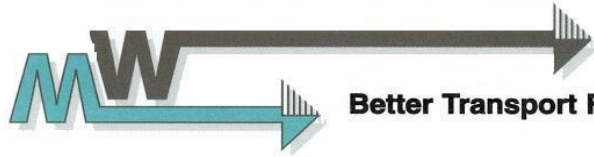


Appendix F

Traffic Impact Assessment

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Better Transport Futures

Mark Waugh Pty Limited
ABN 67 106 169 180
Transport Planning & Engineering

Proposed Expansion of Tile Factory, Racecourse Road, Rutherford, NSW



Traffic Impact Assessment

December 2009

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1. Introduction

Background

Better Transport Futures has been commissioned by AECOM Australia Pty Ltd on behalf of National Ceramic Industries Australia to prepare a Traffic Impact Assessment for the proposed modification and expansion of the ceramic tile manufacturing facility off Racecourse Road, Rutherford, NSW. This work is required as part of the environmental assessment for the proposed development that will form part of the development application to the Department of Planning.

Scope of Report

The scope of this report is to review the traffic and access implications for the proposed development, a site plan is shown in Appendix A. The report will also provide advice on access issues, internal site layout and issues relating to service vehicles.

Issues and Objectives of the study

The issues relative to the proposed development are:

- Assess impact on the arterial and local road network due to the additional traffic flows;
- Assess the impact of the additional parking generated by the proposed development;
- Review the access arrangements for the proposed development;
- Review the internal site layout and the car park access arrangements;
- Review the service arrangement for the development; and
- Assess any other transport impacts associated with the proposed development.

The objective of the report is to document the impacts of the proposed development and provide advice on any infrastructure work required.

Planning Context

In preparing this document, the following guides and publications were used:

- RTA Guide to Traffic Generating Developments, Version 2.2 Dated October 2002;
- Maitland City Council City Wide Development Control Plan (Parking);
- Australian / New Zealand Standard ó Parking Facilities Part 1 : off-street car parking (AS2890.1:2004);

2. Existing Situation

2.1 Site Description and Proposed Activity

2.1.1 Site Location and Access

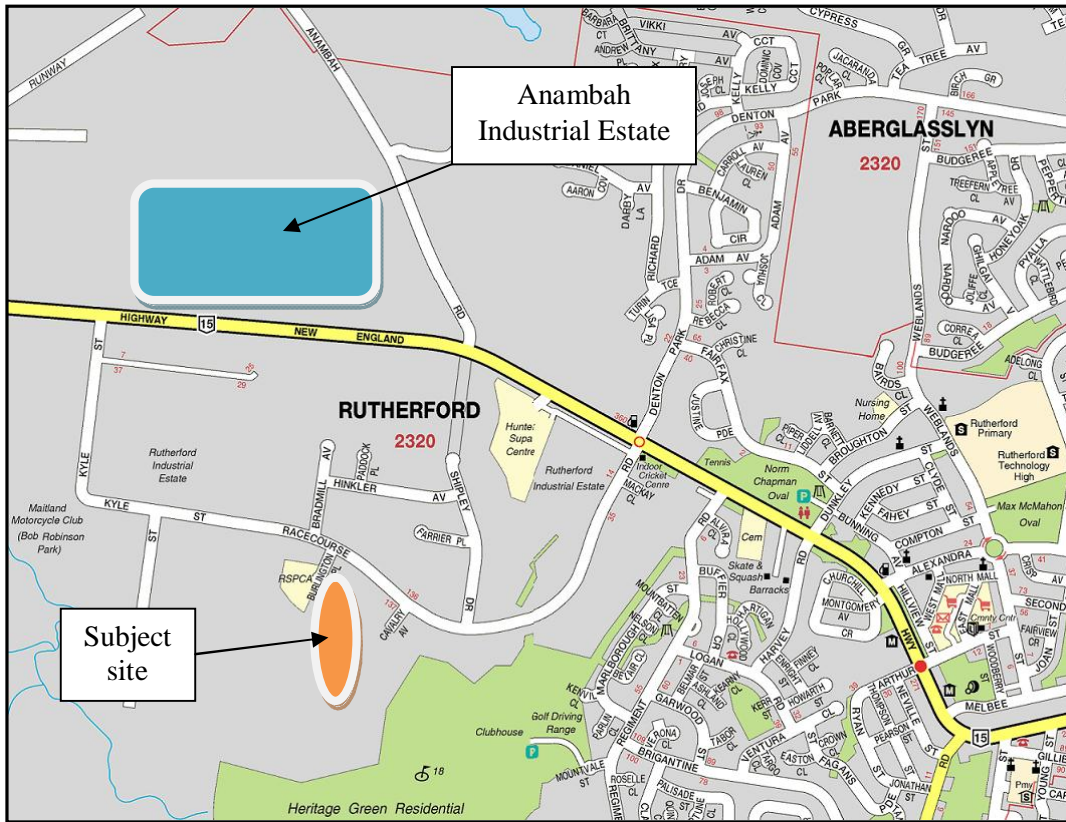
The subject site is located on the southern side of Racecourse Road, Rutherford. The site has a single road frontage to Racecourse Road and all vehicle access to the site is via a gated driveway located on Racecourse Road. The site is currently occupied by the existing tile factory with all vehicle access via the existing driveway.

NCIA propose to extend their current facility located at Rutherford, NSW. The expansion proposal is seeking approval to operate an addition four production lines (known as Stages Five to Eight). Approval to operate Stages Five to Eight would increase the maximum annual production to approximately 25.6 million square meters of tiles.

The proposal would involve the Construction of a second factory building adjacent to the current building to accommodate the proposed four additional production lines (Stages Five to Eight) with associated infrastructure and services.

All access will be via Racecourse Road.

The location of the site is shown below in Figure 2.1.



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Figure 2-1 - Site Location

2.2 Existing Traffic Conditions

2.2.1 Road Hierarchy

Immediately adjacent to the subject site is Racecourse Road, a local industrial road controlled by Maitland City Council. Racecourse Road provides one of the major access roads to the Rutherford Industrial Area. It has a carriageway width of 12.5m to the east of the subject site with verges to both sides. To the west of the site, Racecourse Road runs into Kyle Street that has a lower standard of construction. The road width along Kyle Street varies, with a minimum width of around 8.0 metres that still allows for two-way traffic movements. There are no footpaths along either Racecourse Road or Kyle Street. Racecourse Road provides kerb and gutter along its length, whilst Kyle Street has limited kerbing reflecting its older build.

The posted speed limit for the length of Kyle Street and Racecourse Road is 60km/h.



- **Photo 1.** View east along Racecourse Road showing typical cross section



■ **Photo 2.** View south along Kyle Street showing typical cross section

To the north of the site, the New England Highway provides the major route for traffic in the area. It forms part of the National Highway (H9) and any works along this road require concurrence from the Roads and Traffic Authority for NSW (RTA). In the locality of the subject site, it provides a mixture of single and double lanes in each direction. Racecourse Road connects with the New England Highway via a two lane roundabout at its eastern end and via a seagull type give way intersection at its western end via Kyle Street.



■ **Photo 3** – View east along New England Highway at Kyle Street intersection

2.2.2 Roadworks

Council have recently completed some kerb work and resurfacing of Racecourse Road at its eastern end where it connects with the New England Highway via the 4 way roundabout. It is understood that other than routine maintenance by the road authorities there are no active plans for any other road network changes in the immediate vicinity of the subject site. Recent road upgrades have included the provision of a roundabout at the intersection of the New England Highway and Anambah Road that allows for connection via Shipley Drive to Racecourse Road. This work has been completed in conjunction with the expansion of the Homemaker Centre off the New England Highway in this location. Work is occurring on the northern side of the New England Highway associated with the Anambah Industrial Park.

2.2.3 Traffic Management Works

Due to the comparatively low traffic flows along Racecourse Road, there are no planned traffic management measures proposed in the general vicinity of the subject site. Advice from the RTA indicates that there are no proposals to upgrade the intersection of the New England Highway and Racecourse Road. Traffic surveys completed as part of this study indicate that the performance of this roundabout appears to have improved over recent times, perhaps due to lower traffic flows associated with mining works further up the valley. Previously, surveys completed at this intersection show that during the morning peak at around 6.00 AM there can be considerable delays at this intersection. Similarly, there are delays in the afternoon peak period, from around 2.30 PM onwards at this intersection.

The recently announced funding for the construction of the F3 to Branxton Road will provide a significant benefit to the New England Highway in this location. The provision of this important road link will remove a large portion of the through traffic movements along the New England Highway and provide relief for the operation of the existing intersections along this length of the road.

2.2.4 Pedestrian and Cycling Facilities

There are no pedestrian and cycling facilities within the general locality of the subject site. However, given the low overall traffic flows and the wide overall width of Racecourse Road, it can be seen that cyclists can be accommodated on road. There are no footpaths provided along the length of Racecourse Road on either side.

2.2.5 Public Transport

There are no regular buses serving the locality. The nearest train station is at Telarah, approximately 3.5 kms east of the subject site.

2.3 Traffic Flows

The proposed development is for an expansion of the existing tile manufacturing facility. The proposal will operate in a similar manner to the existing facility on the site, operating on a 24 hour basis with shift work. Staff movements will be split between manufacturing staff and staff associated with administration work. Weekend flows are similar as the plant operates on a 7 day per week program. The current facility works for 340 days a year, with a scheduled close down for maintenance work.

The key roads affected by the development will be Racecourse Road and to a lesser extent the New England Highway.

2.3.1 Daily Traffic Flows

As part of this study, a peak hour traffic survey was undertaken at the roundabout controlled intersection of New England Highway and Racecourse Road. This survey was completed on Wednesday 1st July 2009. This count indicated the two-way morning peak flow of some 381 vehicles per hour on Racecourse Road adjacent to this roundabout. The flows adjacent to the subject site would be much lower, as there are a number of traffic generators located between the subject site and this roundabout that would contribute to a significant portion of this flow on Racecourse Road. During the PM peak, the two-way flow was in the order of 412 vehicles per hour.

The flows on Racecourse Road were 84 vehicles per hour northbound and 297 vehicles per hour southbound during the morning peak. During the corresponding afternoon peak, the flows were 323 and 89 respectively. The surveys showed that there is a significant volume of heavy vehicles using Racecourse Road, including B-doubles. Assuming the peak hour flows represent some 10% of the daily traffic flows, this would indicate the daily traffic flows on Racecourse Road adjacent to the New England Highway in this locality are in the order of 4,000 vehicles per day two-way.

The traffic survey also provides details on the traffic flows along the New England Highway in this location. The surveys show that the morning peak hour is between 7.30 and 8.30 AM and the afternoon peak is between 4.30 and 5.30 PM. The survey shows that during the morning peak period the two-way traffic flow on the New England Highway to the west of this roundabout is in the order of 1782 vehicles per hour. These flows are split between 627 vehicles eastbound and 1155 vehicles westbound. The corresponding two-way flows during the afternoon peak period were 1047 and 1321 respectively. Assuming the peak hour flows represent some 10% of the daily traffic flows, this would indicate the daily two-way traffic flows in this locality are in the order of 20,750 vehicles per day.

■ **Table 2-1 Traffic survey results**

Road	AM peak	PM peak
New England Highway ó east of Racecourse Road	1249 westbound 770 eastbound	2184 westbound 792 eastbound
Racecourse Road	84 northbound 297 southbound	62 northbound 9 southbound
New England Highway ó west of Racecourse Road	627 eastbound 1155 westbound	1047 eastbound 1321 westbound

2.3.2 Daily Traffic Flow Distribution

Observations on site and a review of the RTA traffic data for the New England Highway in this locality show that traffic flows outside of the normal working day are low in this locality. There are currently no residential dwellings within the locality of the subject site, with the vast majority of businesses in this locality working typical days of 7.00 AM through to around 5.00 PM. Flows on the New England Highway also reduce significantly at night in this area.

2.3.3 Vehicle Speeds

No vehicle speed measurements have been taken as part of this study. Observations on site would indicate that traffic appears to travel at or close to the posted speed limits, with no obvious signs of excessive speed. With the high volume of traffic on the New England Highway during the day and the numerous intersections along its length, it can be seen that traffic speeds on the New England Highway are contained to the posted speed limit.

2.3.4 Existing Site Flows

The site is currently used by the existing tile factory. There are currently some 50 staff working on site, split between work on production lines and office based work. The site also has an existing approval for expansion that will allow for some additional 20 more staff members. It is noted that the existing production lines operate on a 24 hour basis, allowing for shift work to occur. The shift change times are 7.00 AM and 7.00 PM.

2.3.5 Heavy Vehicle Flows

There are significant heavy goods vehicles in the locality, due to existing industrial users. The New England Highway also carries a high volume of heavy goods vehicles, associated with both local travel as well long distance interstate travel connecting with Queensland and areas in the Upper Hunter.

2.3.6 Current Road Network Operation

Observations on site show that the traffic flows along Racecourse Road generally operate with acceptable delays or congestion. However during peak hours, observations show that the intersection of the New England Highway and Racecourse Road suffers from excessive delays. This is mainly due to high through traffic movements on the New England Highway blocking traffic from entering the roundabout from the side roads. As discussed above, the New England Highway carries a high volume of both local and state traffic movements that create significant capacity issues for traffic movements, especially during the peak periods. The provision of the F3 to Branxton Road link should have a significant benefit and reduce the delays for road traffic in this location.

2.4 Traffic Safety and Accident History

A review of the accident history for the area indicates there have been some 12 accidents at the intersection of Racecourse Road and the New England Highway, with all accidents displaying typical roundabout type incidents e.g. rear end accidents and vehicle entering the roundabout colliding with a vehicle already on the roundabout. The data shows that no one has been killed, but there have been a number of injuries.

The same accident data shows that there have been limited accidents along Racecourse Road, reflecting the high standard of road construction along its length.

2.5 Parking Supply and Demand

2.5.1 On-street Parking Provision

Currently, there is limited on street parking demand in the vicinity of the subject site, as the subject site and the majority of the adjacent properties provide adequate off-street parking. Racecourse Road provides an overall width in the order of 12.5 metres and can therefore accommodate parked cars with minimal impact upon through traffic movements.

2.5.2 Off-Street Parking Provision

There is ample off-street parking provided within the subject site to cater for the existing demands. The majority of adjacent properties in the general locality of the subject site also accommodate their individual parking demands.

2.5.3 Parking Demand and Utilisation

There was minimal on-street parking noted in the general vicinity of the subject site. It was noted that the older development to the west off Kyle Street appeared not to provide adequate on-site parking, and created some on-street parking demand. There was little if any parking demand to the east of the site on Racecourse Road.

2.5.4 Set down or pick up areas

There are no set down or pick up areas in the locality of the subject site.

2.6 Public Transport

2.6.1 Rail Station Locations

The nearest train station is located at Telarah, some 3.5 kms to the east of the subject site. There is a regular service to and from Telarah railway station, providing access through to Newcastle as well as connections to Sydney.

2.6.2 Bus Stops and Associated Facilities

There are no regular bus services along Racecourse Road nor are there any bus stops provided along its length.

2.6.3 Pedestrians

There are no pedestrian facilities in the general vicinity of the subject site. There is currently little pedestrian demand in the general vicinity of the subject site.

2.7 Other Proposed Developments

To the immediate south-east of the subject site is the location for the proposed Heritage Green residential development. This proposed development could provide upto 450 residential lots, with access connections provided to both Racecourse Road and Regiment Road to the east. It is understood that this land has been zoned under Amendment 75 to the LEP to Open Space zone 6(b) private recreation and that development of this site is being pursued.

A review of the area shows that there are a number of vacant blocks within the Rutherford Industrial Estate as well as the Homemaker Centre. It is considered that these blocks will be developed in time and will provide a similar type of development to that within the general locality.

The Anambah Industrial Park is currently being developed to the north of the subject site, adjacent to the New England Highway with access via Anambah Road. There is also planned residential development on Anambah Road that will connect via the recently constructed roundabout at the intersection of New England Highway and Anambah Road.

There are no other developments of significance in the general locality of the subject site.

3. Proposed Development

3.1 The Development

NCIA propose to extend their current facility located at Rutherford, NSW. The expansion proposal is seeking approval to operate an addition four production lines (known as Stages Five to Eight). Approval to operate Stages Five to Eight would increase the approved maximum annual production to approximately 25.6 million square metres of tiles.

The proposal will involve the construction of a second factory building adjacent to the current building to accommodate the proposed four additional production lines (Stages Five to Eight) with associated infrastructure and services.

The NCIA facility produces high quality ceramic wall and floor tiles utilising a number of raw products including clay, feldspar and glazes.

The manufacturing process involves grinding and mixing of predominantly clay and feldspar, followed by a process of drying the mixture, adding dry glaze, roller pressing, additional dry glazing and decorating, additional pressing, cutting to size and firing in a kiln prior to packaging and dispatch.

NCIA has an existing approval for four production lines (knows as Stages One to Four) that allows production of up to 12.8 million square meters of tiles per annum when all four Stages are operational. Stage One and Two are operational and the NCIA will produce approximately 6.4 million square meters of tiles per annum.

Current staff numbers are in the order of 50, split between office staff and manufacturing staff. For the approved expansion, the staff numbers will increase to 70 in total. The proposed expansion will require an additional 70 staff, giving future total staff numbers of 140.

The on-going expansion of the factory will also increase the truck movements in and out of the site. The current truck numbers are in the order of 22 trucks per day (2-way) which will increase to 44 with the approved Stage 3+4 of the development. Stage 5 to 8 will generate some 44 truck movements per day, giving total future truck movements of 88 per day (2-way).

3.1.1 Nature of Development

The proposed development is to expand an existing industrial facility. The expansion will increase the approved capacity of the plant for manufacturing tiles. The proposal will allow for up to 25.6 million square metres of tiles to be produced. The existing facility produces approximately 6.4 million square metres of tiles per annum with existing approvals allowing expansion up to 12.8 million square metres of tiles. This proposal would double the production of tiles over the approved development for the factory.

As part of the proposed development, there will be an increase of staff on the various production lines, for both process controllers and shift supervisors. However, the admin staff numbers will remain at similar levels to the existing facility.

3.1.2 Access and Circulation Requirements

The subject site has a single site frontage to Racecourse Road and access is controlled via a security gate access off this road. All vehicles enter and exit the site in a forward direction and staff parking is provided within the site separate to the circulating traffic movements. The site layout allows for inbound material to be unloaded at the northern end of the site, nearest Racecourse Road. Outbound material is loaded at the southern end of the site, at the end of the production line. The outbound trucks continue through the site in an anti-clockwise direction, allowing smooth and continual movement of trucks through the site. The trucks vary in size and include B-doubles, so the design of the site layout reduces conflicts between light and heavy vehicles to ensure safety is maintained.

The layout of the internal road network and operations is included in Appendix A to this report.

3.2 Access

3.2.1 Driveway Location

The driveway to the site is an existing one and allows for safe access and egress for all vehicles.



- **Photo 4 View south showing existing site driveway layout. Note raised central median to separate inbound movements from outbound movements.**

3.2.2 Sight Distances

All generated vehicles will access the road network via the existing driveway on Racecourse Road. Racecourse Road provides a straight alignment at this location, ensuring good visibility for all drivers entering and exiting the site.

The existing speed limit on Racecourse Road is 60 km/h and for this limit the required visibility splay is 105 metres (source: RTA Road Design Guide) for an intersection. For a driveway access, the visibility requirements are much lower, at 83 metres desirable and 65 metres minimum. Given the straight alignment of Racecourse Road these visibility splays are exceeded for all traffic entering and exiting the site. The visibility splays have been measured on site at the site access point and exceed 100 metres in both directions.



- **Photo 5 View to right (east) for traffic exiting subject site.**



- **Photo 6 View to left (west) for traffic exiting the subject site.**

3.2.3 Service Vehicle Access

The development will require service vehicle access as per the existing situation. The site currently allows for access for all size of vehicles including B-doubles. Advice from the study team indicates that there have been no recorded issues with regard to safety or access for service vehicles in and around the subject site.

All service vehicles can enter and exit the site in a forward direction, with little if any reversing required on site. The unloading and loading bays allow for vehicles to enter and exit the bays without the need to reverse.

The full development will double the number of trucks accessing the site from the approved 44 trucks per day to 88. Spread over a typical 10 hour day this gives in the order of 4 or 5 trucks per hour per direction.

3.2.4 Queuing at entrance to site

Given the peak traffic flows along Racecourse Road, it is considered that there will be only occasional minor delays associated with the traffic waiting to turn into and out of the site at peak times. It is considered that the majority of traffic would in fact be left turns in and right turns out of the site, thereby reducing the amount of delays further. Outside of peak periods, the low overall flows on Racecourse Road will mean that there would be minimal delays for traffic entering or exiting the site.

3.3 Circulation

3.3.1 Pattern of circulation

All staff vehicles are parked within the designated staff parking area located towards the centre of the building, on the western side of the existing building. There is a hardstand area here that caters for all staff vehicles. Staff vehicles exit via this main driveway, which has an overall width of 6.0 metres.

For inbound raw materials, trucks enter the site via the driveway off Racecourse Road and then turn left into the receiving dock located at the northern end of the building. They then exit this unloading area and turn left in an anti-clockwise direction to exit the site.

For outbound material, the trucks enter the site and proceed along the driveway to the southern end of the building. The material is loaded onto the trucks at the southern end of the building and then the trucks exit the site via the existing driveway, again in an anti-clockwise direction.

3.3.2 Road width

The width of the internal driveways is 6.0 metres and allows for two-way traffic movements. This is in accordance with Council's Design Guide and the lay out allows for a safe and efficient movement of vehicles. Given the low overall traffic flows within the site it can be seen that this design of driveways allows for safe movements of vehicles. The detailed design plans will be prepared as part of the Construction Certificate process and all roads will be constructed in accordance with Council requirements.

3.3.3 Internal Bus Movements

No internal bus movements required as part of this development. However, given that the site accommodates the swept path movements of B-doubles it can be seen that a bus could be easily accommodated if required.

3.4 Parking

3.4.1 Proposed Supply

All parking for the proposed development will be contained within the site. The parking provision proposed is based on the requirements of the site and is based upon the existing use and provision on site. The current car park provides parking spaces for all staff as well as visitors. The parking supply will be increased in line with the increased staff demands.

The parking on site will provide 70 spaces in total.

3.4.2 Authority Parking Requirements

3.4.2.1 RTA Parking Requirements

The RTA Guide to Traffic Generating Developments does not provide any guidance for parking requirements for this specific type of development. Whilst it provides parking guidelines for industrial users, it can be seen that the subject site is a very specific user and that basing parking demand on floor area is not appropriate. The guide states that parking should be based on similar developments, thus using the existing parking demand and supply and increasing the provision in line with the increased staff demands is considered appropriate.

3.4.2.2 Maitland City Council Parking Requirements

Development Control Plan 6 Parking Requirements indicates parking should be provided at a rate of 1 space per 2 employees or 1 space per 75 m² GFA. Based upon the total staff numbers on site of 140 it can be seen that a parking provision of 70 spaces should be provided on site.

3.4.3 Parking Layout

The current car park layout is in accordance with AS 2890. As part of the expansion, the existing car park will be increased to ensure adequate provision is provided for all staff and visitors and all new spaces will be provided in accordance with AS2890.

3.4.4 Parking Demand

The peak parking demand for the proposed development is through the day, when there are both shift workers involved with the process line as well as administration staff in the building. At night, the demands are less, as there are no administration personnel on site.

The future total work numbers will be 140 staff. Allowing for 10 admin staff, this provides in the order of 130 staff who work over two shifts. The shift change times are 7.00 AM and 7.00 PM. It is proposed to provide 70 parking spaces on site as a minimum in accordance with the Council DCP, to ensure all staff can park on the site with no external demands or impacts.

3.4.5 Service Vehicle Parking

The service areas have been designed with adequate turning and manoeuvring space provided for service vehicles. The trucks park within the loading dock areas for unloading raw materials and for loading the finished products.

3.4.6 Pedestrian and Bicycle Facilities

The site allows for pedestrian and cyclists to access the site. Parking for cyclists can be provided around the site throughout the various buildings. There is no dedicated cycle parking facility but it can be seen that bikes can be parked in a secure and dry location within the buildings.

4. Impact of Proposed Development

4.1 Traffic Generation

4.1.1 Daily and Seasonal Factors

The facility operates on a 24 hour basis, 7 days a week for 340 days. There is an annual shut down period for maintenance work to be completed. There is no varying in daily or seasonal operations on site.

4.1.2 Pedestrian Movements

It is considered that there will be limited pedestrian movements to and from the site given the distance to the nearest residential development or bus routes. The shift work also discourages staff from walking to or from the facility.

4.2 Traffic Distribution and Assignments

4.2.1 Origin / destinations assignment

It is expected that the traffic movements would be predominantly to and from the east of the site, towards Newcastle, the F3 Freeway and the Pacific Highway. This means that traffic would predominantly use the roundabout controlled intersection of Racecourse Road and the New England Highway to access the New England Highway.

To a lesser extent, traffic will have an origin / destination to the west of the site and will use the intersection of Kyle Street and the New England Highway.

4.3 Impact on Road Safety

It is considered that the additional traffic flows associated with the proposed development will have a minimal impact upon traffic safety. The site access provides a safe and clear layout for all users, with visibility splays that exceed the requirements of the RTA Road Design Guide. Advice from the study team indicates that there are no recorded issues for the existing movements of staff or delivery vehicles in and out of the site at this location.

Whilst the proposed development will increase the movements of both staff and materials vehicles, it is considered that the similar characteristics will have a minimal impact upon road safety at this location.

The intersection the New England Highway and Kyle Street is well laid out and provides a sheltered right turn lane for traffic entering Kyle Street off the New England Highway. There is also a short length of left turn acceleration lane for traffic exiting Kyle Street. Visibility splays at this location are good, due to the straight alignment of the New England Highway at this location.



■ Photo 7 View east along New England Highway showing visibility splay for traffic entering Kyle Street.



■ Photo 8 View east along New England Highway showing visibility splay for traffic exiting Kyle Street.

The accident data for this intersection indicates that there have been 3 accidents close to this intersection, with one relating to a vehicle hitting an animal. It is considered that the accident data does not indicate that the intersection has a safety record issue.

The majority of the additional traffic generated by the proposed development will use the roundabout controlled intersection of the New England Highway and Racecourse Road. The review of the accident data indicates that there have been 7 recorded accidents at this roundabout over the 5 year period. There were three injuries and the accidents are fairly typical of a roundabout controlled intersection. It is considered that overall this roundabout provides an acceptable layout and the increased flows associated with the proposed development will have a minimal impact upon safety at this intersection.



- **Photo 9 Aerial photo of roundabout controlled intersection of New England Highway and Racecourse Road showing overall layout (source: Google Earth).**

4.4 Impact of Generated Traffic

4.4.1 Impact on daily Traffic Flows

The existing daily traffic flows are within acceptable limits for their classifications. The New England Highway is classified as a regional road acting as an arterial road. As an arterial road, it can carry more than 15,000 vehicles per day, based upon advice from the RTA. The development could on average increase the daily traffic flows on the New England Highway to the east of the site by some 180 vehicles per day (two-way). This traffic would then disperse along the New England Highway. This would potentially increase the average daily traffic flow from around 20,750 to 20,950. This would indicate that the Annual Average Daily Traffic flow (AADT) would remain within the acceptable limits for an arterial road.

The additional 44 truck movements will have a minimal impact upon the overall road operation. The New England Highway currently carries a significant volume of trucks and the additional volumes generated by the subject site represent a small increase in these volumes.

4.4.2 Peak Hour Impacts on Intersections

Observations on site indicate that the critical intersection in the vicinity of the site is the roundabout controlled intersection of the New England Highway and Racecourse Road and to a lesser extent Kyle Street with the New England Highway. The intersection of the New England Highway and Racecourse Road suffers from delays, due to the high through demand along the New England Highway. The intersection of Kyle Street and the New England Highway however suffers from minimal delays, as the majority of traffic movements are right in and left out, with low flows turning right out.

As part of this study, a traffic survey has been completed at the roundabout controlled intersection of the New England Highway and Racecourse Road. The numbers from this survey have been used to assess the operation of the roundabout between 6.30 AM and 7.30 AM, when the shift change occurs within the (existing) and future use on the site.

The operation of the intersection has been assessed using the standard computer program Sidra. Sidra is a traffic analysis tool developed originally by the Australian Road Research Board. It calculates the amount of delay to vehicles using an intersection, and gives a level of service rating which indicates the relative performance of the nominated intersection treatment. Levels of service of A to C are considered to be satisfactory, a level of service of D is acceptable, and levels of E and F are considered unsatisfactory. Sidra also calculates the degree of saturation, which indicates the amount of **spare capacity** available.

See **Appendix D** for full definition of Sidra results.

The results of the operation of this intersection with the current traffic flows are present in the table below:

■ **Table 4-1 – AM peak 2009 current intersection operation – New England Highway and Racecourse Road**

Approach	Level of Service	Average Delay (secs)	95 th percentile queue
New England Highway south	A	6.5	41
Denton Park Drive	B	13.2	26
New England Highway north	A	6.0	22
Racecourse Road	B	19.2	12
Overall	A	7.9	41

The above results indicate that the roundabout is currently operating within acceptable limits. However, observations on site indicate that whilst the flows at the roundabout are operating well, the downstream traffic flows create some delay due to the volume of through traffic along the New England Highway.

It is considered that the PM peak period between 4.30 and 5.30 PM (as observed at the survey time) need not be tested for the proposed development. The shift times associated with the current operations on site are at 7.00 AM and 7.00 PM and these will continue with the proposed expansion. The only movements through the intersection between 4.30 and 5.30 PM could be those associated with the administration staff on the site and these numbers will remain at the current levels with the factory expansion.

The operation of the roundabout has been assessed for the current design year with the additional traffic movements associated with the proposed development. It has been assumed that an additional 70 inbound staff movements before 7.00 AM and 70 outbound movements just after 7.00 AM. The results of this analysis are presented below:

■ **Table 4-2 - AM peak 2009 current intersection operation plus proposed development traffic – New England Highway and Racecourse Road**

Approach	Level of Service	Average Delays (secs)	95 th percentile queue
New England Highway south	A	6.6	45
Denton Park Drive	B	14.5	32
New England Highway north	A	6.6	26
Racecourse Road	C	22.7	28
Overall	A	8.8	45

The above results demonstrate that the proposed development will have a minimal impact upon the overall operation of the intersection. The traffic from Racecourse Road will suffer from some additional delay, but the critical movements on the New England Highway will experience little if any additional delay or congestion.

A review of the concept plan for the Heritage Green residential development shows that some 65% of this development could access the greater road network via the intersection of Racecourse Road and the New England Highway. Assuming a standard generation rate of 0.85 per lot, this would give some 248 trips per hour accessing the site via Racecourse Road. Assuming 80% of this traffic heads east from the site, this would increase the flows through this critical intersection by 200 vehicles per hour, split 170 vehicles out and 30 vehicles in. The impact of this additional traffic has been assessed at the roundabout and the results are presented below:

■ **Table 4-3 - AM peak 2009 current intersection operation plus proposed development traffic plus Heritage Green– New England Highway and Racecourse Road**

Approach	Level of Service	Average Delays (secs)	95 th percentile queue
New England Highway south	A	6.7	43
Denton Park Drive	B	18.9	47
New England Highway north	A	8.4	34
Racecourse Road	C	38.5	96
Overall	A	13.0	96

The above results indicate that with the additional flows associated with the Heritage Green residential development, the delays on the New England Highway will remain similar to the existing situation. A review of the traffic flows show that the reason for the delay for traffic exiting Racecourse Road is due in the main to the high through movements along the New England Highway in this location.

The additional traffic flows associated with the subject proposed development forms a very small part of the total traffic flows at this intersection and as such has a minimal impact upon the operation of this intersection.

The above represents a worst case scenario, as a review of the road network shows that traffic from the subject site and the adjacent Heritage Green development could in fact use Shipley Drive to access the New England Highway via the roundabout controlled intersection of these two roads. Whilst this will increase the through movements on the New England Highway at the roundabout at Racecourse Road, the critical movement at this intersection is the right turn out of Racecourse Road.

As part of this assessment it is assumed that the majority of truck movements in and out of the site generally occur outside the normal peak hours, as per the existing operations. The trucks typically arrive early on the site before the peak hour and then depart after the morning peak. As the facility operates 24 hours, there are no access issues. It is noted however that there are no deliveries or despatches occurring at night.

4.4.3 Future Intersection Impact (2020)

The existing annual average daily traffic flow (AADT) in this location on the New England Highway is in the order of 22,300 vehicles per day. Data from the RTA count station indicates that the AADT in 2004 was 20,287 allowing for 2% growth per annum this would give the current AADT in the order of 22,300. Traffic data provided by the RTA from the Lower Hunter Transport model (TransCAD) indicates the future traffic flows in this location will be in the order of:

2016 -	15,000 to 16,000
2026 -	23,000 to 24,000
2031 -	27,000 to 28,000

Using the above data, it can be seen that the flows in 2020 (ten years future design year as per normal RTA requirements) the traffic flows on this section of the New England Highway will be similar to the existing flows due to the construction of the F3 to Branxton Road (Hunter Expressway). With current traffic flows being in the order of 22,300, the predicted future flows in 2026 (plus 16 years) will be similar.

It can therefore be seen that no future design year analysis is required for the subject site.

4.4.4 Impact of Construction Traffic

The construction work will occur over an 18 month period with most construction traffic approaching and departing to the east of the site via Racecourse Road and the New England Highway. The majority of construction material will be prefabricated off site, delivered to site and then assembled within the building. This limits the amount of construction activity on site.

All works on site will be governed by the relevant EP&A rules and as stipulated within any Project Approval granted by the Department of Planning (DoP). This will include hours of work, which will be 7am to 7pm Monday to Saturday, with no works on Sunday or public holidays.

At peak demand times, there could be 50 construction workers on site generating up to 50 inbound movements at the beginning of the day and 50 movements at the end of the day. The construction work will also typically generate up to 30 inbound (and outbound) truck movements per day associated with material and equipment delivery. This would be during normal peak demands with lower flows when the demand for material delivery is lower. There could also be demand for over sized loads to deliver to the site, which will require a separate application to the RTA.

Overall, it is considered that the construction works will have a minimal impact upon the operation of the local road network. All of the construction work will occur within the site and away from the public roads. The construction workers typically commence work at 7.00 AM on site, before the peak hour on the New England Highway. The peak hour in the afternoon is between 4.30 and 5.30pm and it is expected that the majority of construction traffic will have left the site by then.

It can also be seen that the volume of construction traffic would be slightly less than the additional staff movements. The assessment above in **Table 4-2** indicates that this construction traffic will have a minimal impact upon the operation of the key intersection of the New England Highway and Racecourse Road.

4.4.5 Other Developments

It is understood the only other proposed development in the area is on the adjacent site as discussed in Section 2.7. The access to the Heritage Green residential development is proposed to be spread between four separate access points, although some 65% of the traffic could access this site via Racecourse Road. The proposed development will not impact upon the access options for this proposed development.

4.4.6 Assessment of Traffic Noise

An assessment of traffic noise is being completed by Heggies separate to this report.

4.5 Public Transport

4.5.1 Options for improving services

It is considered that the development will create little if any demand for additional public transport use. The site location together with shift work operations will generally discourage the use of public transport. It is therefore considered that no alterations are required to existing bus services to cater for the proposed development.

4.5.2 Pedestrian Access to Bus Stops

The current bus stops in this general locality do not have specific pedestrian facilities and it is not expected that significant numbers of pedestrians using the bus stops will be generated by the proposed development. Any upgrades to the existing bus stops are not justified as a consequence of the development.

4.6 Recommended Works

4.6.1 Improvements to Access and Circulation

It is considered that the existing site access and circulation provides a safe and appropriate access arrangement for the proposed development. The new works within the site will be designed and constructed in accordance with Council Design Standards and will take into account the specific requirements of the proposed development.

4.6.2 Improvements to External Road Network

It is considered that no improvements are required to the road network as part of this proposed development. The remaining roads and intersection controls in the area are adequate for the traffic generated by the proposed development.

4.6.3 Improvements to Pedestrian Facilities

It is considered that no additional pedestrian facilities are required as part of this proposed development.

4.6.4 Effect of Recommended Works on Adjacent Developments

It is considered that the proposed development will not have any impact on the adjacent developments in the general locality of the subject site.

4.6.5 Effect of Recommended Works on Public Transport Services

There will be no effect upon the public transport services in the vicinity of the subject site.

4.6.6 Provision of LATM Measures

There are no other Local Area Traffic Management measures required as part of this development.

4.6.7 Funding

No external road works are required therefore there are no funding issues. All works within the subject site will be funded by the proponent.

4.6.8 Noise Attenuation

Any noise attenuation measures will be assessed by Heggies in their Noise Impact Assessment.

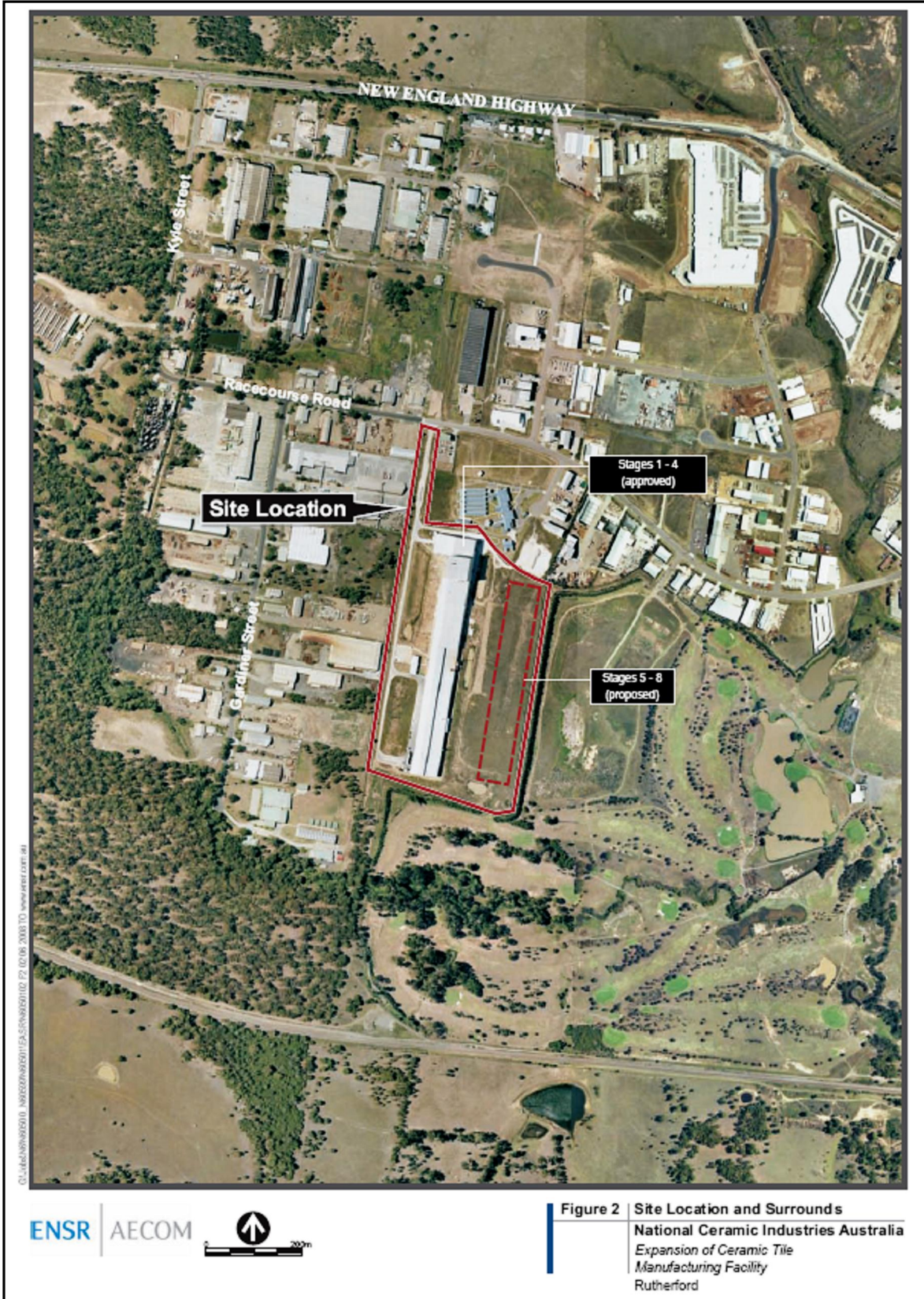
5. Conclusions

The following conclusions are drawn from the investigations into the proposed expansion of the tile factory located off Racecourse Road, Rutherford, NSW:

1. The proposal is to expand the existing tile factory, to increase production from the current approved maximum of 12.8 million square metres to 25.6 million square metres per annum. The proposed expansion will increase the staff numbers from the current 50 to 140, with the majority of the employees working on two shifts with shift changes at 7.00 am and 7.00pm. Access will be provided via the existing gated driveway off Racecourse Road.
2. The site is located off the southern side of Racecourse Road and the primary access route to the New England Highway is via the roundabout controlled intersection of Racecourse Road and the New England Highway. As part of this study traffic surveys have been completed at this intersection to confirm current traffic flows during the morning and afternoon peak periods.
3. The site is currently occupied by the existing factory and has some 50 employees. With the proposed expansion the total number of employees will be 140, with the vast majority of these people working on shift work with shift change times of 7.00am and 7.00pm. It can be seen that the critical period for the factory traffic movements is during these shift change times and in particular the morning shift change. When the shift change occurs at 7.00pm the background traffic flows on the local road network are very low.
4. As part of the study work, a traffic survey was completed at the intersection of the New England Highway and Racecourse Road during the morning and afternoon peak periods. The intersection operation has been assessed using Sidra and the Sidra analysis indicates that the roundabout operates to a satisfactory level of service for all approaches. Observations on site show that there is a high volume of traffic along the New England Highway during the peak periods, and this traffic can suffer from some delays at peak periods.
5. The operations on site will in the future increase the traffic movements at the shift change times, which could be critical during the 7.00am shift time. At this time, there will be an additional 65 inbound trips prior to the 7.00am shift start, an increase over the existing situation. There will be a corresponding outbound movement just after 7.00am. The administration staff numbers will remain as per the existing situation with these staff working a more traditional 9-5 day.
6. The impact of this additional traffic has been assessed at the roundabout controlled intersection of New England Highway and Racecourse Road and the analysis indicates that the roundabout will continue to perform well. This assessment has also been completed allowing for the proposed residential development to occur at the proposed Heritage Green development adjacent to the subject site and shows continual acceptable performance for this intersection.
7. The existing site access of Racecourse Road provides a safe and appropriate layout and will cater for the additional movements associated with the expansion of the tile factory.
8. Additional parking will be provided on site to cater for the increased demands for the employees on site. The parking is currently provided in a sealed car park area which will be expanded as part of the expansion of the factory.

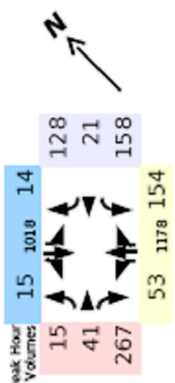
The overall conclusion from the investigations is that traffic and parking arrangements for the development proposal are satisfactory and that there is no traffic or parking impediments to the development.

Appendix A Site Plan



Appendix B Traffic Survey Results

Turning movement count
 090501bt p0538
 Wednesday, 1 July 2009
 New England H'y, Denton Pk Dr & Racecourse Rd
 Fine
 Better Transport Futures



Time Period	From New England H'wy north			from Racecourse Rd			From New England H'wy south			From Denton Pk Dr			Total vehicle movement												
	Light Vehicle	Heavy Vehicle	Total	Light Vehicle	Heavy Vehicle	Total	Light Vehicle	Heavy Vehicle	Total	Light Vehicle	Heavy Vehicle	Total													
14:30 to 14:45	2	4	98	40	4	1	5	1	19	0	36	5	27	10	169	44	11	2	22	1	2	1	16	1	521
14:45 to 15:00	2	2	98	30	1	1	2	1	17	0	41	6	28	1	214	23	7	0	26	1	8	0	17	1	527
15:00 to 15:15	8	0	218	25	3	0	3	0	8	0	50	8	33	3	283	25	20	0	25	3	7	0	30	1	753
15:15 to 15:30	8	0	292	29	3	1	3	0	10	0	63	5	37	5	287	22	25	2	36	0	8	0	43	0	879 Peak
15:30 to 15:45	0	0	176	25	2	3	7	1	11	0	64	9	19	6	191	15	5	1	25	0	11	1	20	1	593
15:45 to 16:00	5	0	266	29	3	1	3	0	0	0	50	4	20	4	278	15	26	1	40	0	15	1	44	0	805
16:00 to 16:15	3	0	190	19	1	1	1	0	7	0	43	6	19	3	193	13	17	2	26	0	15	0	30	2	591
16:15 to 16:30	4	1	171	21	1	1	1	0	9	0	45	3	19	4	200	13	18	1	25	0	16	0	25	1	579
16:30 to 16:45	4	1	217	17	4	0	8	0	12	0	77	3	10	4	256	6	44	0	38	1	8	0	35	1	746
16:45 to 17:00	6	0	290	11	2	1	3	0	9	1	82	2	15	0	308	18	26	1	43	1	5	0	40	0	864
17:00 to 17:15	0	0	170	17	1	1	1	0	9	0	48	3	9	1	259	16	32	2	29	0	5	0	17	0	620
17:15 to 17:30	2	1	279	17	5	1	3	0	10	0	51	1	10	4	307	8	49	0	46	0	3	0	34	1	832
17:30 to 17:45	1	0	210	15	2	1	1	0	11	0	29	1	8	0	295	11	35	1	39	0	5	0	23	0	688
17:45 to 18:00	2	2	208	14	2	1	0	0	9	0	23	2	7	0	247	12	30	1	41	1	5	0	20	0	627
Hourly Summary	47	11	2883	309	34	14	41	3	141	1	702	58	261	45	3487	241	345	14	461	8	113	3	394	9	2680
14:30 to 15:30	20	6	706	124	11	3	13	2	54	0	190	24	125	19	953	114	63	4	109	5	25	1	106	3	2752
15:00 to 15:45	18	2	784	109	9	5	15	2	46	0	218	28	117	15	975	85	57	3	112	4	34	1	110	3	3030
15:15 to 16:15	16	0	952	108	11	5	16	1	29	0	227	26	109	18	1039	77	76	4	126	3	41	2	137	2	2868
15:30 to 16:30	12	1	803	94	7	6	12	1	27	0	202	22	77	17	862	56	66	5	116	0	57	2	119	4	2568
15:45 to 16:45	16	2	844	86	9	3	13	0	28	0	215	16	68	15	927	47	105	4	129	1	54	1	134	4	2780
16:00 to 17:00	17	2	868	68	8	3	13	0	37	1	247	14	63	11	957	50	105	4	132	2	44	0	130	4	2809
16:15 to 17:15	14	2	848	66	8	3	13	0	39	1	252	11	53	9	1023	53	120	4	135	2	34	0	117	2	3062 Peak Hour
16:30 to 17:30	12	2	956	62	12	3	15	0	40	1	258	9	44	9	1130	48	151	3	156	2	21	0	126	2	3004
16:45 to 17:45	9	1	949	60	10	4	8	0	39	1	210	7	42	5	1169	53	142	4	157	1	18	0	114	1	2767
17:00 to 18:00	5	3	867	63	10	4	5	0	39	0	151	7	34	5	1108	47	146	4	155	1	18	0	94	1	

Appendix C Sidra Outputs

SIDRA INTERSECTION

Intersection Summary
 NEH and Racecourse Road
 AM peak 2009 base

Performance Measure	Vehicles	Persons
Demand Flows - Total	2434 veh/h	3651 pers/h
Percent Heavy Vehicles	13.2 %	
Degree of Saturation	0.537	
Effective Intersection Capacity	4535 veh/h	
95% Back of Queue (m)	41 m	
95% Back of Queue (veh)	5.3 veh	
Control Delay (Total)	5.31 veh-h/h	7.97 pers-h/h
Control Delay (Average)	7.9 s/veh	7.9 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS C	
Total Effective Stops	1452 veh/h	2179 pers/h
Effective Stop Rate	0.60 per veh	0.60 per pers
Proportion Queued	0.54	0.54
Travel Distance (Total)	1504.9 veh-km/h	2257.3 pers-km/h
Travel Distance (Average)	618 m	618 m
Travel Time (Total)	31.3 veh-h/h	47.0 pers-h/h
Travel Time (Average)	46.3 secs	46.3 secs
Travel Speed	48.1 km/h	48.1 km/h
Operating Cost (Total)	1204 \$/h	1204 \$/h
Fuel Consumption (Total)	219.3 L/h	
Carbon Dioxide (Total)	551.7 kg/h	
Hydrocarbons (Total)	0.788 kg/h	
Carbon Monoxide (Total)	42.78 kg/h	
NOX (Total)	1.350 kg/h	



Site: AM peak 2009 base

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**SIDRA
 INTERSECTION**

**Movement Summary
 NEH and Racecourse Road
 AM peak 2009 base
 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)
NEH south										
1	L	238	12.2	0.378	7.4	LOS A	23	0.52	0.62	48.4
2	T	1003	11.7	0.536	5.9	LOS A	41	0.56	0.51	49.2
3	R	74	12.3	0.537	12.7	LOS B	41	0.57	0.69	44.3
Approach		1314	11.8	0.536	6.5	LOS A	41	0.55	0.54	48.7
Denton Park Rd										
4	L	112	5.4	0.481	10.0	LOS A	26	0.72	0.89	47.2
5	T	53	5.8	0.481	9.1	LOS A	26	0.72	0.86	48.0
6	R	209	7.6	0.481	15.9	LOS B	26	0.72	0.92	42.9
Approach		373	6.7	0.480	13.2	LOS B	26	0.72	0.91	44.7
NEH north										
7	L	6	50.0	0.222	8.2	LOS A	11	0.38	0.58	49.4
8	T	632	13.9	0.368	5.7	LOS A	22	0.40	0.49	50.4
9	R	22	72.7	0.367	14.0	LOS B	22	0.41	0.70	45.0
Approach		659	16.2	0.367	6.0	LOS A	22	0.40	0.49	50.2
Racecourse Rd										
10	L	3	100.0	0.023	30.1	LOS C	1	0.83	0.91	34.8
11	T	18	5.6	0.200	12.5	LOS B	12	0.81	0.85	44.9
12	R	67	46.3	0.199	20.5	LOS C	12	0.81	0.94	40.3
Approach		88	39.8	0.199	19.2	LOS B	12	0.81	0.92	40.9
All Vehicles		2434	13.2	0.537	7.9	LOS A	41	0.54	0.60	48.1



Site: AM peak 2009 base

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**SIDRA
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**Intersection Summary
 NEH and Racecourse Road
 AM peak 2009 base plus development traffic**

Performance Measure	Vehicles	Persons
Demand Flows - Total	2581 veh/h	3872 pers/h
Percent Heavy Vehicles	14.0 %	
Degree of Saturation	0.570	
Effective Intersection Capacity	4526 veh/h	
95% Back of Queue (m)	45 m	
95% Back of Queue (veh)	5.9 veh	
Control Delay (Total)	6.29 veh-h/h	9.44 pers-h/h
Control Delay (Average)	8.8 s/veh	8.8 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS C	
Total Effective Stops	1647 veh/h	2470 pers/h
Effective Stop Rate	0.64 per veh	0.64 per pers
Proportion Queued	0.61	0.61
Travel Distance (Total)	1597.7 veh-km/h	2396.5 pers-km/h
Travel Distance (Average)	619 m	619 m
Travel Time (Total)	33.9 veh-h/h	50.9 pers-h/h
Travel Time (Average)	47.3 secs	47.3 secs
Travel Speed	47.1 km/h	47.1 km/h
Operating Cost (Total)	1313 \$/h	1313 \$/h
Fuel Consumption (Total)	241.2 L/h	
Carbon Dioxide (Total)	606.9 kg/h	
Hydrocarbons (Total)	0.867 kg/h	
Carbon Monoxide (Total)	47.80 kg/h	
NOX (Total)	1.499 kg/h	



Site: AM peak 2009 base+dev

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SIDRA INTERSECTION

Movement Summary NEH and Racecourse Road AM peak 2009 base plus development traffic 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)
NEH south										
1	L	306	12.4	0.402	7.5	LOS A	25	0.54	0.62	48.3
2	T	1003	11.7	0.569	5.9	LOS A	45	0.59	0.52	48.9
3	R	74	12.3	0.570	12.8	LOS B	45	0.60	0.69	44.2
Approach		1383	11.9	0.569	6.6	LOS A	45	0.58	0.55	48.5
Denton Park Rd										
4	L	112	5.4	0.529	11.3	LOS B	32	0.78	0.95	45.9
5	T	58	5.3	0.528	10.4	LOS B	32	0.78	0.94	46.9
6	R	209	7.6	0.529	17.3	LOS B	32	0.78	0.98	41.9
Approach		378	6.6	0.529	14.5	LOS B	32	0.78	0.96	43.6
NEH north										
7	L	6	50.0	0.250	8.8	LOS A	13	0.49	0.64	48.7
8	T	632	13.9	0.406	6.3	LOS A	26	0.52	0.54	49.5
9	R	22	72.7	0.407	14.6	LOS B	26	0.54	0.78	44.4
Approach		659	16.2	0.406	6.6	LOS A	26	0.52	0.55	49.3
Racecourse Rd										
10	L	3	100.0	0.024	31.2	LOS C	1	0.84	0.92	34.2
11	T	23	4.3	0.397	15.8	LOS B	28	0.87	0.98	42.1
12	R	136	45.9	0.398	23.7	LOS C	28	0.87	1.01	38.2
Approach		161	41.0	0.398	22.7	LOS C	28	0.87	1.01	38.6
All Vehicles		2581	14.0	0.570	8.8	LOS A	45	0.61	0.64	47.1



Site: AM peak 2009 base+dev

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**SIDRA
 INTERSECTION**

**Intersection Summary
 NEH and Racecourse Road
 AM peak 2009 base plus development traffic plus Heritage Green**

Performance Measure	Vehicles	Persons
Demand Flows - Total	2793 veh/h	4190 pers/h
Percent Heavy Vehicles	15.9 %	
Degree of Saturation	0.890	
Effective Intersection Capacity	3139 veh/h	
95% Back of Queue (m)	127 m	
95% Back of Queue (veh)	13.4 veh	
Control Delay (Total)	11.57 veh-h/h	17.35 pers-h/h
Control Delay (Average)	14.9 s/veh	14.9 s/pers
Level of Service	LOS B	
Level of Service (Worst Movement)	LOS E	
Total Effective Stops	2264 veh/h	3396 pers/h
Effective Stop Rate	0.81 per veh	0.81 per pers
Proportion Queued	0.74	0.74
Travel Distance (Total)	1734.9 veh-km/h	2602.4 pers-km/h
Travel Distance (Average)	621 m	621 m
Travel Time (Total)	41.4 veh-h/h	62.1 pers-h/h
Travel Time (Average)	53.3 secs	53.3 secs
Travel Speed	41.9 km/h	41.9 km/h
Operating Cost (Total)	1599 \$/h	1599 \$/h
Fuel Consumption (Total)	288.4 L/h	
Carbon Dioxide (Total)	726.7 kg/h	
Hydrocarbons (Total)	1.046 kg/h	
Carbon Monoxide (Total)	58.43 kg/h	
NOX (Total)	1.811 kg/h	



Site: AM peak 2009 base+dev+Heritage

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SIDRA INTERSECTION

Movement Summary

NEH and Racecourse Road

AM peak 2009 base plus development traffic plus Heritage Green

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)
NEH south										
1	L	333	12.3	0.415	7.5	LOS A	27	0.57	0.62	48.1
2	T	1003	11.7	0.587	6.0	LOS A	49	0.62	0.52	48.7
3	R	74	12.3	0.589	12.8	LOS B	49	0.63	0.70	44.0
Approach		1409	11.9	0.587	6.7	LOS A	49	0.61	0.55	48.3
Denton Park Rd										
4	L	112	5.4	0.677	17.8	LOS B	52	0.92	1.13	40.4
5	T	63	6.3	0.677	16.9	LOS B	52	0.92	1.12	41.2
6	R	209	7.6	0.677	23.7	LOS C	52	0.92	1.14	37.6
Approach		384	6.8	0.678	20.9	LOS C	52	0.92	1.13	38.9
NEH north										
7	L	6	50.0	0.316	10.5	LOS B	18	0.70	0.80	47.4
8	T	632	13.9	0.521	8.4	LOS A	41	0.76	0.76	47.8
9	R	22	72.7	0.524	17.0	LOS B	41	0.79	0.96	43.4
Approach		659	16.2	0.521	8.7	LOS A	41	0.76	0.77	47.6
Racecourse Rd										
10	L	3	100.0	0.025	31.7	LOS C	1	0.84	0.92	34.0
11	T	39	5.1	0.886	47.2	LOS D	127	1.00	1.66	26.3
12	R	299	46.2	0.890	55.1	LOS E	127	1.00	1.58	25.4
Approach		341	41.9	0.889	54.0	LOS D	127	1.00	1.59	25.5
All Vehicles		2793	15.9	0.890	14.9	LOS B	127	0.74	0.81	41.9



Site: AM peak 2009 base+dev+Heritage

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Appendix D Criteria for interpreting results of Sidra

1-Level of Service (LoS)

LoS	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Good	Good
B	Good, with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but requires accident study
D	Operating near capacity	Near capacity and requires accident study
E	At capacity, excessive delay: roundabout requires other control method	At capacity, requires other control mode
F	Unsatisfactory, requires other control mode or additional capacity	Unsatisfactory, requires other control mode

2-Average Vehicle Delay (AVD)

The AVD is a measure of operational performance of an intersection relating to its LoS. The average delay should be taken as a guide only for an average intersection. Longer delays may be tolerated at some intersections where delays are expected by motorists (e.g. those in inner city areas or major arterial roads).

LoS	Average Delay / Vehicle (secs)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 15	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28 to 42	Satisfactory	Satisfactory but accident study required
D	42 to 56	Operating near capacity	Near capacity, accident study required
E	56 to 70	At capacity, excessive delays: roundabout requires other control mode	At capacity; requires other control mode
F	Exceeding 70	Unsatisfactory, requires additional capacity	Unsatisfactory, requires other control mode

3-Degree of Saturation (D/S)

The D/S of an intersection is usually taken as the highest ratio of traffic volumes on an approach to an intersection compared with the theoretical capacity, and is a measure of the utilisation of available green time. For intersections controlled by traffic signals, both queues and delays increase rapidly as DS approaches 1.0. An intersection operates satisfactorily when its D/S is kept below 0.75. When D/S exceeds 0.9, queues are expected.

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