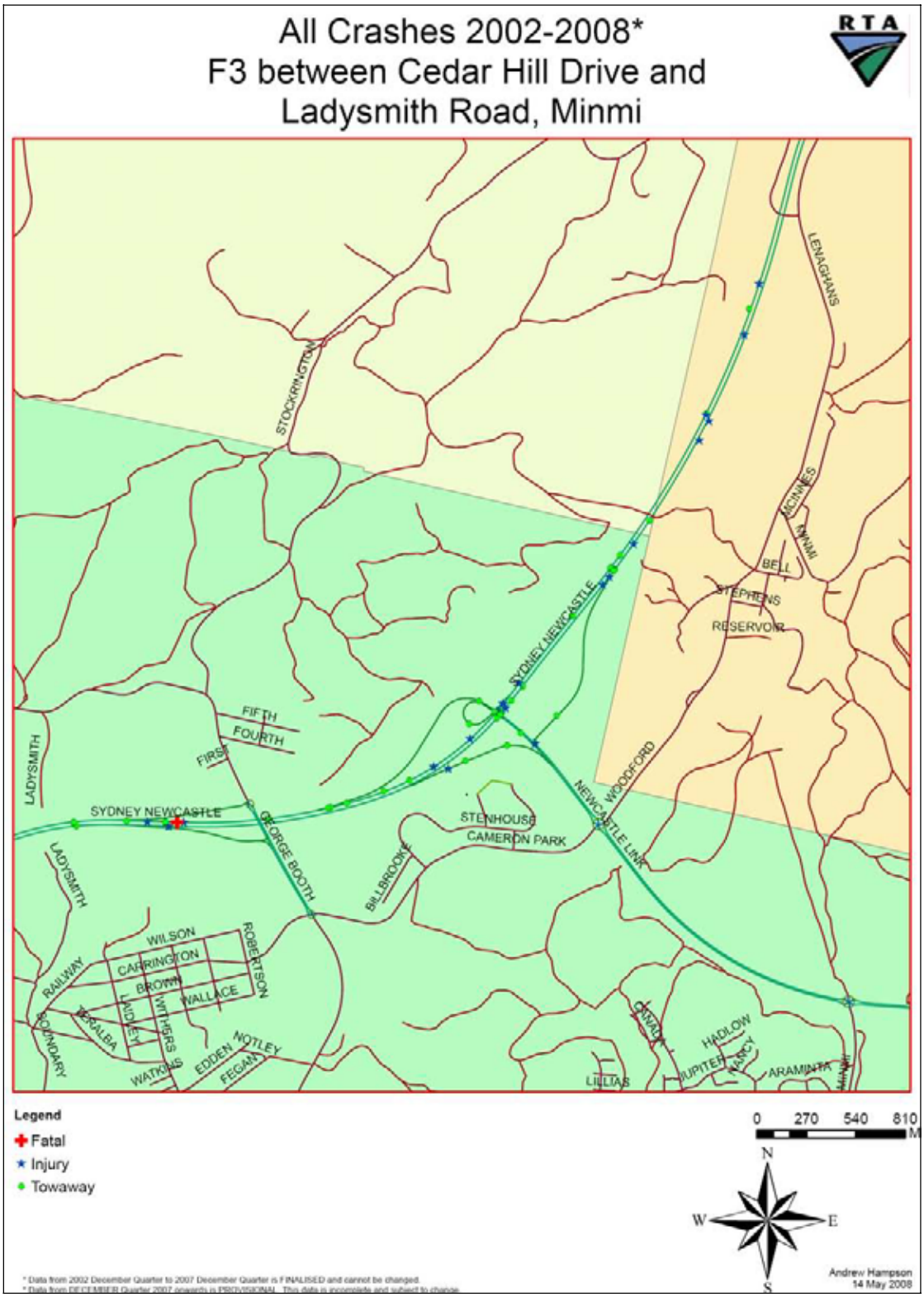

Figure 2-7 Crash Locations on the Sydney Newcastle Freeway (F3)

3 Traffic Data Service and Results

In October 2007, traffic data was collected on key roads and intersections in the vicinity of C&A Northern lands. The following sections summarise the data collected, and explain how the data was used in the C&A impact assessment.

3.1 Traffic Surveys

For this study area two categories of survey were carried out:

- Mid-block tube counts for periods of at least a week; and
- Intersection turning movement counts during morning and afternoon peak periods.

For the mid-block tube counts, six key sites were chosen that were deemed to be crucial for the proposed development. Figure 3-1 shows six count locations:

1 Newcastle Link Road, west of Woodford Street;

2 Newcastle Link Road, east of Minmi Road;

3 Minmi Road, south of Newcastle Link Road;

4 Woodford Street, north of Newcastle Link Road;

5 Minmi Road through Minmi/Fletcher; and

6 Lenaghans Drive, north of Peter Street.

The mid-block surveys were undertaken for the continuous seven-day period between 16 October 2007 and 22 October 2007. From this count data all vehicles were then classified into the twelve Austroads standard vehicle classes. In addition to the mid-block counts, key locations were selected for intersection counts. Figure 3-1 shows the locations of three intersections:

- Newcastle Link Road/Woodford Street;
- Newcastle Link Road/Minmi Road (Edgeworth); and
- Woodford Street/Minmi Road (Minmi).

The intersection surveys were fully classified turning counts, conducted for both AM (7am to 10am) and PM (3pm to 6pm) peaks on Friday 19 October 2007 being the critical day found from other survey locations in this corridor.

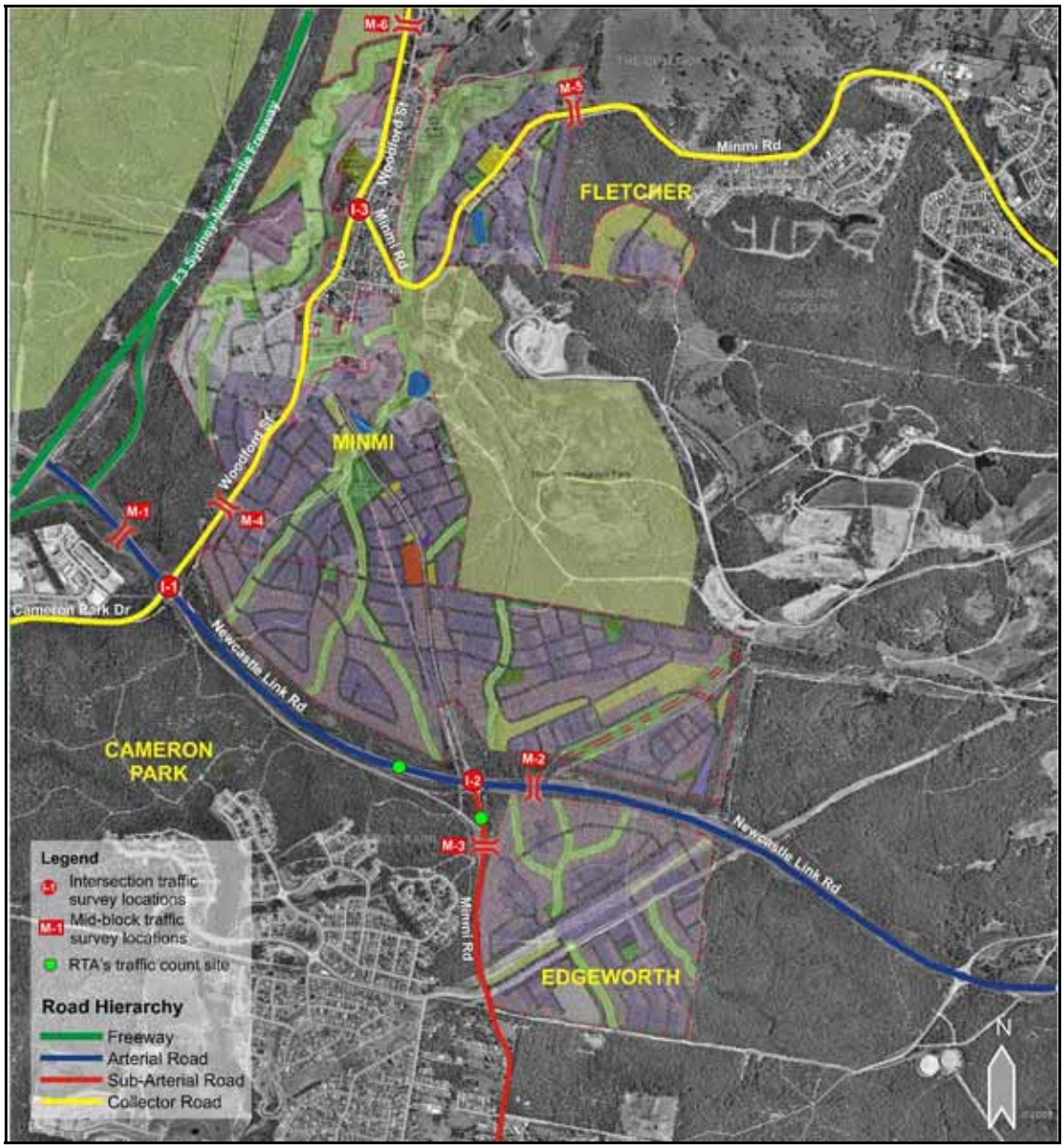

Figure 3-1 Traffic Survey Locations

3.2 Traffic Volumes

From the collected traffic data we have analysed and presented results in a number of ways. Daily traffic volumes for the key roads were calculated (see Table 3-1 below) for an 'average weekday' and an 'average weekend' traffic. These two variations of traffic volume are derived from the mid-block surveys conducted during a 'typical' week, i.e. not during school holidays.

Table 3-1 Daily traffic volumes on key roads

Site ID	Road sections	Average Weekday	Average Weekend	Traffic Changes (Weekend)
	Arterial Road:			
M-1	Newcastle Link Road, west of Woodford Street	22,900	15,300	-33%
M-2	Newcastle Link Road, east of Minmi Road (Edgeworth)	22,400	15,100	-33%
	Collector Road:			
M-3	Minmi Road (Edgeworth), south of Newcastle Link Road	14,000	9,700	-31%
M-4	Woodford Street, north of Newcastle Link Road	3,200	3,000	-6%
M-5	Minmi Road, through Minmi/Fletcher	4,900	3,700	-25%
M-6	Lenaghans Drive further north of Peter Street	3,900	2,700	-31%

Daily Traffic Volume data shows that:

- Newcastle Link road, between Woodford Street and Minmi Road, carries over 22,000 vehicles per day during a weekday, with weekend traffic around a third lower than an average weekday. This implies that the Newcastle Link Road at this location carries a high proportion of commuter traffic demand to/from Newcastle;
- Minmi Road (through Edgeworth), south of Newcastle Link Road carried approximately 14,000 vehicles per day during a weekday, the highest of the collector roads listed. This location is similar to Newcastle Link Road in that weekend volumes are significantly lower (31%) than the average weekday; and
- Of the other collector roads, Woodford Street carries the lowest volume during a weekday, but has the smallest change for weekend traffic, dropping just 6%. Leneghans Drive and Minmi Road (through Minmi) carry slightly more traffic than Woodford Street during the week, but have significant reductions on a typical weekend, with traffic reducing by over 25% on both roads.

Daily Traffic Profiles

A 7-day profile of the two-way traffic volumes was calculated and plotted for comparison between the six mid-block count sites. These charts can be found in Appendix A. They show that:

- At each of the survey locations there are two clear peaks during a typical weekday, with weekends generally having lower overall volumes but less distinguished peaks;
- Across all sites, there is no one day that has markedly higher two-way flows than any other day; and
- The PM Peak on Friday tends to be when there is the highest two-way flow. This is particularly the case on the Newcastle Link Road, where the peak occurs just before 6pm.

Peak Hour Variations

The traffic survey data was also used to plot charts of the directional hourly volumes on a typical weekday. This information was used to establish the travel pattern during the day and to ascertain the peak period of traffic flow in each direction. These traffic volumes for morning and afternoon peaks have been summarised in Table 3-2. From analysis it was found that:

- Morning traffic reached its highest point between 8 AM and 9 AM for the majority of surveyed locations;
- The afternoon peak occurred between 5 PM and 6 PM on the Newcastle Link Road and Minmi Road (south of Newcastle Link Road) as would be expected for commuter trips;
- For all other collector roads, the afternoon peak occurred earlier, between 3 PM and 4 PM, suggesting a heavier influence of local trips, such as shopping and school traffic;
- The highest peak hour traffic (PM Peak) on the Newcastle Link Road is about 2,200 vehicles. This is significantly below the stated capacity for a four lane arterial road. Typically, an arterial road with dual carriageway such as Newcastle Link Road at this location would have a notional capacity of 6,000 vehicles per hour, assuming 1500 vehicles per lane. This implies current 2/2 lane road has capacity for further growth provided key intersections (roundabouts) can accommodate additional traffic; and
- Considering traffic data at all sites, Figure 3-2 shows a composite traffic profile. AM peak hour is about 8% of daily traffic and PM peak is slightly higher than AM peak, 8.8% of daily traffic.

Table 3-2 AM and PM peak hour volumes on key roads (Friday)

Site ID	Road sections	AM Peak (8 to 9am)			PM Peak (5 to 6pm) *(3 to 4pm)		
		NB/EB	SB/WB	Total (2-way)	NB/EB	SB/WB	Total (2-way)
	Arterial Road:						
M-1	Newcastle Link Road, west of Woodford Street	910	1,010	1,920 (8,4%)	970	1,230	2,200 (9.6%)
M-2	Newcastle Link Road, east of Minmi Road	1,150	770	1,920 (8,6%)	980	1,280	2,260 (10%)
	Collector Road:						
M-3	Minmi Road, south of Newcastle Link Road	660	440	1,100 (7,8%)	490	850	1,340 (9.5%)
M-4	Woodford Street, north of Newcastle Link Road*	120	180	300 (9,3%)	150	170	320 (10%)
M-5	Minmi Road, through Minmi/Fletcher*	260	270	530 (10,8%)	260	250	510 (10.8)
M-6	Lenaghans Drive further north of Peter Street*	190	180	370 (9,5%)	180	210	390 (10%)

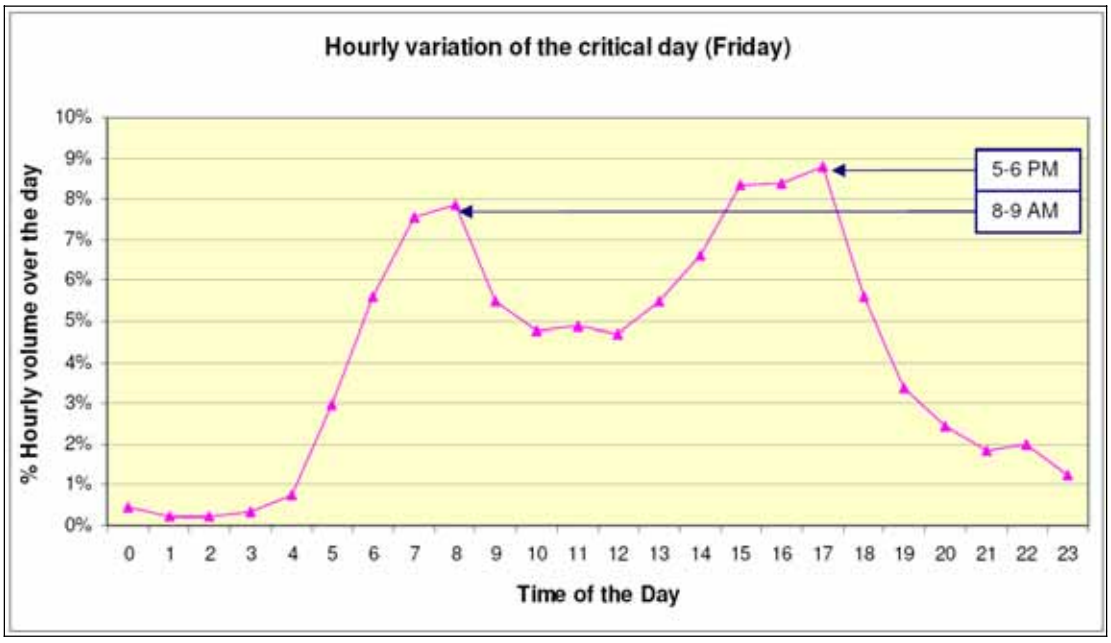

Figure 3-2 Hourly variation of the critical day (Friday) –Combined all sites

Road Traffic Distribution

The directional analysis is important as road capacity and level of service can vary substantially as per directional distribution. Table 3-3 below, summarises the directional split of daily flows at the mid-block count locations. The result shows that:

- Newcastle Link Road, west of Woodford Street, has a directional split of 44% eastbound and 56% westbound;
- Newcastle Link Road, east of Minmi Road, has an equal split of 50/50 directional distribution; and
- All other collector roads have a balanced traffic flows with directional distribution around 50:50.

Table 3-3 Directional distribution of daily traffic on key roads (typical Friday)

Site ID	Road sections	NB/EB	SB/WB	2-way
	Arterial Road:			
M-1	Newcastle Link Road, west of Woodford Street	10,800 (44%)	13,900 (56%)	24,700 (100%)
M-2	Newcastle Link Road, east of Minmi Road	12,200 (50%)	12,100 (50%)	24,300 (100%)
	Collector Road:			
M-3	Minmi Road, south of Newcastle Link Road	7,300 (50%)	7,400 (50%)	14,700 (100%)
M-4	Woodford Street, north of Newcastle Link Road	1,700 (49%)	1,800 (51%)	3,500 (100%)
M-5	Minmi Road, through Minmi/Fletcher	2,600 (49%)	2,700 (51%)	5,300 (100%)
M-6	Lenaghans Drive further north of Peter Street	2,100 (50%)	2,100 (50%)	4,100 (100%)

Heavy vehicles

According to Austroads vehicle classification system, 'heavy vehicles' include trucks with two or more axles, buses, semi-trailers and B-doubles. Table 3-4 below shows the

number of heavy vehicles recorded during the morning and afternoon peak hours and over the entire day. The numbers in brackets indicate the proportion of the total traffic volume made up of heavy vehicles. The heavy vehicle data showed the following patterns:

- On Newcastle Link Road about 1,600 to 2,200 heavy vehicles were recorded for a weekday being approximately 7% to 9% of total traffic; and
- Number of heavy vehicles on collector roads is generally less than 500 vehicles per day.

Table 3-4 Heavy vehicles (2-way) on key roads (Friday)

Site ID	Road sections	AM Peak (8-9am)	PM Peak (5-6pm) *(3-4pm)	Daily
	Arterial Road:			
M-1	Newcastle Link Road, west of Woodford Street	190 (10%)	150 (7%)	2,180 (9%)
M-2	Newcastle Link Road, east of Minmi Road	140 (7%)	110 (6%)	1,590 (7%)
	Collector Road:			
M-3	Minmi Road, south of Newcastle Link Road	40 (3%)	40 (3%)	500 (3%)
M-4	Woodford Street, north of Newcastle Link Road*	20 (6%)	30 (8%)	250 (7%)
M-5	Minmi Road, through Minmi/Fletcher*	50 (9%)	40 (8%)	470 (9%)
M-6	Lenaghans Drive further north of Peter Street*	40 (10%)	30 (9%)	490 (12%)

3.3 Road Network Capacity and Performance

3.3.1 Assessment Criteria of Intersection

The standard intersection analysis program is aaSIDRA, which analyses the performance of single intersections and can thus determine the impact of a number of development options. For the assessment of this development's traffic impact, the four accepted measures of performance have been considered:

- Level of Service (LoS);
- Degree of Saturation;
- Average Delay; and
- Maximum Queue Length.

These four measures are discussed below.

Level of Service (LoS)

This is a measure of the delay a vehicle suffers in negotiating an intersection. LoS applies to the intersection as a whole and to individual turning movements. Ratings of LoS A to C are in the acceptable range, with E and F considered unacceptable. LoS D may be acceptable in certain circumstances. The standard NSW Level of Service criteria for intersections are:

Table 3-5 LoS Criteria

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

Source: RTA Guide to Traffic Generating Developments

Degree of Saturation (DoS)

This is the ratio of traffic flow for a particular vehicle movement to the capacity flow for that movement. The highest DoS is the DoS for the intersection. DoS values up to 0.95 are generally acceptable.

Average Delay

The average delay is a simple calculation to find the difference between the travel times of vehicles delayed by traffic, compared to the travel time expected if there were no interruptions to the flow through an intersection. This is usually presented as seconds per vehicle.

Maximum Queue Length

As the name suggests, this criteria measures Queue length at an intersection. The figures used in this assessment are quoted in metres, and are usually calculated as the '95th percentile back of queue.' This is the measure which 95% of all queues are within.

3.3.2 Existing Intersection Performance

This intersection modelling was carried out using aaSIDRA software, using the existing layout and observed turning volumes. Traffic signal data for phases and cycle times was based on the Traffic Control System (TCS) plan and aaSIDRA optimised cycle times. This gives a 2007 base year (2007) performance using the four measures detailed above. LoS results are presented in Table 3-6 below for comparison. Figure 3-3 shows intersection turning volumes used to estimate LoS results presented in Table 3-6.

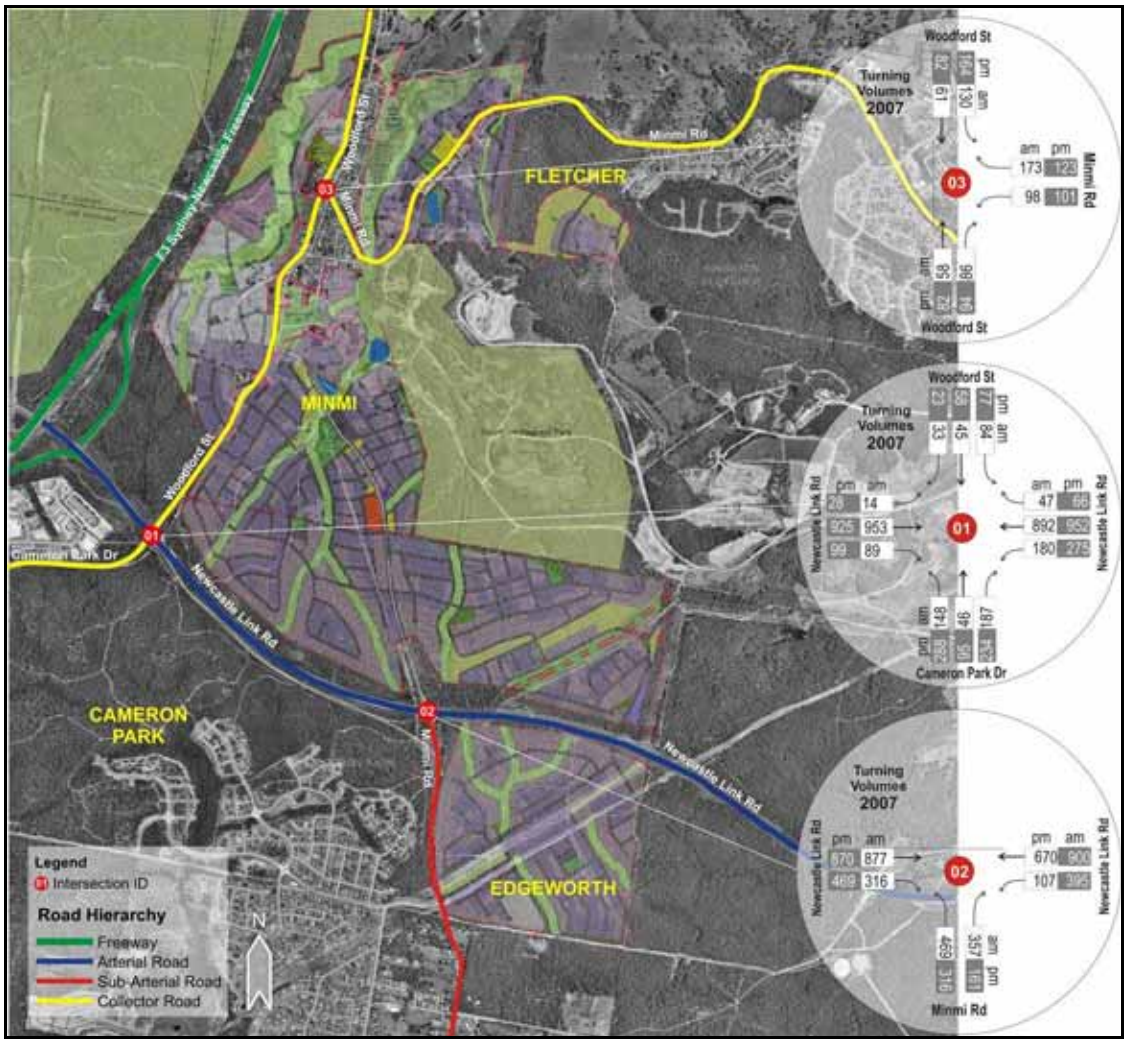

Figure 3-3 Turning volumes 2007 (AM, PM peak) on key intersections

Table 3-6 also highlights the 'critical movements' at each modelled intersection to indicate which legs and movements at each location should be given priority in any future improvements.

Results from LoS analysis indicate all key intersections provide access to proposed Minmi/Link Road sites operate at LoS between A and B with satisfactory performance during both the morning and evening peak periods. A key capacity indicator for measuring intersection performance is degree of saturation (DoS). All intersections show a DoS between 0.30 and 0.60 implies some spare capacity for future growth.

Table 3-6 Intersection LoS for 2007 traffic conditions

Intersection Name	Ints Control Type	Ints DOS	Ave Delay (s)	Ints LOS	Queue (veh)	Critical Movements
Morning peak						
Newcastle Link Rd-Woodford St	Roundabout	0.43	5	A	4	* 33 vehs right turn from Woodford St-N (DoS=0.10; LoS=B) * 88 vehs right turn from Newcastle Link Rd-W (DoS=0.45, LoS A)
Newcastle Link Rd-Minmi Rd	Roundabout	0.51	7	A	5	* 878 vehs through from Newcastle Link Rd-W (DoS=0.54; LoS=A)
Woodford St-Minmi Rd	Signals	0.30	15	B	6	* 86 vehs right turn from Woodford Rd (DoS=0.32; LoS=B)
Evening peak						
Newcastle Link Rd-Woodford St	Roundabout	0.49	6	A	4	* 23 vehs right turn from Woodford St-N (DoS=0.11; LoS=B) * 275 vehs left turn from Newcastle Link Rd-E (DoS=0.49, LoS A)
Newcastle Link Rd-Minmi Rd	Roundabout	0.62	7	A	7	* 900 vehs through from Newcastle Link Rd-E (DoS=0.62; LoS=A)
Woodford St-Minmi Rd	Signals	0.30	14	A	5	* 94 vehs right turn from Woodford Rd (DoS=0.32; LoS=B)

4 Traffic Forecasting Process

4.1 Model Overview

The Lower Hunter Traffic Model (LHTM) was developed using TransCAD software as part of the National Highway F3 to Branxton Link traffic study for the RTA. The model represents the weekday daily, and AM peak period (between 7:00 and 9:00) traffic conditions associated with the assumed future road network and LHRS land use developments. The model covers the entire Lower Hunter Region, comprising the six Statistical Local Areas (SLAs) of Newcastle – inner, Newcastle – Remainder, Lake Macquarie, Cessnock, Maitland and Port Stephens. The model network includes all National, State and Regional roads, and local roads generally down to the level of collector road.

Hyder used the traffic model for four main reasons (a) to quantify the impact of medium and long-term growth from C&A Northern Lands (b) to assess the requirements for evaluation of alternative traffic management options (c) to quantify impact from new infrastructure proposed in the corridor (d) to assess the cumulative impact from other land developments planned in the corridor.

RTA provided Hyder with the latest version of LHTM (V12r01). LHTM effectively allows us to assess future estimated traffic conditions and their probable impact on the operation of the road network. In general, the traffic modelling process requires three key elements as follows:

- A representation of the physical road network system. Hyder adopted the 2006 LHTM model for current road conditions;
- A representation of the trips that take place on the system. The main influential factor of the travel model for assessing large development proposals like the C &A Northern Lands is the size and spread of the population and locations of jobs in and around the modelled study area. For the C &A, forecasts of the population and employment levels are used from the Lower Hunter Regional Strategy (LHRS). It has identified new population and employment projects over a 25 year planning horizon (2006 – 2031) for the Lower Hunter region. The strategy forecasts a population increase of about 160,000, and an additional 66, 000 jobs over the next 25 years; and
- A software package that can assign the demand to the network in a way that accurately reflects the constraints of the network, and the economic and behavioural decisions made by motorists.

Hyder updated V12r01 model to include the C&A Minmi/Link Road residential development of approximately 3300 dwelling units, and the Black Hill employment development with a capacity of 800,000 square metres gross floor area (GFA). A comparison of the estimated traffic conditions for the full C&A Northern Lands with those for the base model (regional and other traffic conditions) provided an indication of the incremental impacts of the C&A development on the performance of the road network and of further capacity constraints which may arise. The network model was run for the years 2016, 2026 and 2031 for the Daily and AM peak two hour period future traffic conditions. The network modelling was supplemented by more detailed assessments of selected key intersections using the aaSIDRA intersection model for AM peak hours. We also tested intersection performance for the PM peak hour travel pattern which was a mirror of the AM peak, and applying PM peak hour factors derived from traffic counts.

To address DGRs requirements, Hyder also developed a micro-simulation model for the core C&A study area by using “Paramics” software. Paramics micro-simulation software provides functionality to model individual vehicles in a traffic flow stream and extract performance outputs from the simulation runs for modelled traffic networks. Figure 4-1 shows the relationship among three levels of models-TransCAD, aaSIDRA and Paramics that were used in the C&A Northern Land impact assessment.

Future road networks in the base 2016, 2026 and 2031 model included a number of planned road improvements that would contribute significant travel pattern changes in the F3, Newcastle Link Road and John Renshaw Drive corridors relevant to C&A Northern Lands. They are shown below with assumed completion year for modelling purpose only:

Project Ref.	Improvements	Year		
		2016	2026	2031
R03	F3 to Raymond Terrace Link (F32R), Motorway Standard		✓	✓
R03-1	F3 to Branxton Link (F32B), Motorway Standard	✓	✓	✓
R07	Main Road Glendale widening to four lanes, Urban Arterial Standard	✓	✓	✓
R11	Newcastle Link Rd - Glendale Dr Link - the RTA new link to connect Newcastle Link Rd and Glendale Dr		✓	✓
R12	Minmi Rd - Frederick St Link - A proposed new link to connect Minmi Rd East of Cameron Park and Frederick St North of Lake Rd-Lake Macquarie Council proposed.		✓	✓
R13	Minmi Rd/Northlakes Dr - George Booth Dr link	✓	✓	✓
D05	Weakleys Dr Upgrade widen to four lane, Urban Arterial Standard	✓	✓	✓

Note: The above road improvement projects are a subset of full lists assumed in the base model.

In considering the above committed projects in the model we anticipate that both F32B and F32R are long term infrastructure projects subject to Federal Government funding. We have tested both projects as a scenario for the C&A impact assessment.

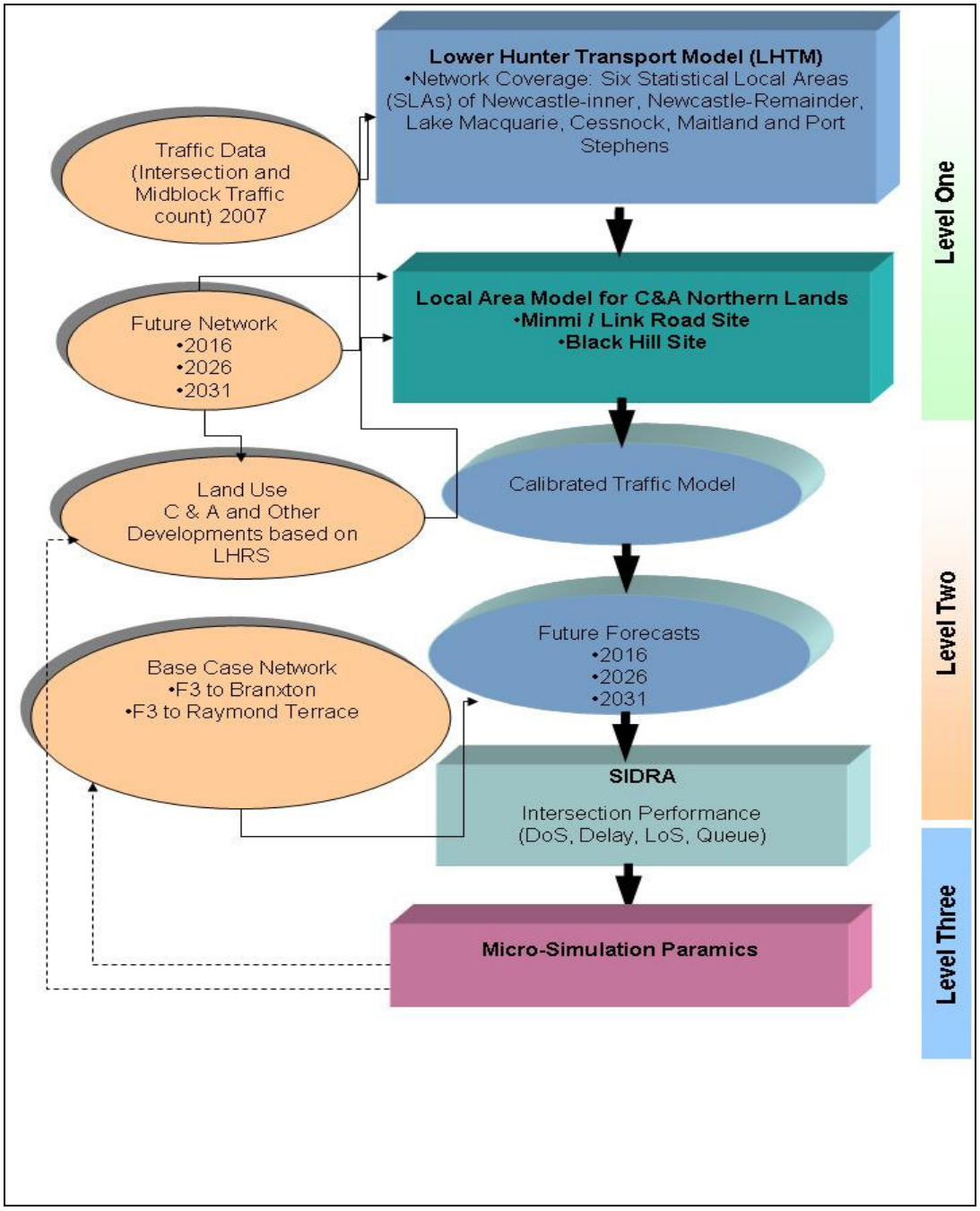

Figure 4-1 Proposed Three Level Modelling Approach

4.2 Local Area Model Calibration

Local area model calibration for C&A Northern Lands involved both TransCAD and the Paramics model. The following sections provide an overview of model calibration at both network and intersection levels.

4.2.1 TransCAD Model Calibration

Model calibration is the process of matching the modelled flows with the observed traffic flows after adjusting the model parameter and inputs in a logical manner. The calibration of the model confirms the consistency of the future year model and assessment of the impact of increased traffic and network changes in the future. Table 4-1 shows the comparison 2006 model forecasts with 2007 observed traffic flows at key roads in the study area. The results show that V12r01 model forecast is about 2% less than actual counts and indicates a good match between modelled and observed traffic flows.

Table 4-1 Comparison of surveyed flows (in vehicles) with modelled flows-(AM 2 hrs, 2way

Site ID	Road	Location	Traffic Count'07	Model06	% Difference
M-1	Newcastle Link Rd	West of Woodford St	2216	2245	1%
M-2	Newcastle Link Rd	East of Minmi Road	2114	1947	-9%
M-3	Minmi Road	South of Newcastle Link Rd	1304	1284	-2%
M-4	Woodford St	North of Newcastle Link Rd	284	313	9%
M-7	John Renshaw Dr.	West of Weakleys Drive / F3 Freeway	782	780	0%
Total Flows			6700	6569	-2%

The performance indicators of selected intersections based on actual turning counts were compared to those with modelled turning volumes. Table 4-2 presents a comparison between LoS and delays at key intersections from both sources. Intersection LoS and delay between count and model are within acceptable range. Our analysis therefore confirmed that model was calibrated at both link (midblock) and intersection turning movement levels and can be taken forward for predicting future traffic for C&A Northern Lands.

Table 4-2 Intersection LoS comparison between surveyed and TCAD modelled for AM peak hour

		Traffic Counts (07)		Model (06)	
Intersection	Control	Avg Delay	LoS	Avg Delay	LoS
Woodford Street / Newcastle Link Road	Roundabout	5	A	6	A
Newcastle Link Rd / Minmi Rd	Roundabout	7	A	7	A
Woodford Street / Minmi Rd	Signalised	15	B	13	A
John Renshaw Dr / Weakleys Dr	Roundabout	11	A	19	B

4.2.2 Paramics Model Calibration

C&A Northern Lands Paramics model covers the area bounded by the F3, Newcastle Link Road and John Renshaw Drive. Key collector and local roads that feed traffic to above arterial and freeway are also included. Woodford Street, Minmi Road, Cameron Park Drive, Northlakes Drive and Lenaghans Drive provide key connections to C&A lands and are therefore included in the existing Paramics model. Figure 4-2 shows coverage of the Paramics model.

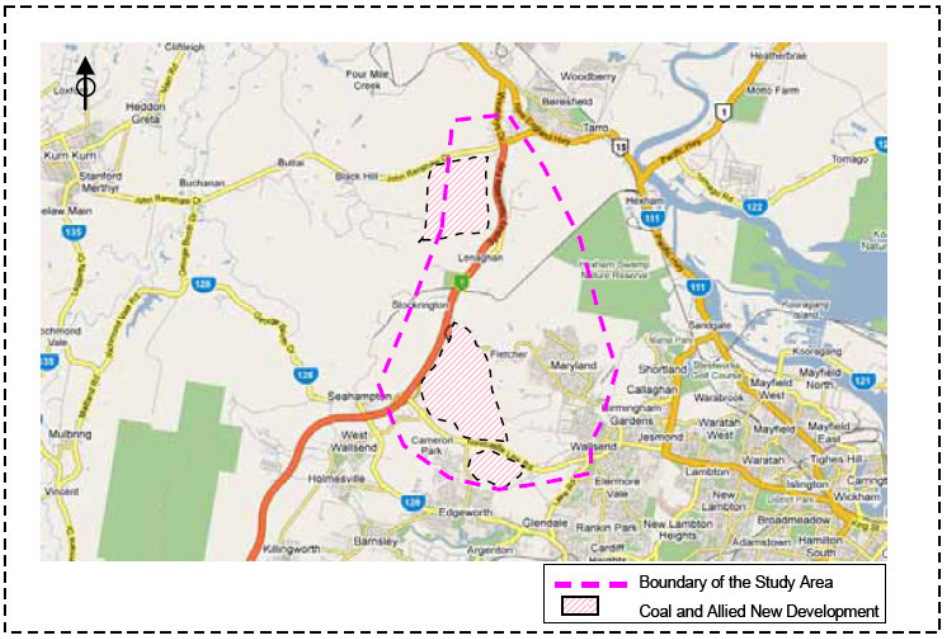

Figure 4-2 Extent of Study Area, Paramics

The base Paramics model covers the two hour AM peak period (7:00 am to 9:00 am) demand consistent with the TransCAD model. The model period was extended by a 15 minutes warm up period to allow vehicles to load into the network. AM peak period demands in Paramics were estimated from the TransCAD model by using a 'sub-area' matrix technique. Both cars and heavy vehicles were modelled separately.

In the Paramics model stability criteria were sourced from the RTA. Calibration criteria, which was based on the UK guidelines described in the Design Manual for Roads and Bridges (DMRB). The DMRB uses GEH statistics to test models stability against observed flow. The GEH statistics is calculated as:

$$GEH = \sqrt{2(M-C)^2/(M+C)}$$

Where M is the model volume and C is the observed traffic count.

A GEH parameter of 5 or less indicates an acceptable fit between model and counts. Table 4-3 and Table 4-4 summarised calibration indicators used for Paramics model.

Table 4-3 Midbolck Calibration Results for Am Peak period

GEH	Percentage of Link Flow	Target	Overall
<5	96%	85%	Pass
<10	100%	100%	Pass

Table 4-4 Statistics for Inbound and Outbound Traffic

GEH statistics	GEH<5	Target	Overall
Percentage of Inbound counts (destinations)	100	85	Pass
Percentage of outbound counts (origin)	100	85	Pass

To check the Paramics model stability, hourly modelled flows were used for model runs using five different seed values. The seed values were selected as per the RTA standard. RTA guidelines state that total variation for different seed value runs should be within 5% (vehicle per hour). Table 4-5 shows the seed values and the modelled traffic flows on midblock sections. The percentage variation was about 2% therefore confirming that the model achieved RTA's stability criteria.

Table 4-5 Traffic Flows in selected locations for different selected seed value runs

Road	Location	Direction	560	28	7771	86524	2849	% Diff
Newcastle Link Road	West of Woodford Street	NB/WB	1076	1103	1081	1109	1095	3%
		SB/EB	1041	1086	1086	1066	1071	4%
Newcastle Link Road	East of Minmi Road	NB/WB	854	878	834	883	851	6%
		SB/EB	1196	1240	1242	1236	1236	4%
John Renshaw Drive	West of Weakleys Drive/Freeway	NB/WB	307	314	305	297	314	6%
		SB/EB	518	494	495	491	514	5%
Total Modelled Flows			4992	5114	5044	5083	5083	2%

Figures 4-3 shows the number of released vehicles in the current network at every minute for five runs using different seed (560, 28, 7771, 86524 and 2849). The figure shows a consistent traffic patterns for all five seeds. This indicates the base model is stable between model period of 7:00 am and 9:00 am and can be used for future years.

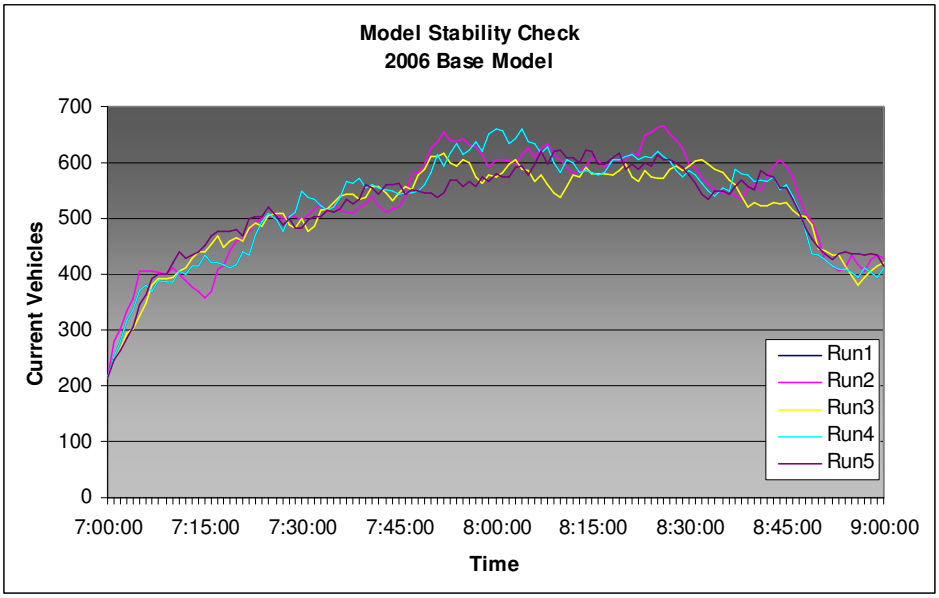

Figure 4-3 Model Stability Check

Similar to TransCAD, the results from Paramics model were also measured at intersection level. Table 4-6 summarises LoS and delays obtained from Paramics and aaSIDRA. Both model results showed a close match, confirming that appropriate parameters are used in model calibration process.

Table 4-6 Intersection LoS comparison between surveyed and modelled for AM peak hour

		Paramics Result		Traffic Counts,07	
Intersection	Control	Avg Delay	LoS	Avg Delay	LoS
Woodford Street / Newcastle Link Road	Roundabout	4	A	5	A
Newcastle Link Rd / Minmi Rd	Roundabout	4	A	7	A
Woodford Street / Minmi Rd	Signalised	7	A	15	B
JohnRenshaw Dr / Weakleys Dr	Roundabout	16	B	11	A

Table 4-7 shows the maximum queue length observed at key intersections during the simulation period (AM peak period, 7-9). The model indicates no significant queue at Woodford St and Minmi Road roundabouts with the Newcastle Link Road. However, occasional queues were observed at Cameron Park Drive and Minmi Road southern approach, due to priority movements on the Newcastle Link Road.

At F3/John Renshaw Drive intersection, a queue was observed on F3 (south approach), John Renshaw Drive (West approach) and Weakleys Drive (North approach). The observed queue length was between 54 m (9 vehicles) and 162 m (27 vehicles). However, queues at this intersection during the PM peak period are expected to be higher than the AM. Model (aaSIDRA) shows DoS 0.62 (AM) and 0.91 (PM) and indicates capacity problems during the PM peak. Figure 4-4 to Figure 4-6

shows the screen captured from the Paramics model at key intersections on Newcastle Link Road and John Renshaw Drive.

Table 4-7 Max Queue length (m) (Paramics)

ID	Intersection	Control	North	East	South	West
I-01	Newcastle Link Road and Woodford Street	Roundabout	25	14	41	14
I-02	Newcastle Link Road and Minmi Road	Roundabout	--	18	57	27
I-03	Woodford Street and Minmi Road	Signalised	19	52	22	--
I-04	John Renshaw Dr and Weakleys Dr.	Roundabout	129	54	114	162

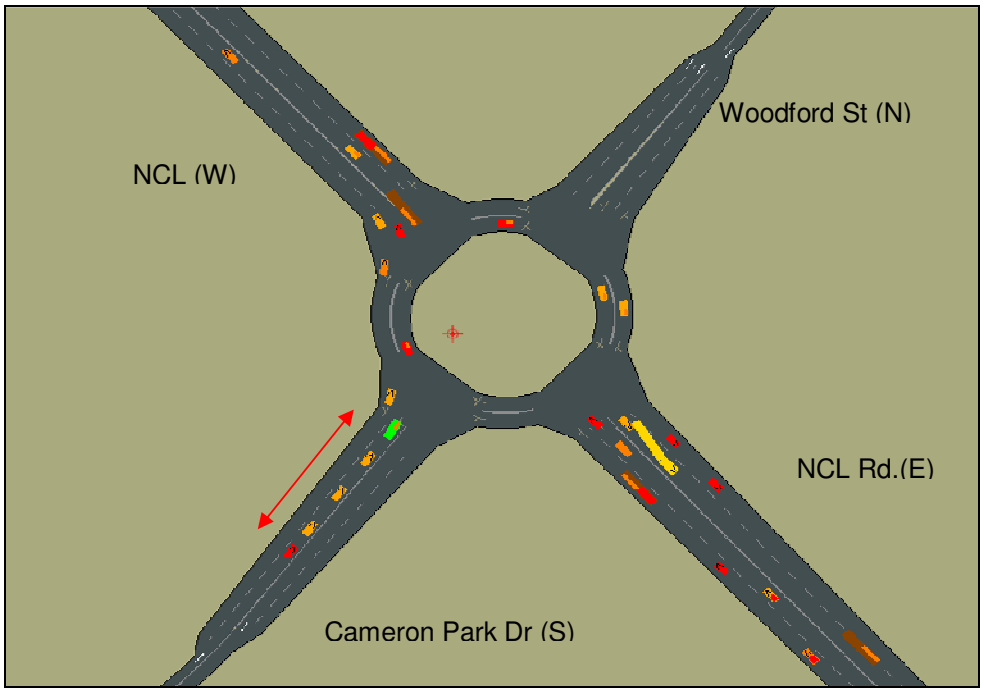

Figure 4-4 Queue length observed in Newcastle Link Rd / Woodford Street roundabout(I-01) –Time 7:52 AM

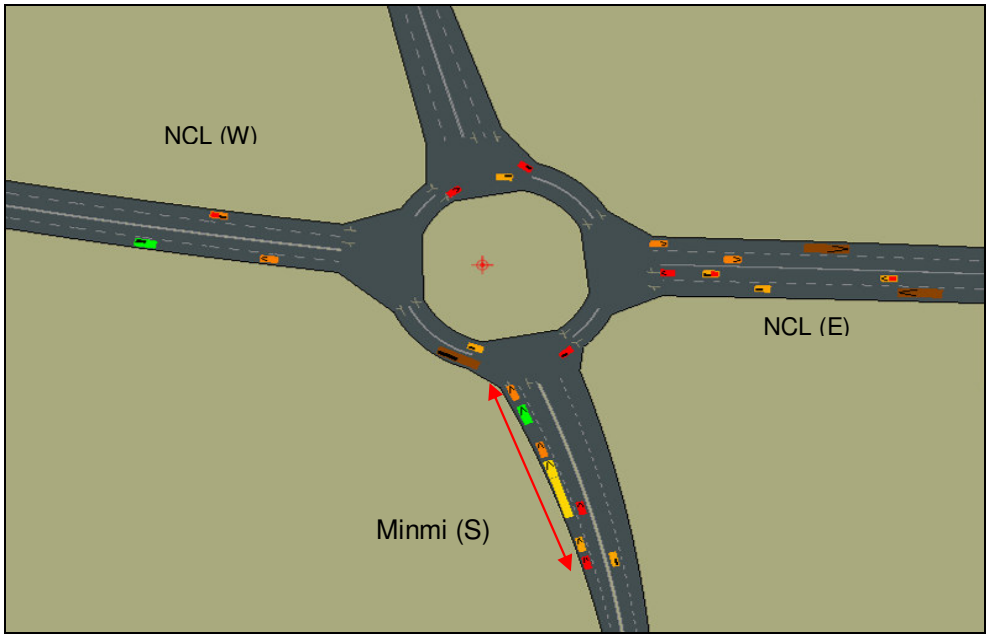

Figure 4-5 Queue length observed in Newcastle Link Rd / Minmi Road roundabout (Time 8:13 AM)

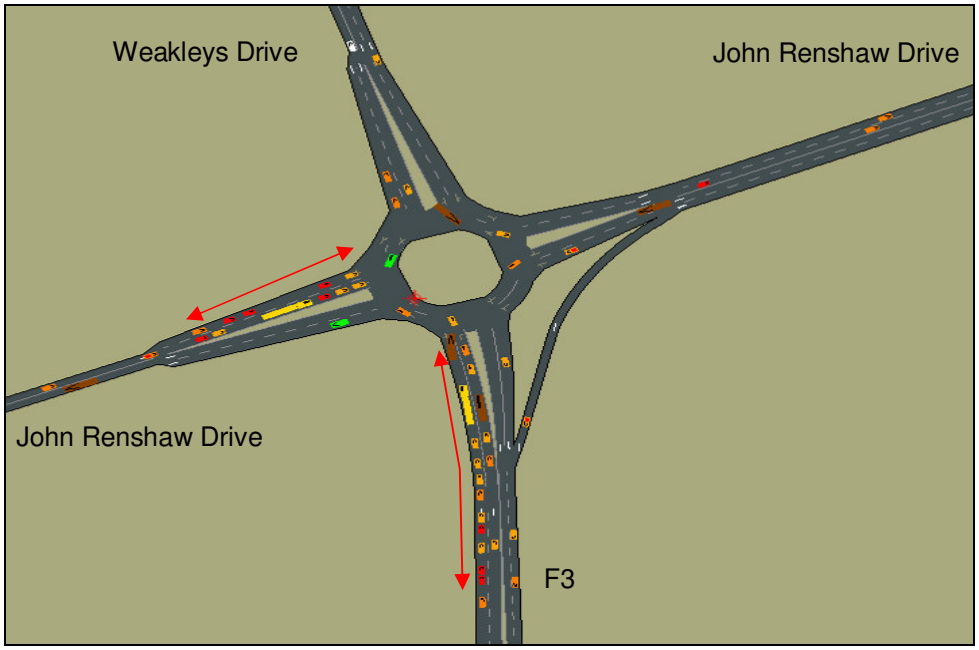

Figure 4-6 Queue length observed in John Renshaw Drive / Weakleys Drive Roundabout (Time 8:25 AM)

5 Impact Assessment

Section 1.5 of this report identified a number of driving factors which determines the future traffic conditions on regional road network in the vicinity of C&A Northern lands including Minmi/Link Road and Black Hill sites. The current road network in and around the C&A Northern lands provides a number of route choices or alternative accesses. This implies that motorists will have a number of options on how they will access the C&A development. Key transport corridors involving Newcastle Link Road, F3 and John Renshaw Drive carry a significant volume of regional traffic, and in the future predicted population and employment growth from LHRS land use will impact on traffic operations on these roads and associated intersections. This means the cumulative impact will have implications on the access strategy adopted for C&A Northern lands. This was further complicated by two planned longer term infrastructure projects F3 to Branxton Link (F32B) and F3 to Raymond Terrace Link (F32R). Both projects will have significant traffic impacts on F3, Newcastle Link Road and John Renshaw Drive. Potential staging of F32B project can further impact on the John Rensahw Drive corridor if the western section between Branxton and Buchanan interchange terminates at the John Renshaw Drive.

Due to the complexity of future travel patterns within the corridor, we have assessed the C&A impact for a number of scenarios. The scenarios considered three key issues (a) impact from C&A Northern Land development alone (b) cumulative impact from other planned land developments (c) impact from F32B and F32R projects. In this section we have quantified them separately so that any contributions required from C & A Northern Lands on proposed upgrading works to the Newcastle Link Road, John Renshaw Drive and or other collector/local roads are fair and transparent.

5.1 Proposed Site Accesses

C&A proposes to develop Minmi/Link Road sites by stages. The concept plan shows approximately 3,300 dwellings to be developed into three stages over the next 25 years. For traffic modelling purpose we have estimated the impact from 3,500 dwellings considered as highest development yield. Although, the impact from an additional 200 dwellings will be insignificant in the long term, but it provides some safeguard to our analysis. Figures 5-1 shows Minmi/Link Road staging plan adopted for modelling purpose. Each phase of the staging determines access requirements and then dictates the road and intersection capacity needed to service the demand.

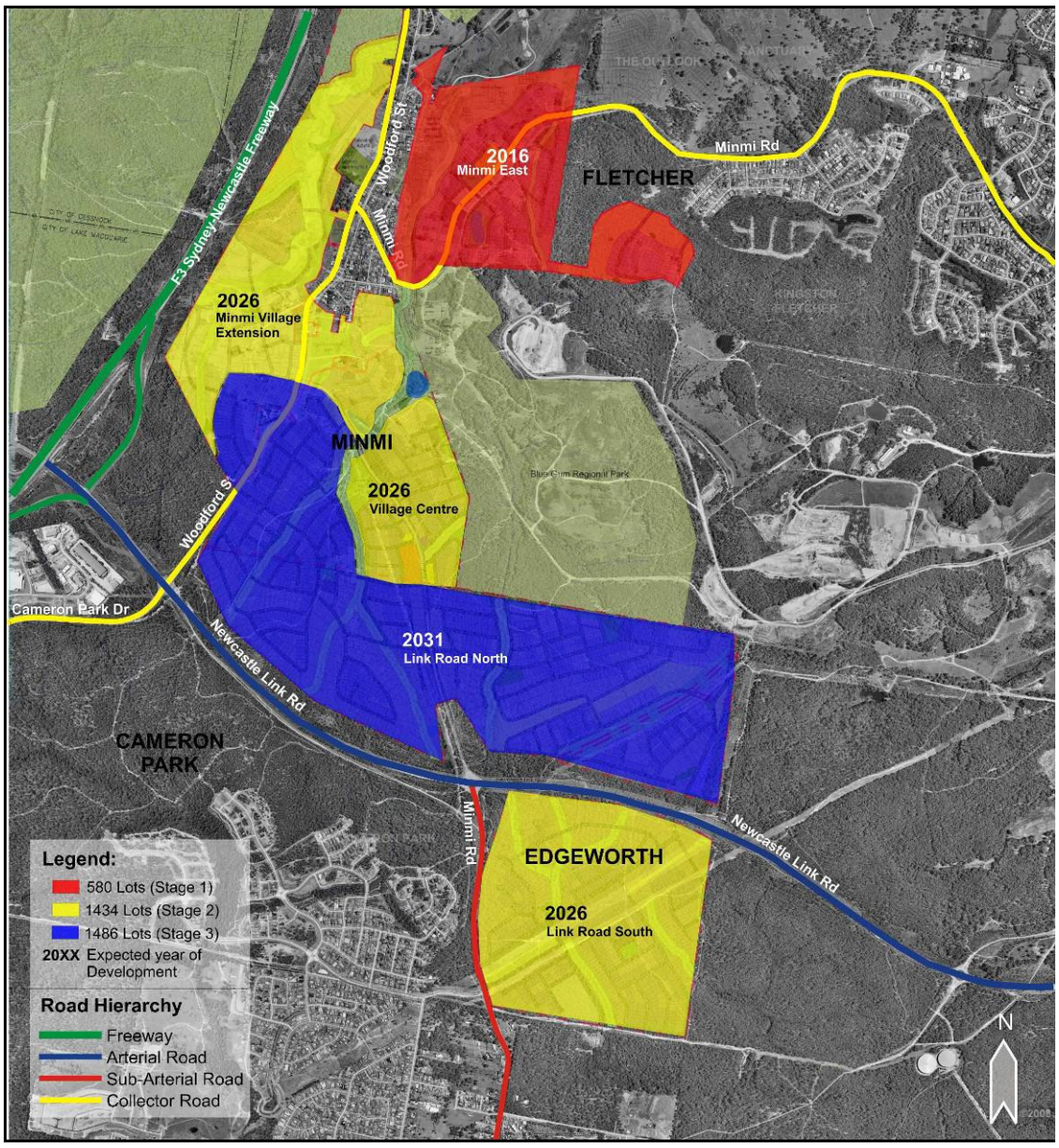

Figure 5-1 Staging Plan

Based on each development stage, the proposed access routes are:

- **Stage 1.** The first stage of development is provisionally titled 'Minmi East' and is to be based on the land around the eastern edges of the current Minmi village. This stage is expected to provide 580 residential dwelling units by 2016. Access to stage 1 development will be provided via existing Minmi Road and Woodford St. Internal roads will be built to cater for the stage 1 development, which also provides a number of access points on Minmi Road (/Minmi High St);
- **Stage 2.** The second stage includes three precincts including 'Minmi Village Extension', 'Village Centre,' and 'Link Road South' and is planned between 2016 and 2026. The first two precincts are located on the northern side of Newcastle Link Road. The 'Link Road South' precinct is located on the southern side of Newcastle Link Road.

  To service the development sites north of Newcastle Link Road it is proposed that a new road through the site ('Minmi Boulevard') be constructed to join Newcastle Link Road (at the current three-leg roundabout with Minmi Road, Edgeworth) and Woodford St. The new Minmi Boulevard road is proposed to be

main collector road feeding traffic from C&A development. The 'Link Road South' site can be accessed via Minmi Road (Edgeworth) at the current Giveway intersection with Northlakes Drive, creating a new 4-leg roundabout; and

- **Stage 3.** The third, and final, stage is expected to release about 1486 dwelling units on the 'Link Road North' site, north of Newcastle Link Road between 2026 and 2031. A second additional access on the Newcastle Link Road is proposed on the eastern end of development for two main reasons (a) to provide a combined access with the Summerhill waste traffic (b) to provide an additional access option for C&A traffic travelling to Newcastle. Following the meeting with the RTA on 18 November 2008, the additional access on the Newcastle Link Road was amended. A combined left in/left out access with the Summerhill waste traffic was not supported by the RTA.

In summary, one access is proposed on the Newcastle Link Road from north. An emergency access (left out only) is proposed from 'Link Road South' site and one access on the Minmi Road (Edgeworth). At each stage of the C&A development, the site will have multiple accesses to comply with the emergency services requirements. This will give any emergency vehicles access and egress when required.

5.1.1 Summerhill Waste Traffic Access

Summerhill Waste Management Centre (SWMC) is located off Minmi Road, Wallsend. Current access to the SWMC is provided via Minmi Road. SWMC accepts domestic waste from Newcastle LGA and commercial waste from adjoining LGA's. In 2003, SWMC was proposed as an alternative site for the regional waste processing facility. The proposed regional waste facility is a joint initiative of Cessnock, Maitland, Lake Macquarie and Newcastle City Councils. The project is managed by a joint venture company called Hunter Integrated Resources (HIR). Access to the regional waste facility is proposed to/from the Newcastle Link Road. Currently HIR is progressing on the project deed and service may commence on 2010. The capacity of regional waste facility was projected about 160,000 tonnes per year to cater for waste generated within four LGA's. For a typical day, about 80 trucks movements are predicted to and from proposed regional waste facility distributed to following LGA:

- About 8 truck movements to and from Cessnock;
- About 14 truck movements to and from Maitland;
- About 30 truck movements to and from Newcastle; and
- About 30 truck movements to and from Lake Macquarie.

In considering the long term strategic importance of Newcastle Link Road corridor we looked at two access options for HIR waste site in conjunction with C&A Minmi/Link Road development. We anticipate the proposed regional waste facility will be operational by 2010, much earlier than the C&A development. We have assessed the following access options on the Newcastle Link Road:

- Option A – a new access for HIR waste truck at the Newcastle Link Road/Minmi Rd intersection. This would create a 5-leg roundabout; and
- Option B – a new combined access on the Newcastle Link Road for C&A and HIR traffic to the east of the C&A site. This is proposed to be left in and left out.

The potential benefit and dis-benefit offered by Option A and B are summarised in Table 5-1.

Table 5-1 Comparison of access options A and B on Newcastle Link Road

Option A	Option B
Crash rate may increase with additional approach	A full access control impacts performance of Newcastle Link Rd. A left in/left out may reduce such impact
Tight curve for waste truck in regard to current roundabout configuration	Left in and left out will not significantly impact HIR all directional movements as adjacent roundabout will facilitate U-turn movements. Minor travel time increase can be expected for waste truck
Need adequate entry/exit angles for additional fifth leg roundabout	A proper acceleration and de-acceleration lane on the Newcastle Link Road will be required.
Safety issues to C & A residents if a road carry waste truck pass through the parkland	
Reduced local amenity for C & A residents and impact aboriginal relics.	
A separate access for SWMC traffic forming a fifth leg at the roundabout was modelled. This was tested for 2026 with background growth plus Stg1 and 2 C&A traffic. Intersection DoS was predicted 0.95 and LoS was B.	A left in left out at Newcastle Link Road. Intersection LoS was predicted A.
With Full C&A development, Newcastle Link Road/Minmi Road intersection will require new signals. The proposed HIR access will make this intersection a five leg signals- not a feasible solution from both traffic and safety perspective. In a recent meeting with the RTA, we discussed five leg signals arrangements and didn't receive RTA's support.	In the future, cumulative traffic growth and proposed F3 to Branxton Link will significantly increase traffic on the Newcastle Link Road. We understand Xstrata is proposing a major development along the Link Road and access can be via existing roundabout further east (about 2.5 km from Minmi Road roundabout). Due to significant traffic growth on the Newcastle Link, Road, both roundabouts at Newcastle Link Road/Cameron Park Drive intersection and further east will require upgrading to signals. This will preclude U-turn facility for HIR waste truck.

C&A presented the RTA above two access options A and B. In considering long term access strategy on the Newcastle Link Road, RTA did not support either of these two access options. In principle, RTA supported emergency access (left out only) from 'Link Road South' and Link Road North sites.

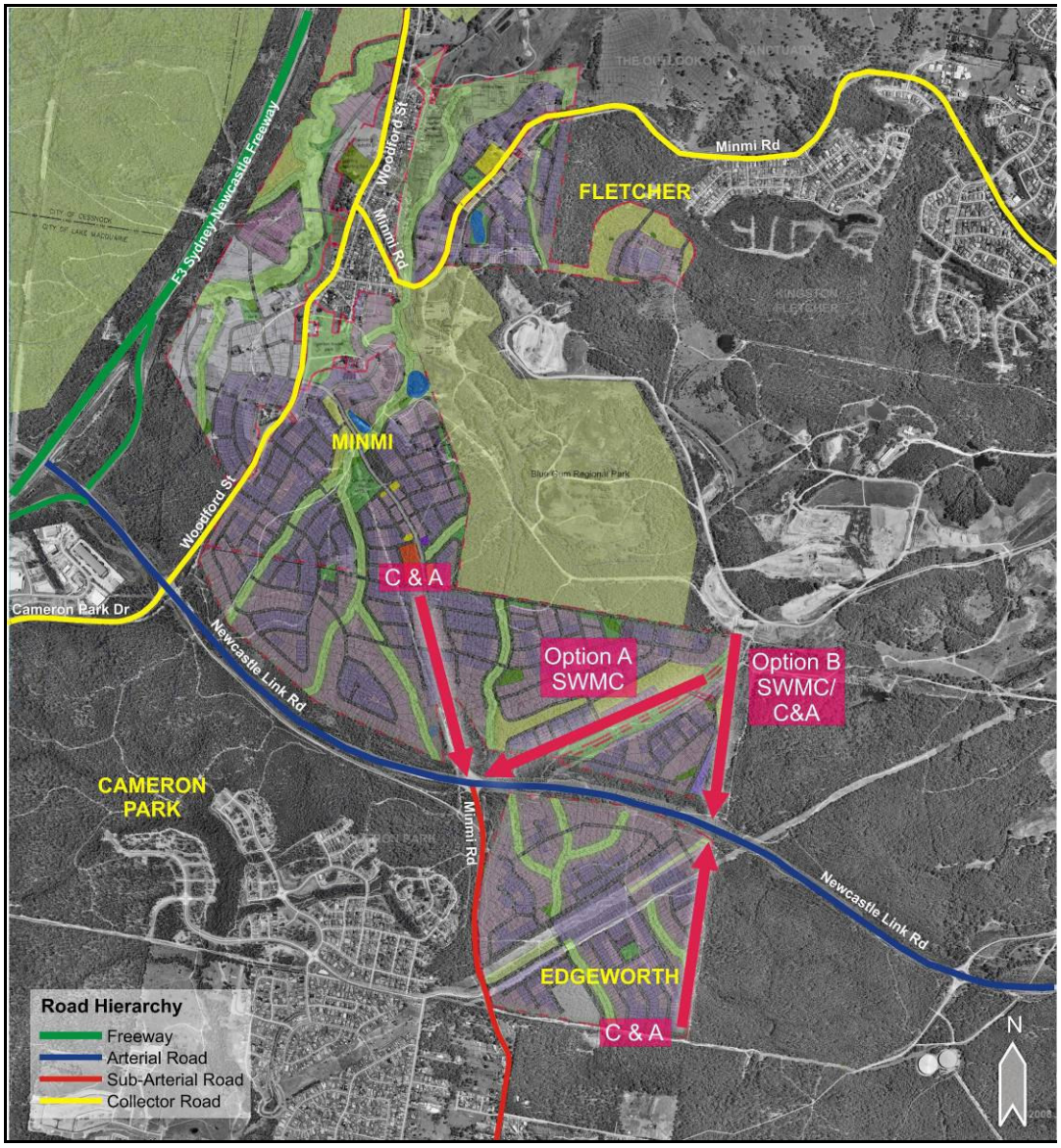

Figure 5-2 Proposed C&A accesses

5.2 Trip Generation Rate

In general, traffic generation is a key input into the traffic model and should be examined carefully prior to assessing future network impact. A common source for trip generation rates is the RTA's *Guide to Traffic Generating Developments (2002).* However, trip generation rates vary from one site to another due to the number of factors such as available modes of travel and household sizes. In calculating the expected trip generation rates for C&A site we looked at (a) RTA's trip generation rates and (b) residential trip generation survey data obtained from Maitland Council.

Standard trip rates from both sources were compared to trip generation rate assumed in V12r01 LHTM model. A key factor assumed in the trip generation rate was 'self-containment trips.' RTA guidelines states about 25% of trips are *internal* to the subdivision, involving local shopping, schools and local social visits (RTA Guide To Traffic Generating Developments. V2.2 Oct 2002). Table 5-2 and Figure 5-3 shows

surveyed trip generation rate for residential development in Aberglasslyn and Thornton areas in Maitland.

Table 5-2 Hourly Trip Generation Rates

Hour	Weekday Average		
	Aberglasslyn (1290 dwelling units)	**Thornton (905 dwelling units)**	**Average**
0	0.02	0.02	0.02
1	0.02	0.01	0.01
2	0.01	0.01	0.01
3	0.02	0.01	0.01
4	0.04	0.03	0.04
5	0.21	0.14	0.18
6	0.35	0.29	0.33
7	0.50	0.50	0.50
8	0.76	0.70	0.74
9	0.58	0.45	0.53
10	0.42	0.35	0.39
11	0.41	0.29	0.36
12	0.44	0.32	0.39
13	0.44	0.35	0.40
14	0.53	0.47	0.50
15	0.81	0.67	0.75
16	0.80	0.70	0.76
17	0.88	0.79	0.84
18	0.66	0.59	0.63
19	0.40	0.33	0.37
20	0.25	0.21	0.23
21	0.19	0.19	0.19
22	0.10	0.08	0.09
23	0.07	0.06	0.06
Total Daily	8.9	7.5	8.4

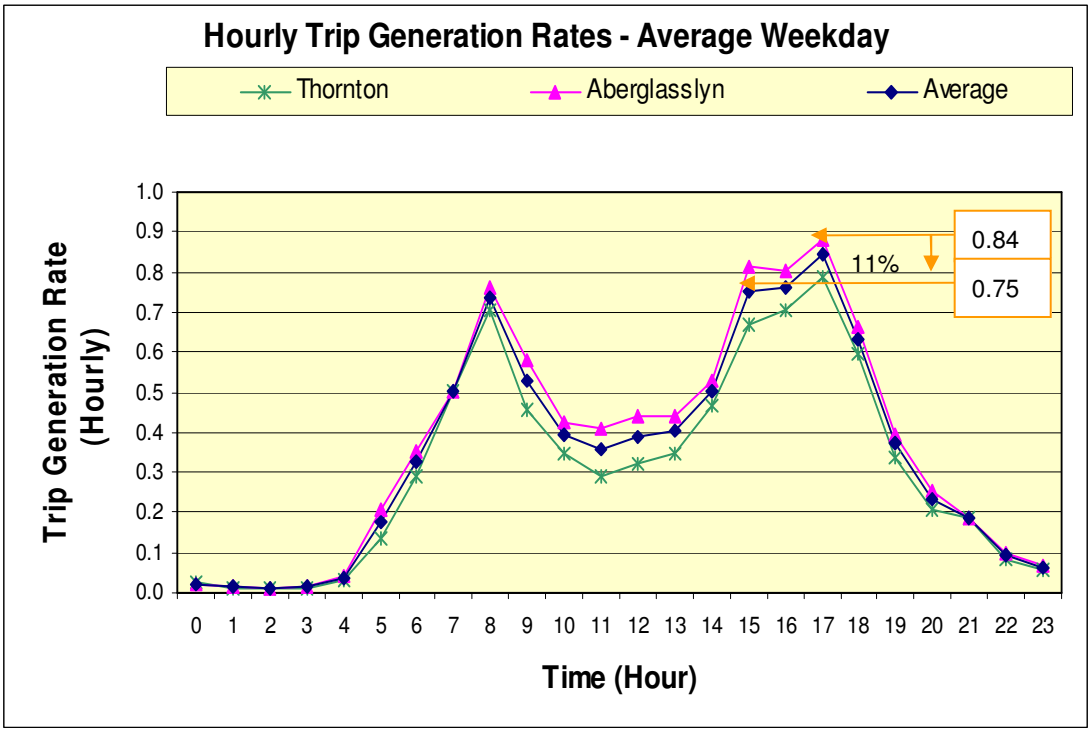

Figure 5-3 Hourly Residential Trip Generation Rates

Following observations are made from Table 5-2 and Figure 5-3 Daily trip generation rates for Maitland residential developments were found to be about 8.4 trips per dwelling. This generation rate excluded self containment trips.

- The rate observed for Maitland was similar to the rate of 9.0 outlined in the RTA's *Guide to Traffic Generating Developments*. With 25% of trips within the development, the external trip rate would be 6.75 per dwelling;
- PM peak generation was observed to be higher than for the AM peak;
- PM peak duration was longer (as seen by the broad peak on the graph) compared to the AM peak, which had a short peak;
- AM peak trip generation rates for external trips varied between 0.50 and 0.74 trips per hour per household between 7 and 9 am; and
- PM peak trip generation rate was between 0.75 and 0.84 per household per hour.

Based on the RTA guidance, and taking into account the local facilities that will be provided in this development (as per the C &A concept plan), we have assumed 25% self-containment or internal trips within the subject development. Internal trips are likely to be spread through the local area with key generation being the schools, shops, and community facilities. Taking all of the above into account, the trip generation rates used in modelling the impact of this proposed development are summarised in Table 5-3 and Table 5-4. Using RTA's trip generation rate for various type of dwellings (as per the concept plan), the full C&A development could generate about 25,000 daily vehicle trips (gross). However, a 25% self containment rate will reduce the total external trips to 18,000 per day (net). In the model we assumed about 22,000 net trips, which is marginally lower (by 12%) than RTA 's gross rate but about 22% higher than RTA's net trip rate. The model assumed about 1800 one hour AM peak trips from the full C&A development, which is consistent with RTA's rate. The above estimates confirmed that