Better Transport Futures

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Transport Planning & Engineering

Proposed Train Support Facility, Nelson Street, Greta, NSW

Traffic Impact Assessment

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1. Introduction

Background
Better Transport Futures has been commissioned by Monteath & Powys on behalf of Pacific National to prepare a Traffic Impact Assessment for the proposed new Train Support Facility off Mansfield Street Greta, NSW. This work is required to support the Environmental Assessment for the proposal.

Scope of Report
The scope of this report is to review the traffic, access and parking implications for the proposed development. The development will provide for a train support facility with all road based access via Mansfield Street. The report will also provide advice on access issues, internal site layout and issues relating to construction and service vehicles. Site plans are shown in Appendix B.

Issues and Objectives of the study
The issues relevant to the proposal are:

- Assess impact on the arterial and local road network due to the additional traffic flows including relevant intersections
- Assess the impact of the additional parking generated by the proposed development;
- Review the access arrangements for the development including access to, from and within the site (for all modes and needs);
- Review the service arrangement for the development;
- Access interaction and integration with existing and planned transport infrastructure and services, including development of the Hunter Expressway and the Hunter Valley (Rail) Corridor Capacity Strategy (ARTC,2009) and
- Assess any other transport impacts associated with the development.

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

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;
- Cessnock City Council DCP2 for off-street vehicular parking (dated September 2001);
- Australian / New Zealand Standard ï Parking Facilities Part 1 : off-street car parking (AS2890.1:2004);

2. Existing Situation

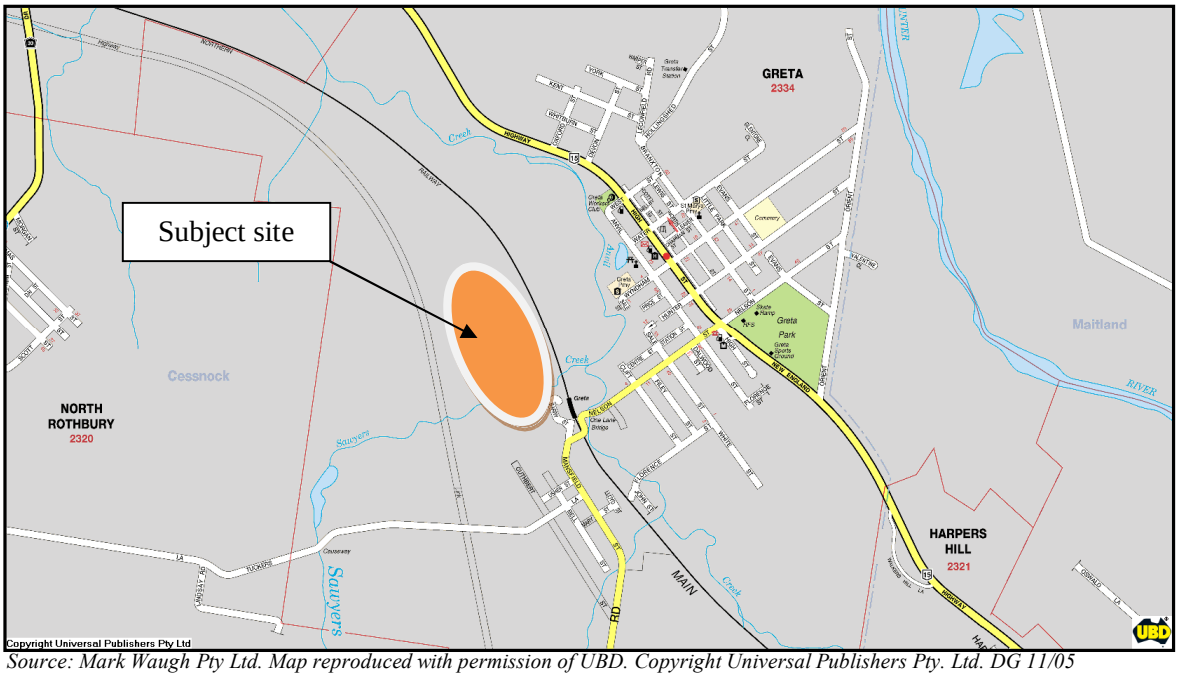
2.1 Site Description and Proposed Activity

2.1.1 Site Location and Access

The subject site is located on a parcel of land off Mansfield Street, Greta, NSW. All road based vehicle and pedestrian access will be via Mansfield Street only. Mansfield Street is accessed off Nelson Street which intersects with the New England Highway.

To the east of the site is the existing township of Greta. The site is bounded by the Main Northern Railway line along its eastern boundary and by the corridor for the Hunter Expressway (Hunter Expressway) on its western boundary.

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

The New England Highway

The New England Highway is the main road through the locality and it provides the major connection between Greta and onwards to Newcastle via Maitland, and Singleton to the west. It also provides an important connection between the Lower Hunter region located along the Golden Highway to the west and connections to the F3 and Sydney to the east. The New England Highway forms part of the National Highway system and is controlled by the Roads and Traffic Authority of NSW (RTA). It is classified as State Highway number H9.

The New England Highway through Greta provides a single lane of travel in both directions, with a parking lane along the westbound lane. A sealed shoulder is marked for cyclists along the eastbound lane. There are limited turn lanes and there is a signal controlled pedestrian crossing just to the west of Wyndham Street. The posted speed limit through Greta is 60 km/h.

- **Photo 1 View to east showing typical cross section for the New England Highway**

There are a number of existing driveways and intersections located along this length of the New England Highway however there is adequate width to accommodate through traffic movements. Each carriageway is in the order of 3.5 metres wide, with a sealed shoulder on the northern edge in the order of 1.5 to 2.0 metres wide. On the southern edge of the road, there is a 1.5 metre wide cycleway and a 2.5 metre wide parking lane. In the vicinity of the site, the New England Highway provides a straight alignment with good forward visibility in both directions. There are street lights provided along both sides of the road.

Nelson Street

Nelson Street is a local road under the control of Council. It provides access between the centre of Greta (New England Highway) and runs south-west through to Mansfield Street and north-east through to Orient Street. There are a number of residents with direct access to Nelson Street as well as a number of minor residential roads connecting to it. It provides a single lane of travel in each direction with an overall width in the order of 12.5 metres with a marked parking lane to both sides. Nelson Street flows into Mansfield Street and Camp Road where it narrows in width to around 9 metres with no parking lanes. There are no footpaths or sealed shoulders along its length. It operates under a speed limit of 60 km/h.

■ **Photo 2 View south-west along Nelson Street showing typical cross section**

2.2.2 Roadworks

The project of significance to the general locality is the planned extension of the F3 Freeway from Seahampton to Branxton. This will significantly reduce travel times between Singleton and Newcastle to Sydney and beyond. The Hunter Expressway will connect with the New England Highway to the west of Branxton and will significantly reduce the volume of traffic using the New England Highway through Branxton. Advice from the RTA indicates that the modelling work completed to date indicates that the through traffic movements along the New England Highway will be reduced in the order of 30% or more over the current flows.

From the site survey work together with the traffic data collected by Better Transport Futures, it can be seen that the current traffic flows along this section of the New England Highway currently suffer from delays and operate at a poor level of service. The existing level of service during the morning peak period for westbound traffic is E. This level of service is not desirable, hence the reason why the road authority has identified the fact that a significant road upgrade is required in the form of the Hunter Expressway. However, until this upgrade is provided, the road authority and road users will have to accept the poor level of service and associated delays. The RTA has been working on this project for a number of years and funding has now been committed to this project. Advice from the RTA indicates that this link will be operational by 2014.

Advice from the study team also indicates that ARTC are proposing to upgrade Nelson Street in the vicinity of the subject site to remove the current poor alignment over the railway line. The proposed road upgrade will be constructed as part of the development of the third railway track and includes a new road bridge over the railway line. The road re-alignment will improve the existing situation and remove the two existing tight bends over the railway line as well as replace the current narrow road bridge over Anvil Creek. It will also include pedestrian and cycle facilities to meet current RTA standards.

It is understood that there are no other major road network improvements planned in the vicinity of the subject site, apart from normal road maintenance performed by Council and the RTA.

2.2.3 Traffic Management Works

There are currently no traffic management works planned in the vicinity of the site, as observations on site indicate the network is currently working to a good level of service for the majority of the length of Nelson Street with minimal delays and congestion during peak periods.

2.2.4 Pedestrian and Cycling Facilities

Cycling facilities are limited and inconsistent in their built form. For the majority of the length of the New England Highway there are no cycle lanes marked, nor is there an off road footpath or shared path. In the vicinity of the site access there are no cycle lanes however within Greta cyclists can use the parking lanes where provided.

There are no pedestrian paths provided on Nelson Street and limited paths on the side of the New England Highway. It is understood that the upgrade of the Nelson Street rail overpass will include pedestrian and cycle facilities to meet current RTA standards.

2.2.5 Public Transport

Public transport in the vicinity of the site is limited. School buses provide access for school children but there are no regular buses for general public use in this locality.

The only direct train from Newcastle to Greta in the morning peak leaves Newcastle at 8.12am and arrives at Greta at 8.59am. Alternate train/bus combinations can take from 1 hour and 20mins to 2 1/4 hours depending upon train and bus connectionsô times and locations. Similarly there is one direct train from Greta to Newcastle in the am peak, otherwise again travel involves lengthy bus/train combinations.

Similarly the evening peak trip from Greta to Newcastle after 4pm is not available until 6pm and requires a bus/train combination. The peak travel options from Newcastle to Greta however are more frequent with a 4.10pm (direct) a 4.20pm (train/bus) and a 5.55pm (direct).

The area is serviced by Hunter Valley Buses. Route 181/182 from Greenhills to Singleton offers an hourly service in the morning peak from Maitland to Singleton via Greta as well as from Greta to Maitland. A less regular service however is offered in the afternoon and evening peak.

2.3 Traffic Flows

The proposed development of the site will allow for the provision of a train support facility. During construction phase there will be a number of vehicles associated with construction employees as well as materials delivery etc. Once the facility is constructed, there will be some traffic movements associated with staff movements in and out of the site. There will also be traffic movements as a result of delivery vehicles including fuel deliveries.

The key roads affected by the development will be Nelson Street and the New England Highway as well as the intersection of these two roads. The impact for the construction work (whilst temporary) will also need to be assessed due to the local connection issues with the New England Highway.

2.3.1 Daily Traffic Flows

Traffic volume data for the project has been collected during a survey of traffic movements at the give way controlled intersection of Nelson Street and the New England Highway. These surveys were completed on Tuesday 1st September 2009 and provided data for both the morning and afternoon peak periods associated with normal peak hour operations.

The results from the traffic survey indicate that during the surveyed morning peak period (7.30 to 8.30 AM) the two-way traffic flow along the New England Highway directly to the east of Nelson Street was in the order of 1553 vehicles per hour. The majority of vehicles were light vehicles, with a reasonably high percentage of heavy goods vehicles observed during this peak period. The traffic flow was split between 590 eastbound (38%) and 963 westbound movements (62%). This shows a strong bias for traffic to head west, towards Singleton.

The corresponding traffic survey during the afternoon peak period shows that between 16.15 and 17.15 PM the corresponding two-way flow was 2,032 vehicles per hour. Again, the majority of traffic was light traffic with a reasonable level of heavy goods vehicles observed during the surveyed peak period. The traffic flows were less evenly split, with 1422 vehicles (70%) eastbound and 610 westbound (30%). This shows a strong bias for return trips eastbound from Singleton and the mining areas to the west via the New England Highway. The traffic surveys completed show that the flows are reasonable high from between around 15.15 through to 18.30 PM.

The survey also recorded the traffic flows in and out of Nelson Street. These flows are much lower than on the New England Highway. During the AM peak the 2-way flow was in the order of 252 vehicles whilst in the PM peak was in the order of 312 vehicles.

The results of the survey are summarised in **Table 2-1** below, with full details of the survey provided in Appendix A of this report.

- **Table 2-1**ï Traffic Volumes

Road	Location	Direction	AM Peak (1)	PM Peak (1)	Mid-Block Road Capacity[2]	Level of Service (AM/PM)	Volume / Capacity AM	Volume / Capacity PM
New England Highway	East of Nelson Street	Eastbound	590	1422	1400	C / E	0.421	1.016
New England Highway	East of Nelson Street	Westbound	963	610	1400	E / D	0.687	0.436
Nelson Street	South of New England Highway	Northbound	144	121	900 [3]	A / A	0.160	0.134
Nelson Street	South of New England Highway	Southbound	108	191	900 [3]	A / A	0.120	0.212

Notes: 1. Peak flow from September 2009 traffic survey results by Mark Waugh Pty Ltd
2 -TA Guide to Traffic Generating Development mid-block capacity for 2 lane undivided and one lane two way.

Table 2-1 demonstrates that whilst Nelson Street is currently operating well within its technical and functional capacity levels, the New England Highway is operating at a poor level of service (E) which will create delays and congestion for road users. Observations on site show that traffic is very heavy through Greta for the peak direction of flows with a near constant line of traffic.

Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RTA Guide to Traffic Generating Developments, version 2.2 dated October 2002.

Traffic data has also been obtained from the RTA, indicating that the Annual Average Daily Traffic flow (AADT) in 2007 was in the order of 16,722 vehicles per day to the west of Branxton at Black Creek Bridge (approximately 1.7 kms west of Nelson Street) on the New England Highway. The data from the RTA count indicates that the AADT at this location has decreased slightly since 2001 at this location (17,098 in 2001).

2.3.2 Daily Traffic Flow Distribution

There is limited data available from Council and the RTA regarding daily traffic flow distribution. However, the New England Highway carries a significant volume of interstate and regional traffic movements and weekend flows can be significant. The New England Highway also carries high traffic volumes during school holidays.

2.3.3 Vehicle Speeds

Vehicle speeds have been observed during the site visit, and it is considered that the majority of traffic appears to travel close to the posted speed limit of 60 km/h. This is in the main due to the high traffic flows during the peak periods. Traffic speed on Nelson Street appears to travel at the posted speed limit at its northern end towards the New England Highway but towards the site at the southern end of Nelson Street the speeds are currently much lower, due to the poor road alignment over the railway line.

2.3.4 Existing Site Flows

The subject site is currently vacant therefore there are very limited traffic flows in or out of the existing site.

2.3.5 Heavy Vehicle Flows

The New England Highway carries a significant volume of interstate transport as well as regional transport, which includes a large number of heavy vehicles. The New England Highway also carries a large number of B-doubles in this location.

There is minimal heavy vehicle usage of Nelson Street. There would be some use by Council garbage collection vehicles and limited access for local deliveries etc.

2.3.6 Current Road Network Operation

Observations on site show that during the peak periods traffic flows along the New England Highway suffer from some delay due to the high volume of traffic. Due to the width of the New England Highway, through traffic movements can continue past traffic waiting to turn right into the various side roads, however this causes some delays for the road movements.

Observations on site show that traffic turning right out of the side roads can suffer from delays, but that with some platooning effect behind large vehicles this side road traffic can enter the flow on the New England Highway. It would also appear that drivers accept a smaller gap that normal in recognition of the high flows. Whilst this potentially could create a safety issue, the accident crash data from the RTA does not indicate a high level of accidents at this location.

2.4 Traffic Safety and Accident History

The New England Highway provides a straight alignment with good visibility on the approach to the intersection with Nelson Street from both directions allowing drivers to observe the intersection operations and adjust their speed or stop accordingly. There is no dedicated turning lane for the right turn movement into Nelson Street but the width of the road at this location allows drivers to manoeuvre their vehicles past traffic waiting to turn right, thereby reducing the delays for the through traffic movements. There is a dedicated left turn lane for westbound traffic movements. There are also street lights provided on both the New England Highway and Nelson Street in this location. These street lights continue along Nelson Street but stop at the edge of the existing urban limit before the subject site.

A review of the RTA accident data for the last 5 years shows that there have been two recorded accidents close to the intersection of the New England Highway and Nelson Street. Both involved rear end accidents relating to traffic flows on the New England Highway. Overall the accident rate in this location is relatively low.

2.5 Parking Supply and Demand

2.5.1 On-street Parking Provision

On street parking is available along much of the length of Nelson Street within Greta however closer to the subject site there is limited parking, due to the reduced road width. The existing alignment of the road over the railway line does not permit parking due the narrow width and lack of shoulders.

2.5.2 Off-Street Parking Provision

There would be no off-street parking available within other sites adjacent to the subject site in the area for use by the subject development.

2.5.3 Parking Demand and Utilisation

There was limited on-street parking within Greta during the site visit and no parking on-street adjacent to the subject site. It is considered that there would be little if any demand for parking in this locality, as there are no business users in the locality and the majority of residential development has off-street parking areas to satisfy the demand.

2.5.4 Set down or pick up areas

There are no dedicated bus stops in the general vicinity of the subject site.

2.6 Public Transport

2.6.1 Rail Station Locations

Greta Railway Station is located adjacent to the subject site and provides a limited service to Newcastle and beyond as well as a service to Singleton.

The only direct train from Newcastle to Greta in the morning peak leaves Newcastle at 8.12am and arrives at Greta at 8.59am. Alternate train/bus combinations can take from 1 hour and 20mins to 2 1/4 hours depending upon train and bus connectionsô times and locations. Similarly there is one direct train from Greta to Newcastle in the am peak, otherwise again travel involves lengthy bus/train combinations.

Similarly the evening peak trip from Greta to Newcastle after 4pm is not available until 6pm and requires a bus/train combination. The peak travel options from Newcastle to Greta however are more frequent with a 4.10pm (direct) a 4.20pm (train/bus) and a 5.55pm (direct). Again this trip takes more than hour to complete between Greta station and Newcastle.

Given the low frequency of trains serving this station, it is considered that there will be no demand from the subject site for train access for work trips. Census data shows that as a whole, the percentage of public transport use for trips to work in the Lower Hunter are very low (around10%) and it is considered that this rate would be even lower in the location of the subject site for work trips. It is therefore considered that all of the future employees on the site will travel by private vehicle to the subject site.

2.6.2 Bus Stops and Associated Facilities

There are no bus stops in the immediate vicinity of the subject site. The area is serviced by Hunter Valley Buses. Route 181/182 from Greenhills to Singleton offers an hourly service in the morning peak from Maitland to Singleton via Greta as well as from Greta to Maitland . A less regular service however is offered in the afternoon and evening peak. This service takes around 40 minutes to complete by bus.
Similarly, given the very infrequent bus service to the locality and the length of journey time, it is considered that no one will use the bus to access the subject site for work trips. It is considered that all the future workers on the site will travel by private vehicle to the site.

From the low services for both trains and buses to the locality, it has been assumed that all of the employees will travel to the site by private vehicle.

2.6.3 Pedestrians

There are no footpaths provided on Nelson Street adjacent to the subject site. It is also noted that there is no footpath provided along Nelson Street within Greta. It can be seen that the pedestrian demands are very low and pedestrians can use the adjacent verges as required. However, it is understood that as part of the realignment of the Nelson Street overpass, there will be pedestrian and cyclistôs facilities provided to meet current RTA standards.

2.7 Other Proposed Developments

There are a number of developments occurring in and around Greta including residential subdivisions. Additionally, in the immediate vicinity of the site there are a number of infrastructure developments occurring including the RTA Hunter Expressway and ARTCôs third track. It is understood that currently there are no other major developments proposed in the immediate vicinity of the subject site.

3. Proposed Development

3.1 The Development

The proposed development is for a Train Support Facility. This facility will provide a low key centre, with staff numbers in the order of 54 on site associated with work at the facility for the full development to Stage Three. In addition, there will be some B-doubles required to access the site associated with fuel deliveries (typically 1-2 per day in the initial stage and upto 6 when fully developed at Stage 3). There will be other delivery vehicles for materials and general supplies with the expected volume of traffic amounting to a maximum of 54 inbound and 54 outbound movements per day spread over a number of hours including staff movements. It is important to note that the development will have 24 hour working, 7 days a week. There will also be some additional movements associated with materials and general supplies.

These traffic flows have been obtained from transport records for the similar facility operated by the applicant in Muswellbrook. It is recognised that the type of development is unique in many ways and the RTA Guide to Traffic Generating Developments does not provide any guidance for this type of specific use. This guide does however indicate that survey of a similar type of development should be completed to obtain traffic flows in and out of sites. This has been applied in this instance.

A preliminary plan for the development has been included in Appendix B to this report.

3.1.1 Nature of Development

The proposed development is to provide a new train support facility. This type of development allows for the vast majority of the work to be completed on site with minimal off-site interaction. There will be staff movements in and out of the site and occasional delivery vehicles, including B-doubles. The facility would operate 24 hours a day and 7 days a week as required.

3.1.2 Access and Circulation Requirements

The development will need to accommodate light vehicle access for employee vehicles as well as larger delivery vehicles including B-doubles. Vehicles will be able to turn around within the site to allow for entry and egress in a forward direction.

3.2 Access

3.2.1 Driveway Location

All vehicle access to the development will be via a new access on Mansfield Street. As part of the construction of the third track by ARTC it is proposed to upgrade Nelson Street with a new alignment and railway crossing. This will remove the existing poor alignment over the railway line and ensure good visibility for vehicles entering and exiting the site. The driveway has been located to ensure adequate visibility is available for vehicles entering and exiting the site.

3.2.2 Sight Distances

The access for the development will be via the new access to Mansfield Street to be constructed on the upgraded section of Nelson Street as part of this development. Sight lines will be provided in accordance with Council requirements for the design speed of this road. This access will be designed in accordance with Council and RTA requirements.

The upgrade of Nelson Street (by others) will be designed in accordance with the RTA Road Design Guide and will allow for adequate sight distances to be provided in both directions for vehicles entering and exiting the site.

The majority of vehicle access will be via the give way controlled intersection of Nelson Street and the New England Highway. This intersection is located within a 60 km/h speed zone. For the posted speed limit of 60 km/h, the sight distance requirements are 105 metres for Safe Intersection Sight Distance and 60 metres for Approach Sight Distance. The sight distances have been checked on site and exceed 150 metres in both directions.

- **Photo 3 Right visibility splay along New England Highway from Nelson Street**

- **Photo 4 Left visibility splay from Nelson Street**

3.2.3 Service Vehicle Access

All service vehicle access will be provided via the new access on Mansfield Street to be built as part of this development. The new access will be designed in accordance with normal Council requirements. All service vehicles will able to enter and exit the site in a forward direction. Given the overall size of the subject site it can be seen that the internal site layout will allow for the movement of large vehicles and as such will allow for ease of manoeuvring within the site.

It is proposed to use Tri-axle semi trailers and/or B-Doubles to deliver fuel to the site for Stage 1 operations and also for subsequent stages. As such the fuel farm has been designed with suitable access for B-doubles and the facility has been designed to provide access both to and within the site for B-doubles. B-doubles may be used for fuel delivery during Stage 1 operations however this is subject to the designation of a suitable access route for B-doubles along with any consent requirements. It is recognised that Nelson Street and Camp Road are currently not designated B-double routes. Designation of Nelson Street and/or Camp Road as B-Double routes would be progressed through a separate application to Council and the NSW RTA.

3.2.4 Queuing at entrance to site

Nelson Street currently operates well within its operational limits. Using the RTA guide to Traffic Generating Developments, it can be seen that the maximum flow along a road of this type is in the order of 500 vehicles per hour (Collector Street, environmental capacity on residential streets). The traffic surveys show that the current two-way flow is in the order of 312 vehicles in the PM peak (252 in the AM peak). This is at its eastern end near the New England Highway and it is considered that a significant portion of the traffic would have an origin / destination within Greta and the flows would be substantially lower adjacent to the subject site.

Given the low flows on Nelson Street together with the very low flows associated with the subject development it is considered that there will be minimal queuing at the site access. There will be minimal impact upon the existing residential lots on Mansfield Street.

3.2.5 Comparison with existing site access

The existing site is vacant so generates negligible traffic flows. The existing site access is located on a tight bend with limited visibility and it is considered that the rail upgrade to be constructed as part of the third track will improve the access considerably over the existing situation in accordance with normal road design standards.

3.2.6 Access to Public Transport

It is considered that no additional access will be required for public transport. The site is adjacent to the existing Greta train station which could be used by the future employees on the site. Additionally, the Hunter Valley Buses network services Greta via the New England Highway approximately 1 km from the site.

3.3 Circulation

3.3.1 Pattern of circulation

All vehicles will be able to enter and exit the site in a forward direction.

3.3.2 Road width

The width of the new roads within the site will be in accordance with Councilsô Design Guide. The roadways will allow for access by a B-double vehicle.

3.3.3 Internal Bus Movements

No internal bus movements will be required.

3.3.4 Service Area Layout

There will be a number of hard stand areas with the site for dedicated servicing within the development including waste disposal. Access for B-doubles will be provided and stand over areas will be provided within the site to allow for these vehicles. Areas will be provided across the site as required by the specialist nature of the project.

3.4 Parking

3.4.1 Proposed Supply

The development will provide off-street parking for employees. There will be a dedicated staff car park as well as hardstand areas suitable for parking. The parking area can cater for some 80 vehicles in total over the entire site. Given the unique nature of the development, the parking provision has been provided based upon the operational requirements and associated staffing requirements.

The parking supply has been determined based upon the future staff numbers for the facility. The facility will be built in 3 stages, with the following staffing numbers:

Stage	Day shift	Afternoon shift	Night shift
One	24	6	6
Two	28	8	8
Three	38	8	6

The above table shows that for the full development (Stage 3) the peak staff demands will be in the order of 38. The day shift also has a variation in start and finish times, which reduces the peak parking demand.

The proposed parking supply of 75 spaces for the admin offices, 2 for the train provisioning facility and 3 for the loco maintenance centre. This parking provision has been derived from the analysis of future staff demands and will cater for the future parking demands associated with the development. This parking provision will allow for visitor parking, contractors and deliveries etc.

3.4.2 Authority Parking Requirements

RTA Parking Requirements

The RTA Guide to Traffic Generating Development does not provide any guidance for parking demands for Rail Support Facilities. The guide advises surveys of similar types of development, but this is not applicable for this facility due to the lack of directly comparable sites. It is therefore considered appropriate to review the parking demands against the staffing numbers.

Cessnock City Council Parking Requirements

The Cessnock City Council DCP does not provide any advice for this type of development. It is therefore considered appropriate to review the parking demands against the staffing numbers.

3.4.3 Parking Layout

The parking on site will be designed and constructed in accordance with the Australian Standard (AS2890.1). This requires a space width of 2.4 metres and a length of 5.4 metres and an aisle width of 6.2 metres to allow for two-way movements. Disabled parking spaces will be provided adjacent to the main buildings in accordance with the Australian Standard.

3.4.4 Parking Demand

The peak parking demand for the development will occur during the normal working day. With typical staffing requirements of 40 maximum, it is considered that a parking provision of 50 spaces will be sufficient for employees as well as visitors. There will also be hardstand areas that will allow for additional parking associated with deliveries and additional contract staff requirements as and when required.

3.4.5 Service Vehicle Parking

No dedicated service vehicle parking is required. Service vehicles will be able to park in a number of locations around the site as required for access to specific areas or buildings.

3.4.6 Pedestrian and Bicycle Facilities

No external pedestrian or cycle facilities will be provided as part of the development. Pedestrian paths will be provided within the site to allow for pedestrian movements between the various buildings and structures. Given the low staffing requirements it is considered that no additional facilities will be required. It is noted that as part of the upgrade of Nelson Street the facilities for pedestrians and cyclists will be improved over the existing situation in accordance with normal RTA requirements.

Bicycle facilities would be provided internally in accordance with the recommendations of the sustainability report.

4. Impact of Proposed Development

4.1 Traffic Generation

4.1.1 Daily and Seasonal Factors

The nature of the development will lead to typical morning and afternoon peak traffic generation, primarily associated with administration and activities on site. Additional traffic movements will occur at maintenance shift change over and also train crew change over times. It is considered that there are minimal seasonal factors.

The level of traffic generated by the proposed development has been determined based upon the future staffing levels on site. Advice from the study team indicates that the site operations will typically require a workforce in the order of 40 per day maximum and will operate over a 24hour period. The volume of traffic entering and exiting the facility associated with staff is shown below, for the three stages. The movements are spread over a number of hours, due to staggered work hours and shift times.

The information provided below has been provided by the study team and is based upon the detailed proposed operations on the site. The recorded transport operations for the site operated by the applicant at Muswellbrook have also been used, to assess the movement of vehicles in and out of the site. An important item is the spread of traffic to and from the site, due to the staggered work shifts on site and the overlap between arrival and departures. This stagger in shifts means that the impacts during the peaks is reduced from an absolute peak that is normally observed at an industrial type development when all staff start and finish at the same time. This staggered work shift has been implemented by the applicant to reduce the absolute peak flows created by the development.

Figure 4.1 Stage One Traffic Movements for Staff

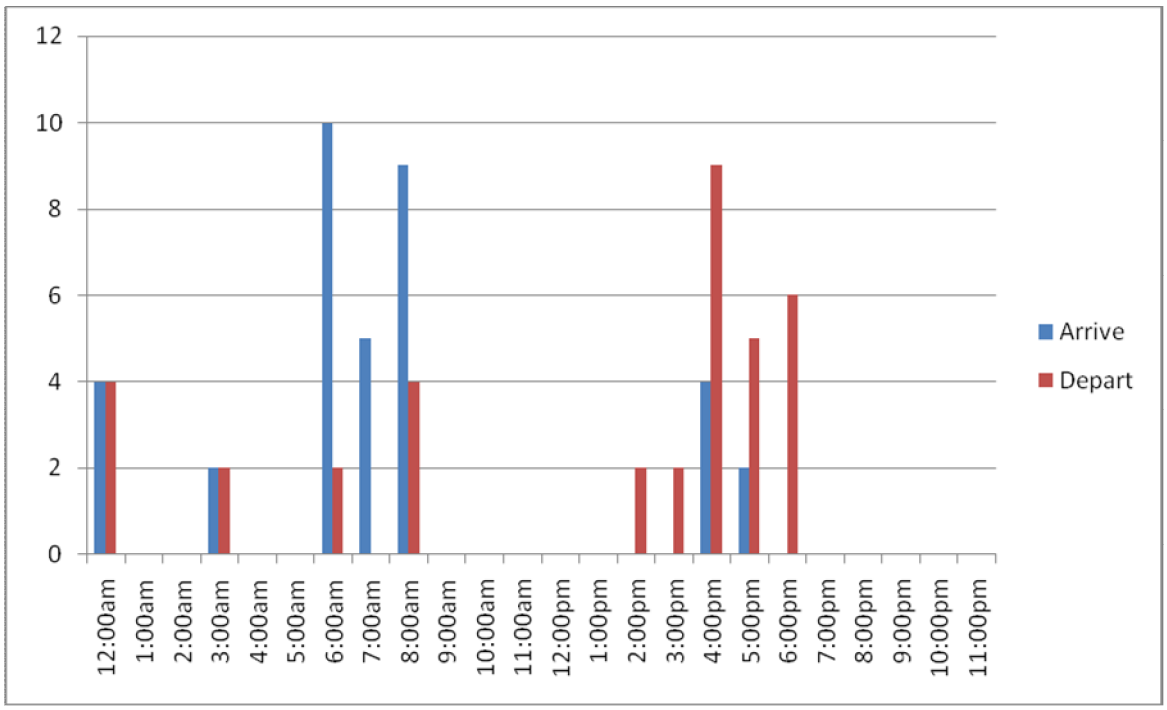
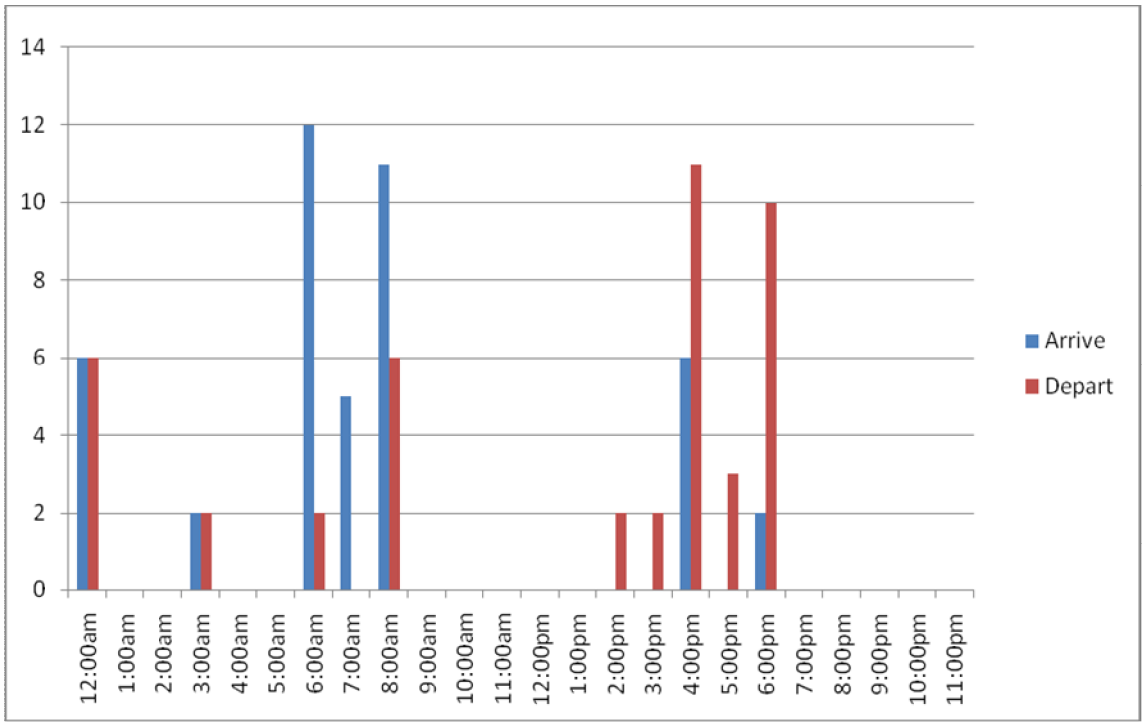
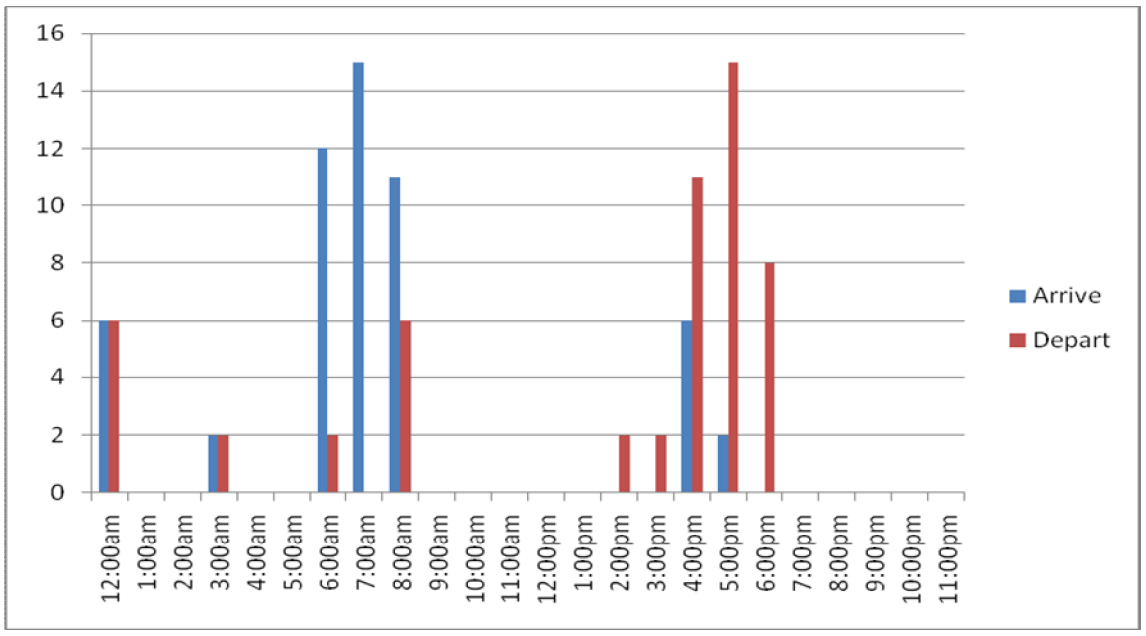


Figure 4-2 Stage Two Traffic Movements for Staff



- **Figure 4-3 Stage Three Traffic Movements for Staff**



When considering the traffic movements for Stage Three, it is important to note that this stage will not occur for at least two years after the completion of Stage Two and is expected to occur post January 2014. At this point, the Hunter Expressway (Hunter Expressway) will be opened and the traffic flows along the New England Highway through Greta will be some 30% lower than the current flows.

It is considered that there will be minimal daily and seasonally variance in flows, although additional staffing may be required on occasion for specific work requirements e.g. major maintenance work.

The volume of trucks accessing the site for servicing the site will be:

- Stage 1 – average 4-6 per day
- Stage 2 – average 6-7 per day
- Stage 3 – average 7-9 per day

These truck movements will be 7 days a week.

4.1.2 Pedestrian Movements

Given the site location it is considered that there will be little if any pedestrian movement to and from the subject site. However, internal pedestrian movements are expected between the various buildings and structures and a network of internal footpaths will be provided.

4.2 Traffic Distribution and Assignments

4.2.1 Origin / destinations assignment

It is considered that the vast majority (90%) of the traffic associated with the development will have an origin / destination towards the New England Highway. Traffic would in the main have an origin / destination towards the east of the site towards Maitland and Newcastle.

4.3 Impact on Road Safety

The additional traffic flows predicted to be generated by this development will have a minimal impact upon traffic safety in the surrounding roads as the flows are well within acceptable limits on the adjacent road network.

It can be seen that the major impact will be at the intersection of the New England Highway and Nelson Street. Whilst the additional turning movements are low, there is limited capacity for additional turning movements at this location due to the high traffic demands during the extended peak periods. During the morning period the majority of traffic movements will involve a left turn off the New England Highway into Nelson Street. This will have little impact upon the safety at this intersection.

However, during the afternoon period the majority of traffic associated with the proposed development will involve traffic turning right out of Nelson Street onto the New England Highway. This movement currently suffers from some delay at times and drivers are often forced to accept smaller gaps in traffic movements. This could lead to safety issues.

Outside of the peak hours, when the background traffic flows along the New England Highway are lower, the impact of the development traffic will be reduced. It can be seen from Figure 2, 3 and 4 above that the traffic movements associated with the development will be dispersed over a number of hours, with staggered start and finish times. Advice from the study team indicates that Stage Two of the development will be some 5 years after the Stage One is completed and opened, indicating this will occur post 2014 when the Hunter Expressway is open.

From the information provided, there will be some 10 staff entering the facility for a 6.00 AM start as well as 5 for a 7.00 AM start and 9 for a 8.00 AM start. During this period, there will be 2 staff

leaving at 6.00 AM and 4 leaving at 8.00 AM. As the arrival will in the main involve traffic turning left in off the New England Highway this will have little if any impact upon the road safety in the locality. The 6 vehicles leaving in the morning period will be over a 2 hour period and again, will have minimal impact upon overall road safety.

For the afternoon peak period, between around 3.00 and 6.00 PM, there will be some 6 inbound trips and 21 outbound trips. The major impact will be created by the outbound trips, but it is important to note that these trips will be spread out over a 4 hour period, with a peak outbound movement occurring at 4.00 PM when 9 vehicles will leave. The remaining movements are spread an hour apart, due to the staggered shift start / finish times. It is considered that this will mean that the development flows will again have a minimal impact upon the overall traffic safety in the locality.

It can be seen that the majority of the traffic associated with the development would in fact travel to and from the New England Highway to the north-east of the site. In this way, the impact upon Mansfield Street would be minimal. It is considered that just 10% of the traffic associated with the development will access the site from the south via Mansfield Street. The information above indicates the flows to the south along Mansfield Street will be in the order of 3 or 4 vehicles per hour during the afternoon peak and less during the morning peak. This volume of traffic will have a negligible impact upon the operation of Mansfield Street.

4.4 Impact of Generated Traffic

4.4.1 Impact on daily Traffic Flows

The additional traffic flows generated by the development are considered to be very low. The typical staffing levels on the site will be in the order of 40 per day, with some delivery vehicles. The development will increase the flows on Nelson Street by 12 vehicles during the peak hours for Stage One, 14 maximum in Stage Two and 17 vehicles in Stage Three and considerably less outside of the peaks.

As a local collector road, the environmental limit for Nelson Street is 500 vehicles per hour two-way. The current peak flows at the northern end is 312 vehicles per hour. The additional 17 trips in the final stage of the development would increase this to some 329 vehicle movements, still well within the environmental limit of 500 vehicles per hour.

Outside of the peak periods, there will be some movements associated with delivery vehicles. However, these will amount to less than 5 per day. Overall, it is considered that the proposed development will have a minimal impact upon the daily traffic flows along Nelson Street.

Whilst the New England Highway is currently operating close to its capacity, the additional traffic movements associated with the development represent a minor increase over the existing flows. The existing westbound flow in the AM peak is in the order of 963 vehicles per hour. The additional trips (as a worst case scenario assuming all traffic to/from Maitland area) would increase this flow by around 1%. Similarly, the existing eastbound flow in the PM peak of 1422 would increase by less than 1%.

Outside of the peak there would be minimal impact created by the proposed development. Overall, it is considered that the development will have a minimal impact upon the daily traffic flows along the New England Highway.

The development will operate 7 days a week. During the weekend, the traffic flows along the New England Highway are much lower than during the morning weekday. Traffic data from the automatic count station to the west of the site towards Singleton (Station number 05.003) demonstrates that the

average weekday flow in 2004 was in the order of 6575 whilst the average weekend flow was in the order of 4881, a reduction of 25%. Thus, the operational traffic during the weekend would have a lower impact than during the normal working week.

During the initial development, prior to the construction of the upgrade to Nelson Street by ARTC, it will be necessary for heavy vehicles to access the site from the south via Camp Street. It can be seen that even the 7 to 9 trucks per day associated with operations on site during stage 3 would still have a minimal impact upon the operation of this road. At its northern end adjacent to the New England Highway, Nelson Street (that runs into Camp Road) is carrying less than 300 vehicles per hour during the morning peaks in the week. Weekend flows would be much lower than this, showing that the operation of Camp Road would remain well within an acceptable level of service to the south of the site.

4.4.2 Peak Hour Impacts on Intersections

Intersection of Nelson Street and New England Highway

To assess the impact of the development upon the intersection of the New England Highway and Nelson Street, the computer program Sidra has been used. 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.

A traffic count for the intersection between Nelson Street and the New England Highway was conducted in September 2009 and has been used for the basis of this analysis.

The operation of the existing give way controlled intersection of Nelson Street and the New England Highway together with the additional peak hour traffic flows associated with the development (including heavy goods vehicles) has been assessed, and a summary of the results from the Sidra analysis is presented below:

Table 4-1 Sidra Analysis for Existing Situation – New England Highway / Nelson Street, AM / PM peak 2009

Approach	LoS	Delay (seconds)	95th percentile queue (metres)
Nelson Street south	C / D	33.5 / 45.8	19 / 17
New England Highway east	A / C	4.4 / 32.0	66 / 116
Nelson Street north	B / F	19.7 / 88.1	0 / 1
New England Highway west	A / B	9.1 / 15.1	51 / 169
Overall	A / A	8.6 / 21.4	66 / 169

Notes AM / PM peak results

The above results confirm the site observations that there are no delays for through movements. However, whilst the Sidra analysis shows considerable delays and queues for the turning movements (and in particular the right turn movements into the side roads off the New England Highway) observations on site indicate that the delays / queues are considerably lower.

It is considered that this is due to a combination of platooning and reduced gap acceptance by drivers. Observations on site indicate that platooning of vehicles occurs, with vehicles travelling in a line behind a slower moving vehicle e.g. large truck. Whilst this creates no gaps in the traffic behind the slower vehicle, there are generally much larger gaps available in front of these slower vehicles. These larger gaps often allow a number of vehicles to exit the side roads in a group. It is also considered that drivers accept a smaller gap in traffic and drivers adjust their approach speed on the New England Highway to the intersection to coincide with an acceptable gap in the on-coming traffic movement when completing a right hand turn.

The same analysis was completed for the morning and afternoon peak periods, with the additional development flows added. For the purposes of this assessment, it was assumed an extra 9 vehicles would enter and exit Nelson Street from the east and an extra 1 vehicle would enter / exit Nelson Street from the west. The results for this analysis are presented in **Table 4-2** below.

Table 4-2- Sidra Analysis for Future Situation – New England Highway / Nelson Street, AM / PM peak 2009 base plus Stage One of the development

Approach	LoS	Delay (seconds)	95th percentile queue (metres)
Nelson Street south	C / F	33.9 / 75.2	19 / 31
New England Highway east	A / C	4.5 / 32.0	68 / 116
Nelson Street north	B / F	19.8 / 88.1	0 / 1
New England Highway west	A / B	9.3 / 15.1	51 / 169
Overall	A / A	8.7 / 23.1	68 / 169

The above results confirm that the additional traffic flows associated with the subject development will have a minimal impact upon the overall operation of the intersection of Nelson Street and the New England Highway. The analysis shows however that the critical right turn out of Nelson Street onto the New England Highway could deteriorate with delays increasing. The queue for this right turn movement could increase, although as discussed above, it is considered that the delays / queues will be less than those predicted by Sidra due to driver behaviour at this location.

Normal RTA requirements are for an assessment of the future operation allowing for a 10 year growth in background traffic flows. As part of the study, the RTA have provided data from the TransCAD model for the Lower Hunter that was established as part of the F3 to Branxton project (now known as the Hunter Expressway). The information provided by the RTA shows the following future daily two-way traffic flows along the New England Highway at Greta:

- 2016 ï 8,000 to 9,000 AADT
- 2026 ï 11,000 to 12,000 AADT
- 2031 ï 13,000 to 14,000 AADT

A review of the RTA count data shows that in 2004 the Annual Average Daily Traffic flow (AADT) on the New England Highway at eastern edge of Branxton was 18,325. Using the above data from the RTA, it can be seen that the traffic flows will reduce significantly with the construction of the Hunter Expressway. Advice from the RTA indicates that this road will be opened by 2014. This means that for Stage One of the proposal the traffic flows will remain as per the current situation. However, Stage Two will not be operational until 5 years after the opening of Stage One, meaning that by the time Stage Two opens the Hunter Expressway will have opened and the traffic flows along this section of the New England Highway will have reduced over the current situation.

It is therefore not necessary to complete the analysis for the future design year of 2019, as the traffic flows on the New England Highway will be lower than the current flows and the impact will therefore be less than the current predicted impact from the Sidra analysis. However, to confirm this a Sidra analysis has been completed for 2020, allowing for the through traffic movements on the New England Highway to reduce by some 8,000 vehicles per day or some 44% (18,500 current AADT and 10,000 AADT in 2020). The results of this analysis are presented below:

Table 4-3 - Sidra Analysis for Future Situation – New England Highway / Nelson Street, AM / PM peak 2020 base plus Stage Three development

Approach	LoS	Delay (seconds)	95th percentile queue (metres)
Nelson Street south	B / A	14.7 / 14.4	8 / 5
New England Highway east	A / A	1.6 / 7.2	19 / 25
Nelson Street north	A / B	11.7 / 22.0	0 / 0
New England Highway west	A / A	4.3 / 4.0	16 / 55
Overall	A / A	4.3 / 5.8	19 / 55

The above analysis for the future design year of 2020 confirms that due to the significant reduction in traffic movements along the New England Highway post opening of the Hunter Expressway, the intersection of Nelson Street and the New England Highway will perform well with minimal delays for turning traffic and no delays for the through movements. The intersection layout modelled allows for the upgrade that the RTA are proposing to implement in the short term at this location, with the introduction of a type CHR intersection. This upgrade allows for sheltered right turn lanes to be provided on the New England Highway so that vehicles waiting to turn right into the side roads can prop outside the through traffic lane and improve safety for these vehicles. It should be noted however that the upgrade proposed by the RTA will NOT improve the situation for traffic turning right out of the side roads.

It is important to note that the traffic flows provided by the RTA from the traffic model allow for the future urban release areas that have been identified along the New England Highway corridor in the general vicinity of the subject site, as well as the development generally occurring in the Lower Hunter Valley. These would include the Anvil Creek site to the south of the location of the subject site.

Intersection of Nelson Street and Mansfield Street

It is useful to consider the Austroads threshold levels for intersection capacity under uninterrupted flow conditions. **Table 4.4** presents these thresholds. Where traffic flows fall within these limits intersection operation is essentially at no delay or interruption for approaching drivers other than to obey the requisite road rules and effectively operates at a level of service of A.

Table 4-4 Intersection Capacity – Uninterrupted Flow Conditions

Road Type	Light Crossing or turning volumes Maximum Design Hour Volumes, Two-way (vph)		
Two Lane through Roadway	400	500	650
Cross Road	250	200	100
Four Lane through roadway	1000	1500	2000
Cross road	100	50	25

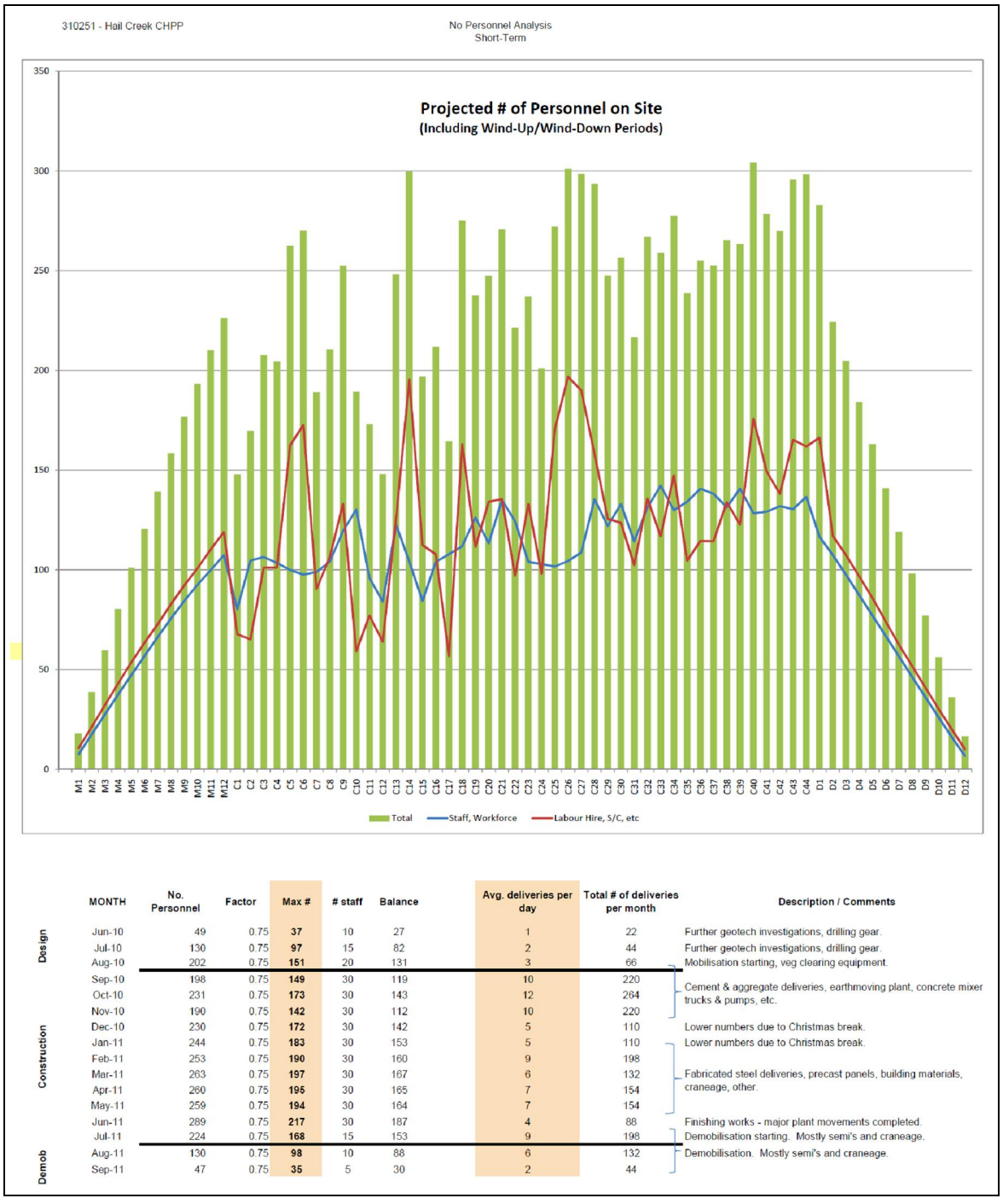
Source: Austroads Guide to Traffic Engineering Practice - Part 5, 1988

From Table 2.1, it can be seen that the two way flow on Nelson Street in the vicinity of the New England Highway is 252 vehicles in the AM peak and 312 vehicles in the PM peak. This would indicate that some 250 vehicles could use the side road with no delay to all road users. This is a worst case scenario as the flows on Nelson Street by the site access would be much lower, as a significant portion of the traffic on Nelson Street at its northern end has an origin / destination within Greta to the north-east of the site and therefore turn off Nelson Street before Mansfield Street.

It can thus be seen that there is no requirement to complete any intersection modelling work at this intersection.

4.4.3 Impact of Construction Traffic

The impact of the construction work for the development would have a short term impact upon the intersection of the New England Highway and Nelson Street. During construction phase of the works, there would be on average some 50 construction workers per day on site with less during the earlier stage when bulk earth works are being completed. The numbers will increase slightly towards the end of the works associated with building construction and other intensive construction activities on site. A detailed assessment has been prepared by Thiess with regards to construction works on the site and is presented below:



	MONTH	No. Personnel	Factor	Max #	# staff	Balance	Avg. deliveries per day	Total # of deliveries per month	Description / Comments
Design	Jun-10	49	0.75	37	10	27	1	22	Further geotech investigations, drilling gear.
	Jul-10	130	0.75	97	15	82	2	44	Further geotech investigations, drilling gear.
	Aug-10	202	0.75	151	20	131	3	66	Mobilisation starting, veg clearing equipment.
Construction	Sep-10	198	0.75	149	30	119	10	220	Cement & aggregate deliveries, earthmoving plant, concrete mixer trucks & pumps, etc.
	Oct-10	231	0.75	173	30	143	12	264	
	Nov-10	190	0.75	142	30	112	10	220	
	Dec-10	230	0.75	172	30	142	5	110	Lower numbers due to Christmas break.
	Jan-11	244	0.75	183	30	153	5	110	Lower numbers due to Christmas break.
	Feb-11	253	0.75	190	30	160	9	198	Fabricated steel deliveries, precast panels, building materials, craneage, other.
	Mar-11	263	0.75	197	30	167	6	132	
	Apr-11	260	0.75	195	30	165	7	154	
	May-11	259	0.75	194	30	164	7	154	
	Jun-11	289	0.75	217	30	187	4	88	Finishing works - major plant movements completed.
	Jul-11	224	0.75	168	15	153	9	198	Demobilisation starting. Mostly semi's and craneage.
Demob	Aug-11	130	0.75	98	10	88	6	132	Demobilisation. Mostly semi's and craneage.
	Sep-11	47	0.75	35	5	30	2	44	

■ **Figure 4-4 Project Personnel Numbers**

The majority of these construction workers will access the site via the intersection of the New England Highway and Nelson Street. Whilst this work will be over a short duration, it is important to consider these impacts, especially for the PM peak when there will be a high portion of construction staff seeking to turn right out of Nelson Street to head towards Maitland and Newcastle.

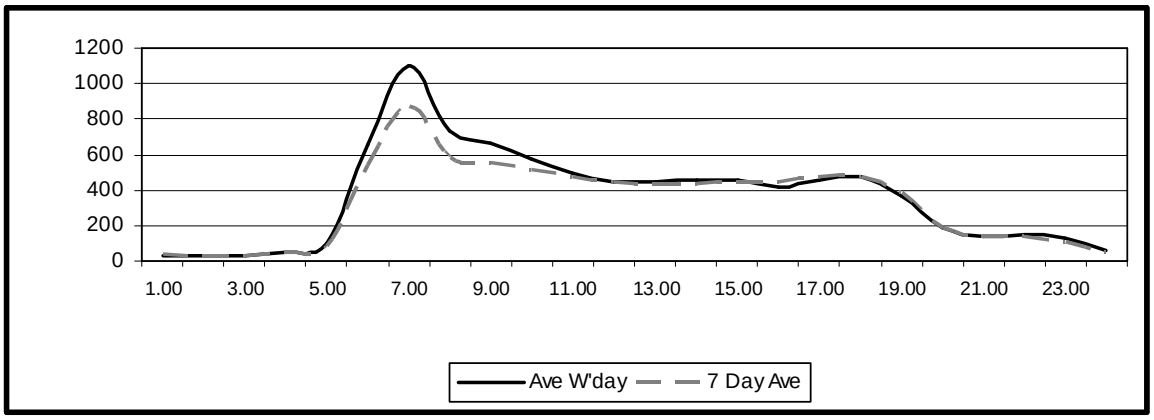
To a lesser extent, there will also be a number of vehicles associated with materials delivery as well as specialist construction plant e.g. cranes, that will impact upon this intersection. Whilst these volumes will be considerably lower, their impact on road safety needs to be considered due to their size and associated slow moving speeds out of the side road. Again, these numbers have been assessed by Thiess and these show the number of deliveries varying between 1 or 2 a day to a high of 12 trucks a day during the initial construction works on site.

An additional traffic survey has been reviewed which was completed over a one week period by Better Transport Futures to highlight hourly and daily variance in traffic flows for the New England Highway. These surveys were completed to the west of the site in Belford between the 13th and 19th May 2006 inclusive.

The results of these surveys are summarised below:

- The morning peak traffic demand was recorded between 6.00 and 7.00 am, with a two-way flow of 1,314. The dominant flow was westbound with 1,098 vehicles (83.5%).
- The afternoon peak hour was between 4.00 and 5.00 pm with a two-way flow of 1,466 vehicles per hour, with the peak being eastbound (1,014 vehicles or 69.2%).

The surveys from the weekôs count in May 2006 also provide details on the hourly variation in traffic flows. The results of this survey are show below:



■ **Figure 4-5 Westbound (towards Singleton) daily variation in traffic flows.**

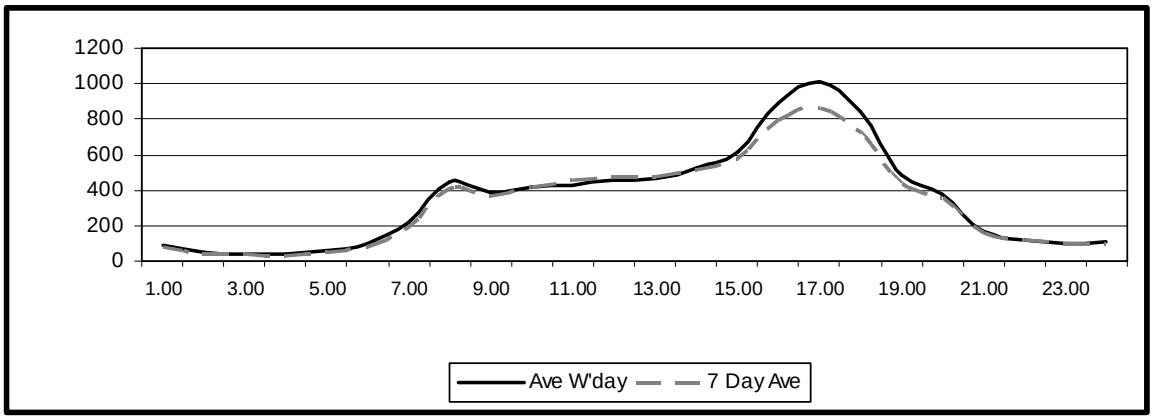


Figure 4-6 Eastbound (towards Branxton) daily variation on traffic flows.

The traffic survey from May 2006 also provides details on the vehicle classification. The variation in vehicle classification is shown below:

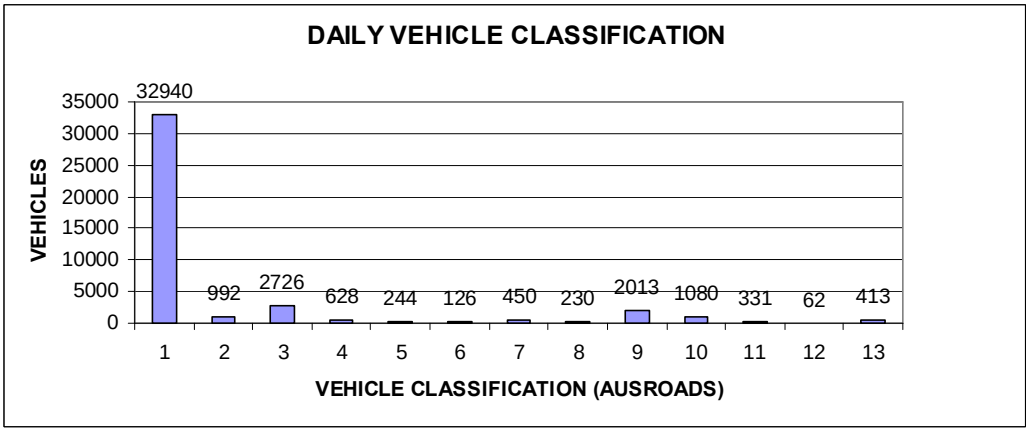
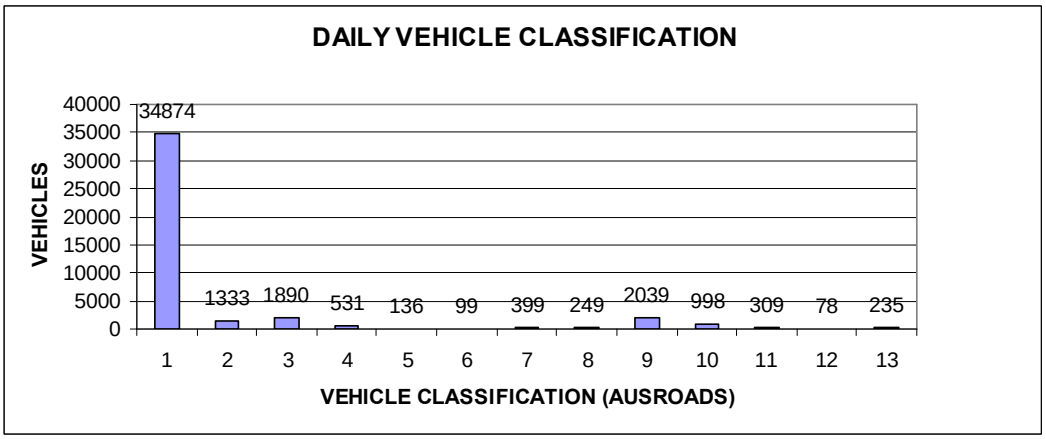


Figure 4-7 Daily variation in vehicle classification, eastbound towardsBranxton.



■ **Figure 4-8 Daily variation in vehicle classification, westbound towards Singleton**

The traffic data collected at the intersection of Nelson Street and the New England Highway shows that during the absolute peak period, the eastbound traffic movement is high and this creates considerable delay for vehicles turning right out of Nelson Street. However, the above data demonstrates that the traffic flow on the New England Highway drops off considerably outside of this afternoon peak period. The traffic data for the weekly survey shows that before 2.30 PM and after 6.00 PM the critical eastbound traffic flow reduces to 600 vehicles or less. This compares with the peak demand of 1,000 vehicles per hour.

During the peak demand for the eastbound traffic movement on the New England Highway, the westbound traffic movement is very low (at around 500 vehicles per hour) or less.

It can be seen that the major impact at the intersection of the New England Highway and Nelson Street will occur during the afternoon peak period, when there is limited capacity for the critical right turn out of Nelson Street. At this time, the left turn out of Nelson Street can occur with little if any impact upon the existing operation of this intersection. The majority of the traffic (some 90%) is considered to turn right out of Nelson Street and the remaining 10% will not create any delays.

Similarly, during the morning peak period the majority of the inbound traffic movements associated with the construction workers will be left turn in off the New England Highway into Nelson Street. This movement will not create any delays for traffic on the New England Highway as there is a left turn deceleration lane into Nelson Street.

From the above survey numbers, it can be seen that the critical issue remains the demand created by traffic wishing to leave the site and then turn right onto the New England Highway. To reduce the impact of the construction workers vehicles, the following arrangements are recommended:

- Workers travelling by private car are to turn right on Nelson Street and use the road to Lovedale to avoid using the critical junction with the New England Highway. This route is considered satisfactory and appropriate for many destinations further to the east such as Kurri Kurri, Lake Macquarie and Newcastle.
- Stagger the release of cars from the site that still need to use the New England Highway / Nelson Street intersection, say 10 cars every 5 minutes
- Ensure that cars leaving the site that use the Nelson Street intersection turn left before using intersections further west to turn around to head back to Maitland. (This arrangement has been previously recommended as a suitable temporary form of traffic management of the subject site.)

In addition to the above the following could also assist in improving traffic management under the temporary conditions created during project construction;

- Employees cars could be identified say with a windscreen sticker combined with recording number plates and car details (if required).
- A traffic monitoring crew could be employed say between 4.30PM and ï 6PM.
- Monitors would ensure that cars leave the site at staggered time intervals, say 10 cars every 5 minutes. (based on an average of 50 people per day on site at peak, and assuming a worst case scenario of every person on site driving their own vehicle, this would spread the release of workers over 50 minutes)
- Monitor the intersection of Nelson Street and ensure that no vehicles identified from the PN site would be turning right out of Nelson Street.

The above control of employees vehicles could form part of the siteôs OH&S System and in particular the Construction Management Plan as a means of ensuring that people are educated regarding the purpose of controlling traffic movements after leaving the site. It could also provide a mechanism for issuing a non compliance under the OHS system or CMP if vehicles are identified turning right out of Nelson Street in the nominated PM peak period on the New England Highway.

In addition we would also encourage supporting the use of car pooling or the use of a day shuttle bus for workers as a means of minimising the extent of private car use. While this cannot be enforced it would assist in reducing the extent of temporary impacts even further than the recommendations for traffic management as outlined above.

Prior to the commencement of construction work on site, a Construction Management Plan (CMP) will need to be prepared and submitted for review and approval by the RTA and Council. This CMP will be developed in accordance with RTA Guidelines and will need to take into account the CMP that will be designed and implemented for the construction of the Hunter Expressway. In this regard, the cumulative impact of the construction works in this locality will be managed to ensure minimal overlap. The CMP for the subject site and the Hunter Expressway will both be reviewed by the RTA and the cumulative impact will form part of the RTA review.

These options for reducing the impact of the construction traffic will need to be discussed and agreed with the road authority as part of the review process. The agreed work options will need to be approved and implemented through the Conditions of Consent.

In the event that construction of the Project commences prior to ARTCôs realignment of Nelson Street, large construction vehicles would be required to access the site from the south, due to the poor alignment of Nelson Street over the railway line as well as a possible weight restriction on the wooden bridge over Anvil Creek. This will require all heavy vehicles to access the site via Cessnock to the south, as the use of Allandale Road is not proposed (as there is a height restriction on this road).

This heavy vehicle access route will form part of the Construction Management Plan for the development. This CMP will require no access for B-doubles until a route is approved by Council and the RTA.

Once the proposed upgrade to Nelson Street has been implemented by ARTC, the Construction Management Plan can be reviewed and altered in consultation with Council and the RTA to allow for access via the New England Highway.

All works on site will be governed by the relevant EP&A rules and as stipulated within any development consent granted by the NSW Department of Planning.

The construction works associated with the Hunter Expressway have been discussed with the project manager from the RTA. It is understood that the eastern section of the road length (F3 to Kurri Kurri) will commence construction in July 2010, whilst the western section between Kurri Kurri and Branxton is currently out to tender and is due to commence construction in January 2011. The full construction works will be completed towards the end of 2013. As part of the construction process for this project, a detailed Construction Management Plan will need to be developed and implemented by the successful tender. This CMP will need to be developed and approved by the RTA and will have to take into account the traffic (including construction traffic) associated with the development under consideration here.

There are no details available on the construction timetable, access routes or volumes of vehicles etc. However, once the alignment of the road has been established it is expected that the majority of traffic would use the Hunter Expressway road alignment and would therefore have little if any impact upon the New England Highway and the local road network.

The timing of the construction of Stages 2 and 3 of this development will occur in 2014 or beyond, when the Hunter Expressway is complete. Thus there will be no clash in construction traffic between the subject site (Stage 2 and 3) and the Hunter Expressway work. It can also be seen that the construction of Stages 2 and 3 will occur whilst Stage 1 is operational. However, the traffic associated with Stage 1 is relatively low. There will be between 4 and 6 trucks per day accessing the site for the Stage 1 operations and staff numbers will be in the order of 24 over the day, giving 24 inbound trips and 24 outbound trips per day. With the staggered shift times that will be operational on site, this gives a peak demand per hour of 10 vehicles (refer Figure 4.1 above). This volume of traffic, as well as the additional traffic associated with the construction work, will have a minimal impact and when compared with the background traffic flows on the New England Highway represents less than 0.6%.

4.4.4 Other Developments

There are currently no other major developments occurring in the locality. There are some residential development proposed within the wider Greta locality but these are on the opposite side of the New England Highway or located some distance away from the subject development.

It is noted that the RTA model for the Lower Hunter developed as part of the approval process for the Hunter Expressway allowed for the urban release areas identified in the Lower Hunter. This included developments such as Huntlee as well as other centres up and down the New England Highway as well as developments within Greta.

4.4.5 Assessment of Traffic Noise

An assessment of traffic noise is beyond the scope of work and expertise of Better Transport Futures and has been completed by Advitech.

4.5 Public Transport

4.5.1 Options for improving services

Given the type of development and the low employee numbers, it is considered that access demands via public transport are limited. The existing train station at Greta is located adjacent to the subject site but due to the very low frequency of trains it is considered that no one will use a train to access the site. The design of the facility allows for pedestrian access to / from the buildings and structures within the site footprint.

4.5.2 Pedestrian Access to Bus Stops

No bus stops are located within the general locality of the subject site, with the nearest bus stop located on the New England Highway. This bus stop is 1 km which will reduce the attractiveness of bus use, together with the infrequent services and routes provided. It is therefore considered that no additional pedestrian access provision is required to the bus stop as part of this development.

4.6 Recommended Works

4.6.1 Improvements to Access and Circulation

It is considered that the proposed site access and circulation can provide a safe and appropriate access arrangement for the development. The driveway and car park will all be designed and constructed in accordance with Council and Australian Standards requirements together with the specialist requirements of the development.

4.6.2 Improvements to External Road Network

It is considered that there are no external road works required as a consequence of the subject development apart from the planned realignment of Nelson Street over the railway line being undertaken by ARTC. With the opening of the Hunter Expressway in January 2014 (or earlier) the traffic flows along the New England Highway in Greta will reduce significantly and the road network will operate to a much higher standard.

4.6.3 Improvements to Pedestrian Facilities

Given the low employee numbers on the site and the lack of public transport in the general locality in combination with the shift work, it is considered that there is no requirement for improvements to external pedestrian facilities in the locality. As part of the development, internal pedestrian paths will be provided to provide a connection between the buildings and structures within the site.

4.6.4 Effect of Recommended Works on Adjacent Developments

The proposed construction work within the site will have minimal impact upon the adjacent developments. Access to the existing adjacent properties will be maintained as a result of this development.

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. It can be seen that existing public transport use adjacent to the subject site is extremely low due to the very infrequent service together with the time of train and bus services during the working day. The availability of services at the weekend are even lower.

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

All works associated with the development will be funded by the applicant.

4.6.8 Noise Attenuation

Any noise attenuation measures will be assessed by Advitech.

5. Conclusions

The following conclusions are drawn from the investigations into the proposed Train Support Facility off Nelson Street, Greta, NSW:

1. The proposed Train Support Facility will be located off Mansfield Street to the immediate west of Greta. Once operational, it will provide employment for some 38 workers, spread out over a 24 hour work day. Parking for the employees and delivery trucks associated with the development will be provided within the site.
2. The majority of the traffic associated with the development is considered to access the greater road network via Nelson Street. It is expected that the traffic to/from the development will have a bias towards the New England Highway. For the purposes of this assessment, it has been assumed that all traffic will access the site via the intersection of the New England Highway and Nelson Street.
3. The performance of the key intersection of Nelson Street and the New England Highway has been assessed using the computer program Sidra as well as site observations. Whilst the Sidra analysis indicates considerable delays for the side road traffic (mainly the right turn movements) observations on site indicate that the delays are much smaller. This is due to a combination of platooning of traffic on the New England Highway and drivers accepting smaller gaps in traffic flows.
4. The Sidra analysis indicates that the traffic flows associated with the development will have a minimal impact upon the overall operation of the intersection of the New England Highway and Nelson Street. Similarly, the overall operation of the New England Highway in this location will remain as per existing conditions. For Stage One of the development (and prior to the opening of the Hunter Expressway) there could be increase delays / queues for traffic turning right out of Nelson Street during the afternoon peak period. The observations on site indicate that due to platooning of traffic movements etc the actual delays / queues at this location are in fact lower than those predicted by the Sidra modelling.
5. Traffic data from the RTA shows that the future traffic flows on this section of the New England Highway will be significantly lower once the Hunter Expressway is opened in 2014. Thus the future impact of the development will also be negligible. The development will expand beyond the initial Stage One (after 5 years) but the actual peak demands do not increase significantly, due to varied shift times.
6. All of the parking requirements for the development can be accommodated on site. There will be an area of staff parking as well as hard stand areas that can be used for parking as well as delivery vehicles as required.
7. The primary impact to surrounding transport infrastructure as a result of the Project would be during the construction phase as the employee numbers would be much higher than during operation. A number of mitigation measures have been put forward to reduce the temporeary impacts during construction, It is also recommended that further discussions be held with the RTA during the preparation of athe sitôs Construction Management Plan to assist in the overall management of construction traffic. This is especially relevant to the potential cumulative impact that may arise in the event that this Project was under construction at the same time as the Hunter Expressway project. It is important to note that these construction impacts are short term only.

8. In the event that construction of the Project commences prior to ARTCôs realignment of Nelson Street, construction vehicles would be required to utilize the existing wooden bridge over Anvil Creek to access the site. It is considered that load limits may apply to this bridge however, these are currently unknown. As such, it is recommended that structural investigations be undertaken and discussions held with Council during the detailed design phase of the Project to determine the load limit for the Anvil Creek Bridge. In the event where construction vehicles would exceed the load limit on the bridge, the Traffic Management Plan would direct them to use alternative site access e.g. via Camp Road.
9. There will be minimal demand for pedestrian, cyclist or public transport improvements generated by the subject development. There is public transport available via a train adjacent to the site or buses which service the New England Highway only. Pedestrian and cyclist facilities are provided within the site for internal pedestrian and cyclist movements.

The overall conclusion from the investigations is that traffic and access arrangements for the development proposal are satisfactory, subject to detailed design and approval by NSW Department of Planning.

The access requirements during the construction phase need to be discussed and agreed with the road authority and implemented as part of the future development consent conditions. This will include the development of a detailed Traffic Management Plan that will be discussed and approved with the RTA and Council

Appendix A Traffic Survey results

Curtis Traffic Surveys

Turning movement count

Job: 090901bt p0643
Day, date: Tuesday, 1 September 2009
Location: New England H'y, & Nelson St Greta
Weather: Fine
Client: Better Transport Futures

Peak Hour Volumes: 99 546 0 / 95 0 / 10 1 / 39 5 / 8 952 3

Time Period	From New England H'way north: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From Nelson St west: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From New England H'way south: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From Nelson St east: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	Total vehicle movements	
06:00 to 06:15	0	0	38	6	3	0	22	1	0	0	4	0	0	0	230	16	0	0	0	0	0	0	0	0	320	
06:15 to 06:30	0	0	61	7	18	0	23	3	1	0	2	1	2	0	222	32	1	0	0	0	0	0	0	0	373	
06:30 to 06:45	0	0	67	16	6	0	21	1	0	0	6	2	1	0	149	25	0	0	2	1	1	0	0	0	298	
06:45 to 07:00	0	0	73	9	13	1	24	1	0	0	2	1	0	0	174	16	0	0	2	0	0	0	0	0	316	
07:00 to 07:15	1	0	150	15	31	0	30	4	0	0	6	0	2	0	266	32	0	0	0	0	0	0	0	0	537	Peak
07:15 to 07:30	0	0	90	12	23	0	20	1	0	1	1	0	0	1	168	10	2	0	0	0	2	0	0	0	331	
07:30 to 07:45	0	0	122	16	37	1	21	4	3	0	10	1	1	1	204	16	0	0	1	0	0	0	0	0	438	
07:45 to 08:00	0	0	130	19	19	2	23	4	2	0	7	0	0	0	204	16	2	0	0	0	1	0	0	0	429	
08:00 to 08:15	0	0	113	18	13	0	19	3	3	0	9	0	1	0	210	19	1	0	2	0	0	0	0	0	411	
08:15 to 08:30	0	0	111	17	27	0	21	0	2	0	12	0	5	0	264	19	0	0	2	0	0	0	0	0	480	
08:30 to 08:45	1	0	131	7	24	2	17	0	0	0	10	0	4	0	155	19	3	0	1	0	0	0	1	0	375	
08:45 to 09:00	0	0	118	11	27	1	29	1	1	0	11	0	4	0	171	25	1	0	3	0	2	0	0	0	405	
09:00 to 09:15	2	0	77	13	12	1	16	0	0	0	7	1	0	0	105	19	1	0	1	0	0	0	0	0	255	
09:15 to 09:30	0	0	111	25	14	0	14	1	1	0	7	0	6	0	122	33	0	0	1	0	0	0	0	0	335	
Hourly Summary	4	0	1392	191	267	8	300	24	13	1	94	6	26	2	2644	297	11	0	15	1	6	0	1	0		
06:00 to 07:00	0	0	239	38	40	1	90	6	1	0	14	4	3	0	775	89	1	0	4	1	1	0	0	0	1307	
06:15 to 07:15	1	0	351	47	68	1	98	9	1	0	16	4	5	0	811	105	1	0	4	1	1	0	0	0	1524	
06:30 to 07:30	1	0	380	52	73	1	95	7	0	1	15	3	3	1	757	83	2	0	4	1	3	0	0	0	1482	
06:45 to 07:45	1	0	435	52	104	2	95	10	3	1	19	2	3	2	812	74	2	0	3	0	2	0	0	0	1622	
07:00 to 08:00	1	0	492	62	110	3	94	13	5	1	24	1	3	2	842	74	4	0	1	0	3	0	0	0	1735	
07:15 to 08:15	0	0	455	65	92	3	83	12	8	1	27	1	2	2	786	61	5	0	3	0	3	0	0	0	1609	
07:30 to 08:30	0	0	476	70	96	3	84	11	10	0	38	1	7	1	882	70	3	0	5	0	1	0	0	0	1758	Peak Hour
07:45 to 08:45	1	0	485	61	83	4	80	7	7	0	38	0	10	0	833	73	6	0	5	0	1	0	1	0	1695	
08:00 to 09:00	1	0	473	53	91	3	86	4	6	0	42	0	14	0	800	82	5	0	8	0	2	0	1	0	1671	
08:15 to 09:15	3	0	437	48	90	4	83	1	3	0	40	1	13	0	695	82	5	0	7	0	2	0	1	0	1515	
08:30 to 09:30	3	0	437	56	77	4	76	2	2	0	35	1	14	0	553	96	5	0	6	0	2	0	1	0	1370	

Curtis Traffic Surveys

Turning movement count

Job: 090901bt p0643
Day, date: Tuesday, 1 September 2009
Location: New England H'y, & Nelson St Greta
Weather: Fine
Client: Better Transport Futures

Peak Hour Volumes: 153 1398 7 / 94 2 / 4 0 / 23 1 / 38 568 4

Time Period	From New England H'way north: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From Nelson St west: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From New England H'way south: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	From Nelson St east: Left (Light Vehicles)	Left (Heavy Vehicles)	Through (Light Vehicles)	Through (Heavy Vehicles)	Right (Light Vehicles)	Right (Heavy Vehicles)	Total vehicle movements	
14:00 to 14:15	1	0	165	16	20	0	15	1	0	0	3	0	4	0	99	20	0	0	1	0	0	0	0	0	345	
14:15 to 14:30	1	0	160	22	20	0	18	1	3	0	7	0	4	0	110	18	0	0	0	0	2	0	0	0	366	
14:30 to 14:45	0	0	219	25	18	1	20	0	0	0	3	0	4	0	77	14	0	0	0	0	0	0	0	0	381	
14:45 to 15:00	0	0	190	28	11	0	18	2	1	0	2	2	5	0	104	15	0	0	0	0	1	0	0	0	379	
15:00 to 15:15	3	0	254	30	29	1	23	1	3	0	11	0	6	0	119	18	0	0	1	0	1	0	0	0	500	
15:15 to 15:30	2	0	285	15	22	0	20	0	2	0	7	0	6	0	105	15	0	0	1	0	0	0	0	0	480	
15:30 to 15:45	1	0	330	18	27	0	19	0	1	0	9	0	7	0	104	13	1	0	0	0	0	0	0	0	530	
15:45 to 16:00	2	0	301	22	23	2	21	1	1	0	6	0	5	0	67	16	0	0	0	0	0	0	1	0	468	
16:00 to 16:15	3	0	319	22	31	4	20	1	1	0	1	0	7	0	112	11	2	0	1	0	0	0	0	0	535	
16:15 to 16:30	1	0	356	26	45	2	24	1	0	0	7	0	14	0	134	19	1	0	0	0	0	0	1	0	631	Peak
16:30 to 16:45	2	0	331	17	28	5	12	1	2	0	6	0	7	0	138	8	1	0	0	0	0	0	1	0	559	
16:45 to 17:00	3	0	288	15	33	0	25	0	0	0	4	1	9	0	125	18	1	0	1	0	0	0	0	0	523	
17:00 to 17:15	1	0	350	15	38	2	30	1	2	0	5	0	8	0	115	11	0	1	0	0	0	0	0	0	579	
17:15 to 17:30	1	0	304	16	36	0	31	2	1	0	6	0	8	0	122	10	3	0	1	0	1	0	0	0	542	
17:30 to 17:45	1	0	245	11	10	0	10	0	2	0	4	0	0	0	90	7	4	0	1	0	2	0	0	0	387	
17:45 to 18:00	1	0	389	20	24	0	29	0	0	0	11	0	7	0	125	14	0	0	2	0	0	0	0	0	622	
18:00 to 18:15	0	0	335	16	15	0	14	0	5	0	8	0	7	1	125	8	0	0	0	0	0	0	0	0	534	
18:15 to 18:30	0	0	240	8	20	0	20	0	0	0	11	0	4	0	84	3	1	0	0	0	0	0	1	0	392	
Hourly Summary	23	0	5061	342	450	17	369	12	24	0	111	3	112	1	1955	238	14	1	9	0	7	0	4	0		
14:00 to 15:00	2	0	734	91	69	1	71	4	4	0	15	2	17	0	390	67	0	0	1	0	3	0	0	0	1471	
14:15 to 15:15	4	0	823	105	78	2	79	4	7	0	23	2	19	0	410	65	0	0	1	0	4	0	0	0	1626	
14:30 to 15:30	5	0	948	98	80	2	81	3	6	0	23	2	21	0	405	62	0	0	2	0	2	0	0	0	1740	
14:45 to 15:45	6	0	1059	91	89	1	80	3	7	0	29	2	24	0	432	61	1	0	2	0	2	0	0	0	1889	
15:00 to 16:00	8	0	1170	85	101	3	83	2	7	0	33	0	24	0	395	62	1	0	2	0	1	0	1	0	1978	
15:15 to 16:15	8	0	1235	77	103	6	80	2	5	0	23	0	25	0	388	55	3	0	2	0	0	0	1	0	2013	
15:30 to 16:30	7	0	1306	88	126	8	84	3	3	0	23	0	33	0	417	59	4	0	1	0	0	0	2	0	2164	
15:45 to 16:45	8	0	1307	87	127	13	77	4	4	0	20	0	33	0	451	54	4	0	1	0	0	0	3	0	2193	
16:00 to 17:00	9	0	1294	80	137	11	81	3	3	0	18	1	37	0	509	56	5	0	2	0	0	0	2	0	2248	
16:15 to 17:15	7	0	1325	73	144	9	91	3	4	0	22	1	38	0	512	56	3	1	1	0	0	0	2	0	2292	Peak Hour
16:30 to 17:30	7	0	1273	63	135	7	98	4	5	0	21	1	32	0	500	47	5	1	2	0	1	0	1	0	2203	
16:45 to 17:45	6	0	1187	57	117	2	96	3	5	0	19	1	25	0	452	46	8	1	3	0	3	0	0	0	2031	
17:00 to 18:00	4	0	1288	62	108	2	100	3	5	0	26	0	23	0	452	42	7	1	4	0	3	0	0	0	2130	
17:15 to 18:15	3	0	1273	63	85	0	84	2	8	0	29	0	22	1	462	39	7	0	4	0	3	0	0	0	2085	
17:30 to 18:30	2	0	1209	55	69	0	73	0	7	0	34	0	18	1	424	32	5	0	3	0	2	0	1	0	1935	

Appendix B Site Plan

Appendix C Sidra Results

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
AM base existing

Performance Measure	Vehicles	Persons
Demand Flows - Total	1829 veh/h	2744 pers/h
Percent Heavy Vehicles	8.5 %	
Degree of Saturation	0.478	
Effective Intersection Capacity	3824 veh/h	
95% Back of Queue (m)	66 m	
95% Back of Queue (veh)	8.9 veh	
Control Delay (Total)	4.36 veh-h/h	6.55 pers-h/h
Control Delay (Average)	8.6 s/veh	8.6 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS D	
Total Effective Stops	274 veh/h	411 pers/h
Effective Stop Rate	0.15 per veh	0.15 per pers
Proportion Queued	0.75	0.75
Travel Distance (Total)	1108.4 veh-km/h	1662.6 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	23.3 veh-h/h	34.9 pers-h/h
Travel Time (Average)	45.9 secs	45.9 secs
Travel Speed	47.6 km/h	47.6 km/h
Operating Cost (Total)	862 $/h	862 $/h
Fuel Consumption (Total)	146.6 L/h	
Carbon Dioxide (Total)	367.9 kg/h	
Hydrocarbons (Total)	0.562 kg/h	
Carbon Monoxide (Total)	28.12 kg/h	
NOX (Total)	0.871 kg/h	

SIDRA SOLUTIONS

Site: AM 2009 Base

Processed Dec 20, 2009 11:39:30AM

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
AM base existing
Give-way

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)
Nelson St south										
1	L	100	12.0	0.474	29.0	LOS C	19	0.87	1.05	33.5
2	T	11	0.0	0.478	27.4	LOS B	19	0.87	1.03	34.2
3	R	41	2.4	0.357	46.1	LOS D	10	0.94	1.02	26.4
Approach		**152**	**8.6**	**0.474**	**33.5**	**LOS C**	**19**	**0.89**	**1.04**	**31.3**
NEH eastern approach										
4	L	8	12.5	0.091	8.6	LOS A	0	0.00	0.67	49.0
5	T	1002	7.4	0.455	4.4	LOS A	66	0.71	0.00	51.4
6	R	3	0.0	0.429	13.5	LOS A	66	0.84	1.04	43.7
Approach		**1013**	**7.4**	**0.455**	**4.4**	**LOS A**	**66**	**0.70**	**0.01**	**51.4**
NelsoN St north										
7	L	5	0.0	0.017	16.1	LOS B	0	0.64	0.75	41.6
8	T	1	0.0	0.017	14.8	LOS B	0	0.64	0.85	42.6
9	R	1	0.0	0.011	42.9	LOS D	0	0.92	0.98	27.4
Approach		**7**	**0.0**	**0.017**	**19.7**	**LOS B**	**0**	**0.68**	**0.79**	**38.8**
NEH western approach										
10	L	1	0.0	0.077	8.2	LOS A	0	0.00	0.67	49.0
11	T	565	11.3	0.389	7.6	LOS A	51	0.75	0.00	49.6
12	R	92	4.4	0.389	18.6	LOS B	51	1.00	1.11	39.7
Approach		**657**	**10.4**	**0.388**	**9.1**	**LOS A**	**51**	**0.79**	**0.15**	**48.0**
All Vehicles		**1829**	**8.5**	**0.478**	**8.6**	**Not Applicable**	**66**	**0.75**	**0.15**	**47.6**

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
PM base existing

Performance Measure	Vehicles	Persons
Demand Flows - Total	2413 veh/h	3619 pers/h
Percent Heavy Vehicles	6.2 %	
Degree of Saturation	0.798	
Effective Intersection Capacity	3023 veh/h	
95% Back of Queue (m)	169 m	
95% Back of Queue (veh)	23.2 veh	
Control Delay (Total)	14.32 veh-h/h	21.48 pers-h/h
Control Delay (Average)	21.4 s/veh	21.4 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS F	
Total Effective Stops	403 veh/h	605 pers/h
Effective Stop Rate	0.17 per veh	0.17 per pers
Proportion Queued	0.81	0.81
Travel Distance (Total)	1462.3 veh-km/h	2193.4 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	38.7 veh-h/h	58.0 pers-h/h
Travel Time (Average)	57.7 secs	57.7 secs
Travel Speed	37.8 km/h	37.8 km/h
Operating Cost (Total)	1349 $/h	1349 $/h
Fuel Consumption (Total)	201.2 L/h	
Carbon Dioxide (Total)	504.3 kg/h	
Hydrocarbons (Total)	0.820 kg/h	
Carbon Monoxide (Total)	38.64 kg/h	
NOX (Total)	1.171 kg/h	

SIDRA SOLUTIONS

Site: PM 2009 Base

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
PM base existing
Give-way

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)
Nelson St south										
1	L	99	3.0	0.284	17.8	LOS B	9	0.68	0.93	40.4
2	T	4	0.0	0.286	16.4	LOS B	9	0.68	0.89	41.3
3	R	24	4.2	0.649	166.6	LOS F	17	0.99	1.06	10.7
Approach		**127**	**3.1**	**0.647**	**45.8**	**LOS D**	**17**	**0.74**	**0.95**	**26.5**
NEH eastern approach										
4	L	40	0.0	0.062	8.2	LOS A	0	0.00	0.67	49.0
5	T	598	9.9	0.310	33.5	LOS C	116	0.88	0.00	31.2
6	R	4	25.0	0.308	47.5	LOS D	116	1.00	1.11	26.2
Approach		**642**	**9.3**	**0.310**	**32.0**	**LOS C**	**116**	**0.82**	**0.05**	**31.9**
NelsoN St north										
7	L	1	0.0	0.036	65.7	LOS E	1	0.95	0.98	21.3
8	T	1	0.0	0.036	64.5	LOS E	1	0.95	0.98	21.6
9	R	2	0.0	0.065	111.1	LOS F	1	0.98	0.99	14.7
Approach		**4**	**0.0**	**0.065**	**88.1**	**LOS F**	**1**	**0.96**	**0.99**	**17.5**
NEH western approach										
10	L	7	0.0	0.159	8.2	LOS A	0	0.00	0.67	49.0
11	T	1472	5.2	0.798	14.0	LOS A	169	0.80	0.00	43.3
12	R	161	5.6	0.797	26.0	LOS B	169	1.00	1.51	35.0
Approach		**1640**	**5.2**	**0.798**	**15.1**	**LOS B**	**169**	**0.82**	**0.15**	**42.4**
All Vehicles		**2413**	**6.2**	**0.798**	**21.4**	**Not Applicable**	**169**	**0.81**	**0.17**	**37.8**

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
AM base existing+dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1840 veh/h	2760 pers/h
Percent Heavy Vehicles	8.5 %	
Degree of Saturation	0.478	
Effective Intersection Capacity	3846 veh/h	
95% Back of Queue (m)	68 m	
95% Back of Queue (veh)	9.1 veh	
Control Delay (Total)	4.46 veh-h/h	6.69 pers-h/h
Control Delay (Average)	8.7 s/veh	8.7 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS D	
Total Effective Stops	282 veh/h	423 pers/h
Effective Stop Rate	0.15 per veh	0.15 per pers
Proportion Queued	0.75	0.75
Travel Distance (Total)	1115.0 veh-km/h	1672.5 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	23.5 veh-h/h	35.3 pers-h/h
Travel Time (Average)	46.0 secs	46.0 secs
Travel Speed	47.4 km/h	47.4 km/h
Operating Cost (Total)	870 $/h	870 $/h
Fuel Consumption (Total)	147.8 L/h	
Carbon Dioxide (Total)	370.8 kg/h	
Hydrocarbons (Total)	0.568 kg/h	
Carbon Monoxide (Total)	28.43 kg/h	
NOX (Total)	0.879 kg/h	

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
AM base existing+dev
Give-way

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)
Nelson St south										
1	L	100	12.0	0.478	29.3	LOS C	19	0.88	1.05	33.4
2	T	11	0.0	0.478	27.7	LOS B	19	0.88	1.03	34.0
3	R	41	2.4	0.363	46.6	LOS D	10	0.94	1.02	26.2
Approach		**152**	**8.6**	**0.479**	**33.9**	**LOS C**	**19**	**0.89**	**1.04**	**31.1**
NEH eastern approach										
4	L	18	5.6	0.092	8.4	LOS A	0	0.00	0.67	49.0
5	T	1002	7.4	0.460	4.4	LOS A	68	0.72	0.00	51.3
6	R	3	0.0	0.429	13.5	LOS A	68	0.85	1.05	43.7
Approach		**1023**	**7.3**	**0.460**	**4.5**	**LOS A**	**68**	**0.71**	**0.01**	**51.2**
NelsoN St north										
7	L	5	0.0	0.017	16.2	LOS B	0	0.64	0.75	41.5
8	T	1	0.0	0.017	14.9	LOS B	0	0.64	0.85	42.5
9	R	1	0.0	0.011	43.0	LOS D	0	0.92	0.98	27.4
Approach		**7**	**0.0**	**0.017**	**19.8**	**LOS B**	**0**	**0.68**	**0.80**	**38.8**
NEH western approach										
10	L	1	0.0	0.077	8.2	LOS A	0	0.00	0.67	49.0
11	T	565	11.3	0.392	7.8	LOS A	51	0.75	0.00	49.4
12	R	93	4.3	0.391	18.8	LOS B	51	1.00	1.11	39.6
Approach		**658**	**10.3**	**0.392**	**9.3**	**LOS A**	**51**	**0.78**	**0.16**	**47.8**
All Vehicles		**1840**	**8.5**	**0.478**	**8.7**	**Not Applicable**	**68**	**0.75**	**0.15**	**47.4**

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
PM base existing+dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	2423 veh/h	3634 pers/h
Percent Heavy Vehicles	6.2 %	
Degree of Saturation	0.919	
Effective Intersection Capacity	2637 veh/h	
95% Back of Queue (m)	169 m	
95% Back of Queue (veh)	23.2 veh	
Control Delay (Total)	15.57 veh-h/h	23.35 pers-h/h
Control Delay (Average)	23.1 s/veh	23.1 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS F	
Total Effective Stops	418 veh/h	627 pers/h
Effective Stop Rate	0.17 per veh	0.17 per pers
Proportion Queued	0.81	0.81
Travel Distance (Total)	1468.3 veh-km/h	2202.5 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	40.0 veh-h/h	60.0 pers-h/h
Travel Time (Average)	59.5 secs	59.5 secs
Travel Speed	36.7 km/h	36.7 km/h
Operating Cost (Total)	1387 $/h	1387 $/h
Fuel Consumption (Total)	203.6 L/h	
Carbon Dioxide (Total)	510.2 kg/h	
Hydrocarbons (Total)	0.833 kg/h	
Carbon Monoxide (Total)	38.85 kg/h	
NOX (Total)	1.178 kg/h	

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
PM base existing+dev
Give-way

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)
Nelson St south										
1	L	99	3.0	0.284	17.8	LOS B	9	0.68	0.93	40.4
2	T	4	0.0	0.286	16.4	LOS B	9	0.68	0.89	41.3
3	R	34	2.9	0.919	249.3	LOS F	31	1.00	1.18	7.6
Approach		**137**	**2.9**	**0.914**	**75.2**	**LOS F**	**31**	**0.76**	**0.99**	**19.5**
NEH eastern approach										
4	L	40	0.0	0.062	8.2	LOS A	0	0.00	0.67	49.0
5	T	598	9.9	0.310	33.5	LOS C	116	0.88	0.00	31.2
6	R	4	25.0	0.308	47.5	LOS D	116	1.00	1.11	26.2
Approach		**642**	**9.3**	**0.310**	**32.0**	**LOS C**	**116**	**0.82**	**0.05**	**31.9**
NelsoN St north										
7	L	1	0.0	0.036	65.7	LOS E	1	0.95	0.98	21.3
8	T	1	0.0	0.036	64.5	LOS E	1	0.95	0.98	21.6
9	R	2	0.0	0.065	111.1	LOS F	1	0.98	0.99	14.7
Approach		**4**	**0.0**	**0.065**	**88.1**	**LOS F**	**1**	**0.96**	**0.99**	**17.5**
NEH western approach										
10	L	7	0.0	0.159	8.2	LOS A	0	0.00	0.67	49.0
11	T	1472	5.2	0.798	14.0	LOS A	169	0.80	0.00	43.3
12	R	161	5.6	0.797	26.0	LOS B	169	1.00	1.51	35.0
Approach		**1640**	**5.2**	**0.798**	**15.1**	**LOS B**	**169**	**0.82**	**0.15**	**42.4**
All Vehicles		**2423**	**6.2**	**0.919**	**23.1**	**Not Applicable**	**169**	**0.81**	**0.17**	**36.7**

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
2020 AM base +dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1151 veh/h	1727 pers/h
Percent Heavy Vehicles	8.3 %	
Degree of Saturation	0.273	
Effective Intersection Capacity	4220 veh/h	
95% Back of Queue (m)	19 m	
95% Back of Queue (veh)	2.5 veh	
Control Delay (Total)	1.39 veh-h/h	2.08 pers-h/h
Control Delay (Average)	4.3 s/veh	4.3 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS B	
Total Effective Stops	227 veh/h	340 pers/h
Effective Stop Rate	0.20 per veh	0.20 per pers
Proportion Queued	0.47	0.47
Travel Distance (Total)	697.2 veh-km/h	1045.8 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	13.5 veh-h/h	20.3 pers-h/h
Travel Time (Average)	42.2 secs	42.2 secs
Travel Speed	51.6 km/h	51.6 km/h
Operating Cost (Total)	493 $/h	493 $/h
Fuel Consumption (Total)	82.1 L/h	
Carbon Dioxide (Total)	205.9 kg/h	
Hydrocarbons (Total)	0.301 kg/h	
Carbon Monoxide (Total)	13.73 kg/h	
NOX (Total)	0.455 kg/h	

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
2020 AM base +dev
Give-way

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)
Nelson St south										
1	L	100	12.0	0.213	13.9	LOS A	8	0.59	0.86	43.7
2	T	11	0.0	0.212	12.3	LOS A	8	0.59	0.83	44.8
3	R	41	2.4	0.115	17.2	LOS B	3	0.73	0.91	40.8
Approach		**152**	**8.6**	**0.213**	**14.7**	**LOS B**	**8**	**0.63**	**0.88**	**42.9**
NEH eastern approach										
4	L	18	5.6	0.052	8.4	LOS A	0	0.00	0.67	49.0
5	T	561	7.3	0.261	1.3	LOS A	19	0.43	0.00	54.5
6	R	3	0.0	0.273	9.8	LOS A	19	0.50	0.71	46.8
Approach		**582**	**7.2**	**0.261**	**1.6**	**LOS A**	**19**	**0.42**	**0.02**	**54.2**
NelsoN St north										
7	L	5	0.0	0.009	10.9	LOS A	0	0.43	0.64	46.1
8	T	1	0.0	0.009	9.7	LOS A	0	0.43	0.71	47.3
9	R	1	0.0	0.003	17.8	LOS B	0	0.74	0.77	40.2
Approach		**7**	**0.0**	**0.009**	**11.7**	**LOS A**	**0**	**0.48**	**0.67**	**45.3**
NEH western approach										
10	L	1	0.0	0.043	8.2	LOS A	0	0.00	0.67	49.0
11	T	317	11.4	0.221	2.2	LOS A	16	0.45	0.00	54.3
12	R	93	4.3	0.221	11.4	LOS A	16	0.60	0.81	45.8
Approach		**410**	**9.8**	**0.221**	**4.3**	**LOS A**	**16**	**0.48**	**0.18**	**52.1**
All Vehicles		**1151**	**8.3**	**0.273**	**4.3**	**Not Applicable**	**19**	**0.47**	**0.20**	**51.6**

SIDRA INTERSECTION

Intersection Summary
NEH and Nelson Street Greta
2020 PM base+dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1512 veh/h	2268 pers/h
Percent Heavy Vehicles	6.0 %	
Degree of Saturation	0.475	
Effective Intersection Capacity	3184 veh/h	
95% Back of Queue (m)	55 m	
95% Back of Queue (veh)	7.5 veh	
Control Delay (Total)	2.44 veh-h/h	3.67 pers-h/h
Control Delay (Average)	5.8 s/veh	5.8 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS B	
Total Effective Stops	285 veh/h	428 pers/h
Effective Stop Rate	0.19 per veh	0.19 per pers
Proportion Queued	0.59	0.59
Travel Distance (Total)	915.8 veh-km/h	1373.8 pers-km/h
Travel Distance (Average)	606 m	606 m
Travel Time (Total)	18.2 veh-h/h	27.3 pers-h/h
Travel Time (Average)	43.3 secs	43.3 secs
Travel Speed	50.4 km/h	50.4 km/h
Operating Cost (Total)	661 $/h	661 $/h
Fuel Consumption (Total)	109.1 L/h	
Carbon Dioxide (Total)	273.3 kg/h	
Hydrocarbons (Total)	0.421 kg/h	
Carbon Monoxide (Total)	20.02 kg/h	
NOX (Total)	0.634 kg/h	

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SIDRA INTERSECTION

Movement Summary
NEH and Nelson Street Greta
2020 PM base+dev
Give-way

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)
Nelson St south										
1	L	99	3.0	0.154	11.1	LOS A	5	0.46	0.74	46.1
2	T	4	0.0	0.154	9.7	LOS A	5	0.46	0.78	47.3
3	R	34	2.9	0.160	24.7	LOS B	5	0.85	0.95	35.7
Approach		**137**	**2.9**	**0.160**	**14.4**	**LOS A**	**5**	**0.56**	**0.79**	**43.0**
NEH eastern approach										
4	L	40	0.0	0.035	8.2	LOS A	0	0.00	0.67	49.0
5	T	335	9.9	0.177	7.0	LOS A	25	0.74	0.00	50.4
6	R	4	25.0	0.174	16.8	LOS B	25	0.80	0.94	41.7
Approach		**379**	**9.0**	**0.177**	**7.2**	**LOS A**	**25**	**0.66**	**0.08**	**50.1**
NelsoN St north										
7	L	1	0.0	0.007	19.0	LOS B	0	0.75	0.78	39.4
8	T	1	0.0	0.007	17.7	LOS B	0	0.75	0.85	40.3
9	R	2	0.0	0.011	25.6	LOS B	0	0.85	0.93	35.1
Approach		**4**	**0.0**	**0.011**	**22.0**	**LOS B**	**0**	**0.80**	**0.87**	**37.3**
NEH western approach										
10	L	7	0.0	0.095	8.2	LOS A	0	0.00	0.67	49.0
11	T	824	5.2	0.475	2.5	LOS A	55	0.55	0.00	53.2
12	R	161	5.6	0.475	11.7	LOS A	55	0.69	0.86	45.5
Approach		**992**	**5.2**	**0.475**	**4.0**	**LOS A**	**55**	**0.56**	**0.14**	**51.7**
All Vehicles		**1512**	**6.0**	**0.475**	**5.8**	**Not Applicable**	**55**	**0.59**	**0.19**	**50.4**