Transport for NSW

Newcastle Light Rail

Technical Paper 1 – Traffic, transport and access assessment

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Glossary and abbreviations

Term	Usage
ADT	average daily traffic
AADT	annual average daily traffic
AM	ante meridiem
BTS	Bureau of Transport Statistics
CBD	central business district
Council	Newcastle City Council
CTMP	construction traffic management plan
HW	highway
km/h	kilometres per hour
LGA	local government area
LoS	level of service
M	motorway
Mitigation	reduction in severity
MR	Main Road
NSW	New South Wales
NUTTP	Newcastle Urban Transformation and Transport Program
Paramics	A computer microsimulation traffic program which allows users to simulate individual vehicle movements to predict future travel pattern behaviour as a result from a change in traffic volume or geometric road layout
PM	post meridiem
PTPM	public transport project model
Roads and Maritime (formerly RTA)	NSW Roads and Maritime Services
SCATS	Sydney Co-ordinated Active Traffic System
Shuttle	A small bus capable of carrying up to 30 passengers direct to the airport from a major centre
SIDRA	A computer program developed to analyse the capacity of road intersections based on given inputs
STM	Sydney Travel Model
TfNSW	Transport for New South Wales

Executive summary

This traffic, transport and access assessment has been undertaken for Transport for NSW (TfNSW) for the proposed Newcastle Light Rail project (the proposal) and forms part of the Review of Environmental Factors (REF) for the proposal.

The proposal is a key infrastructure element in the *Newcastle Urban Renewal Strategy* (Department of Planning and Infrastructure, 2012) and the Newcastle Urban Transformation and Transport Program (NUTTP). The proposal would facilitate urban redevelopment of public, residential and commercial lands by providing an efficient and accessible form of transport for Newcastle city centre. The truncation of the heavy rail at Wickham and development of the new transport interchange at Stewart Avenue is an important precursor. This has already resulted in improved connectivity in the city with new pedestrian and cycle crossings across the heavy rail corridor improving access to the foreshore.

The purpose of the traffic, transport and access assessment is to:

- Describe the existing traffic and transport context.
- Assess the potential changes to traffic, transport and access resulting from the proposal.
- Identify measures to mitigate the potential impacts.

The traffic, transport and access assessment included consideration of the following elements of the transport system:

- Impacts to traffic on the local road network in the city centre and surrounding areas during proposal construction and operation.
- Impacts on access to driveways and laneways and loading zones.
- Impacts on the removal of on-street parking in the city centre.
- Travel time and reliability improvements for public transport customers using the bus network or the light rail services.
- Impacts on bus operation and bus stops in Hunter Street and Scott Street.
- Impacts on taxi and kiss and ride activity in the city centre.
- Impacts on pedestrian movements along footpaths and including requirements for pedestrians to access the light rail stops safely across the light rail line.
- Impacts on bicyclist movements in the city centre.

The impacts considered in this report are of a strategic nature, and further work would need to be undertaken to confirm the expected impacts during detailed design. Traffic management plans would be formulated by the selected construction contractor once the preferred construction methodology is known. The findings of this assessment would be considered during development of these comprehensive traffic management plans prior to construction commencement.

Road network changes

Key changes to the road network are:

- The closure of Beresford Street west of Stewart Avenue.
- Conversion to one-way traffic in Beresford Street between Bellevue Street and Stewart Avenue.
- Reduction to one lane of traffic in both directions in Hunter Street between Worth Place and Perkins Street with the light rail tracks and stops in the median separated from the traffic.
- Reduction to one lane of traffic in both directions in Scott Street between Perkins Street and Watt Street with the light rail tracks in the median with shared traffic and light rail operations between Market Street and Watt Street.
- Implementation of new north-south road connections at Steel Street and Worth Place between Honeysuckle Drive and Hunter Street with traffic signals at Steel Street/Honeysuckle Drive and Hunter Street/Worth Place.
- Installation of new traffic signals for the light rail vehicles to cross Stewart Avenue, Steel Street, Worth Place and Pacific Park and for pedestrians at the Civic, Crown Street and Market Street light rail stops.
- Changes to the intersections at Honeysuckle Drive at Stewart Avenue, in Darby Street at King Street and along King Street between Darby Street and Union Street to improve traffic flows.

Summary of impacts

Road network - 2018 operation

The inclusion of a separated running lane for light rail on Hunter Street, removes one lane for vehicular traffic on Hunter Street in each direction. The predicted changes in traffic volumes in 2018 can be accommodated within the remaining road capacity. The reduced lane capacity in Hunter Street may divert some traffic on to other roads, such as King Street. In order to manage the predicted traffic volumes, a peak period 'No Stopping' zone would be implemented in King Street.

The intersection level of service (LoS) results indicate that most intersections would operate at LoS D or better. The exception to this is at King/ Union Street where the intersection performance would reduce to LoS E in the PM peak period.

At other locations, the intersection performance would improve (compared to existing) to LoS B or C with the connections in the road network at Steel Street and Worth Place redistributing traffic in the western part of the study area. Therefore, the traffic performance on the road network in 2018 is considered satisfactory.

Road network - 2028 operation

The results provide an indication of potential future impacts assuming a constant growth in traffic volumes and population growth associated with an indicative future urban development masterplan.

The intersection LoS results indicate that the majority of intersections would operate at LoS D or better throughout the network. The intersection of King Street/ Stewart Avenue is predicted to deteriorate to LoS E in the AM peak period (compared to D in 2018) and Honeysuckle Drive/ Hannell Street and King/ Union Street to LoS F in the PM peak period compared to LoS C and E respectively in 2018.

The *Guide to Traffic Generating Developments* (Roads and Maritime Services, 2002) indicates that with traffic signal cycle times of over 120 seconds, a LoS E is acceptable during the peak period only as drivers and pedestrians expect this level of delay at this time. The Honeysuckle Drive/ Hannell Street intersection is predicted to be at LoS F in the PM peak without the proposal, indicating the intersection performance is not related to the proposal.

NSW Roads and Maritime Services (Roads and Maritime) in conjunction with TfNSW are currently investigating locations for other upgrade works to complement proposal implementation. These measures are aimed at removing existing pinch points in the road network to ensure traffic continues to moves freely and efficiently. The areas of investigation include King Street north of Union Street and Stewart Avenue/ Hannell Street north of Parry Street. As identified by the impact assessment, the performance of the intersection at King/Union Street will be one of the locations considered for upgrade works.

Car parking, taxi ranks and loading zones

A total of 650 on-street car parking spaces are available in the study area including King Street. Of these, a total of 280 car parking spaces would be permanently removed to provide sufficient room for the proposal and remaining roadway. An additional 83 on-street car parking spaces in King Street would be affected by a proposed peak period 'No Stopping' zone, which would apply on the north side in the AM peak period before 9 am and on the south side between 5 pm and 6 pm on weekdays.

Seventeen motorcycle parking spaces would also be removed in Steel Street for the new road connection and in King Street west of Darby Street for the peak period 'No Stopping' zone.

In addition to the parking spaces removed, a total of 29 spaces in loading zones, including three mail zones, would be removed and would need to be assessed to confirm the parking requirements. These may need to be relocated to other streets in the city centre. These locations would be determined through discussions with Newcastle City Council (Council) who is responsible for the management of the kerbside usage on the streets in the city centre.

Taxi ranks in Hunter Street at Civic Station and in Watt Street at Newcastle Station may need to be relocated to provide convenient access for taxi customers.

A review of options to mitigate the loss of on-street parking and loading zones would be undertaken. The review would include both existing on-street and off-street parking locations as well as the opportunities provided by new or proposed developments or Government-owned land close to the proposal site. The review would:

- Be undertaken in accordance with the objectives and requirements of the *Newcastle Urban Renewal Strategy* and the NUTTP.
- Involve an audit of the use of existing spaces including turnover.
- Include an assessment of the potential options and identification of a preferred option/s.
- Be undertaken in consultation with relevant stakeholders, including surrounding. businesses/organisations, Council, Roads and Maritime and UrbanGrowth NSW.

Bus movements and bus zones

A revised city centre bus plan would be developed for implementation by TfNSW. The plan would confirm which bus routes would operate in Hunter Street and Scott Street following implementation of the proposal. The current design indicates a total of 9 of the 20 bus stops in the construction zone would need to be permanently removed or relocated.

Four local bus routes would continue to operate via Scott Street to service Newcastle East with a terminus at Parnell Place. These bus routes would provide a combined service frequency of four buses per hour between Newcastle East and the Civic precinct.

The route and bus stops for the shuttle bus service operating between Hamilton and Newcastle stations may need to be temporarily adjusted to avoid construction activities in Hunter Street east of Worth Place and in Scott Street.

Cyclists

The existing cycleway along both sides of King Street would be affected by the proposed peak period 'No Stopping' zone, which would apply on the north side in the AM peak and on the south side in the PM peak on weekdays. To mitigate this potential impact, a review of alternative measures would be required to be investigated, designed and communicated with the community prior to implementation.

The review would:

- Be undertaken in accordance with the objectives and requirements of the Newcastle Urban Renewal Strategy and the NUTTP.
- Involve an audit of the use of existing spaces including turnover.
- Include an assessment of the potential options and identification of a preferred option/s.
- Be undertaken in consultation with relevant stakeholders, including surrounding businesses/organisations, Council, Roads and Maritime and UrbanGrowth NSW.

Construction phase impacts

Traffic generation

Construction of the proposal would involve vehicle movements in and around the construction site and compound areas.

The number of heavy vehicle movements is estimated to be 8 to 12 vehicles per zone per day with an average daily total of 38 heavy vehicles. This number of additional vehicles in the city centre road network would result in performance on intersection performance changings substantially as the increased volume is less than 0.5 percent of current traffic volumes in Hunter Street. These heavy vehicles would be distributed over the working day and would be managed with traffic control staff as specified in a comprehensive construction traffic management plan prepared by the contractor.

The delivery of some infrastructure components, such as roofing panels and beams, may be considered oversized deliveries. These deliveries may be undertaken outside of normal working hours in accordance with the requirements of relevant authorities, so as not to cause undue interruption or compromise the safety of the road network.

The total number of light vehicle movements is estimated to be less than 20 vehicles per day. This is largely as a result of workers being required to park at the western site compound and workers and their equipment being shuttled from this location to the work sites by high capacity private vehicles or small buses. Other light vehicle trips would include supervisory staff and other ancillary requirements.

Overall, the total numbers of heavy and light vehicle movements around the construction site, including both heavy and light vehicles, would be low compared to the existing traffic volumes on these roads and would not result in a substantial impact on the local roads or the road network.

To determine the effects of reducing short sections of Hunter Street to one lane in each direction, as required to undertake construction, a SIDRA analysis was completed on the section of Hunter Street between Steel Street and Union Street. The analysis indicated that, while there was a small increase in travel time due to the reduction in lane capacity to one lane, the overall LoS at the intersections did not change. This indicates that with appropriate traffic management, the effects of reducing Hunter Street to one lane in short sections as required during construction, would be minimal.

Worker parking

It is anticipated that an average of approximately 70 staff and workers would be required on site each day with up to 100 staff and workers during the peak construction period. Separate crews would undertake construction in each zone concurrently and at times, on multiple work stages. For these staff, parking would be encouraged either within the site compound or adjacent to the rail corridor to minimise inconvenience to residents and local businesses during the construction period. Where parking is allocated next to the rail corridor assets, effective means of maintaining safety of workers from moving components would be provided. The contractor would provide a shuttle bus to transfer workers from the staff parking areas and compounds to the assigned work zone each day.

Since each construction zone is within an easy walking distance (less than 10 minutes walking time) from each of the compounds, workers who do not have to carry heavy equipment may walk to their assigned work zone each day. This would reduce the number of light vehicles for workers and minimise the number of shuttle bus services operating in the proposal construction zone.

On-street parking and loading zones

Changes to parking as a result of the proposal construction are required to provide sufficient width for construction and to maximise the width of traffic lanes available. These would be removed progressively along the works corridor in each construction zone to minimise impacts on users.

The removal of on-street parking and relocation of loading zones would be further discussed with key stakeholders, including affected businesses, Council and Roads and Maritime to determine appropriate mitigation measures.

Bus and coach services

Public transport arrangements during construction would be unchanged from their current routes and frequency. Some bus stops would be repositioned in order to avoid conflict with proposed construction works areas, which are typically up to 100 metres in length. In these situations, bus stops would be temporarily repositioned either 50 metres east or west of the proposed work site to avoid potential conflict.

Pedestrians

Pedestrians who currently use the footpaths along Honeysuckle Drive near Stewart Avenue and in Stewart Avenue between Honeysuckle Drive and Hunter Street would be provided with safe routes through the construction zone when activity is occurring in these areas. The other north-south connections between the foreshore and Hunter Street, such as Steel Street, Worth Place, Merewether Street and Perkins Street, may affect the routes that pedestrians use. Signage at the entry points into the city centre and an information brochure identifying safe pedestrian routes to and through the city centre would be prepared prior to the start of the construction works.

New pedestrian crossings would be provided to access the light rail stops and to cross the former railway corridor. Safe, convenient and disability-compliant access is required to at least one end of each platform at all light rail stops. This is currently the case at all stops except at Civic, which is located at a mid-block location in Hunter Street. Therefore, a traffic signal to allow for pedestrians and light rail customers to safely cross Hunter Street between the Civic Plaza area and Wheeler Place and to the light rail platforms is required.

Cyclists

Cyclists who currently use the on-road bicycle lanes along Honeysuckle Drive near Stewart Avenue or in Stewart Avenue between Honeysuckle Drive and Hunter Street would be provided with safe bicycle routes through the construction zone when activity is occurring in these areas. The other north-south connections between the foreshore and Hunter Street, such as Steel Street, Worth Place, Merewether Street and Perkins Street, may affect the routes that cyclists use. Signage at the entry points into the city centre and an information brochure identifying safe pedestrian routes to and through the city centre would be prepared prior to the start of the construction works.

Cyclist infrastructure, such as on-road bicycle lanes, that is affected during the proposal construction phase, would be replaced in a condition similar to the existing infrastructure with the appropriate width that meets the bicycle lane standards and with pavement markings that clearly demark the cyclist area from the light rail and traffic lanes.

Cumulative impacts

The construction phases for the Wickham Transport Interchange and the proposal would coincide with the interchange scheduled to be operational in 2017 and the proposal in late 2018. Assuming proposal construction commences in mid-2016, there would be a period of approximately 6 to 12 months when both projects are under construction concurrently and, potential cumulative impacts in the Wickham and Newcastle West areas may result.

With most of the construction activities for the two projects located on either the western or eastern sides of Stewart Avenue, the cumulative impacts during the construction phase are likely to be minimal for traffic, pedestrians and cyclists passing near the construction zones. Regular and continuous liaison between the two construction projects, and particularly for works involving Stewart Avenue / Hannell Street, will aim to maximise the opportunities for coordination of works and reduce the likelihood and severity of any cumulative impacts.

Proposal construction and operation would result in the removal of 267 on-street car parking spaces, located mostly in Hunter, Scott and Beresford Streets. An additional 83 on-street car parking spaces would be removed temporarily during the peak periods on King Street between Darby and Union Streets for the proposed peak period ‘No Stopping’ zone. Therefore, the cumulative reduction of on-street car parking, including 75 car parking spaces from the Wickham Transport Interchange project, would be 342 spaces. A total of 17 motorcycle parking spaces would also be removed.

Investigation of options to mitigate the removal of on-street parking and loading zones as a result of the proposal are currently being undertaken by TfNSW. Consultation would be undertaken with affected businesses in Hunter, Scott and King streets as well as Roads and Maritime and Council.

Mitigation measures

In order to manage the impacts of the proposal on traffic, parking, buses, and pedestrian and cyclist movements, a range of mitigation measures outlined in Section 6 of this report would be implemented during the pre-construction and construction phases.

The measures would focus on maintaining safe, convenient and efficient movements for traffic and transport, including pedestrians and cyclists, through and around the construction work areas and zones. The basis of this would be a comprehensive construction traffic management plan, for which an outline of measures has been provided which would be further developed by the appointed construction contractor. Should the proposed construction methodology differ, a revised impact assessment and approval may be required prior to construction commencement.

Additional investigations are also being undertaken regarding additional traffic efficiency improvements, mitigation for car parking and for impacts to the King Street cycleway and the outcomes of these investigations would be documented in the Submissions Report.

1. Introduction

1.1 Background to the proposal

The NSW Government is revitalising the Newcastle city centre. The revitalisation would reinforce the city's role as a 21st century regional centre, unlock the potential of the city centre as a place that can meet the needs of the current and future community, and boost economic activity across the Hunter Region.

The Newcastle Urban Transformation and Transport Program (NUTTP) has been established to deliver the NSW Government's $510 million commitment to revitalise the city. The program aims to bring people back to the city centre by strengthening connections between the city and the waterfront, creating employment opportunities, providing more public space and amenity, and delivering better transport. The NUTTP comprises:

1. Urban redevelopment/renewal projects being led by UrbanGrowth NSW
2. The transport program being led by Transport for NSW (TfNSW)

The transport program seeks to revitalise Newcastle by improving pedestrian and vehicle connectivity within the CBD and by promoting public transport usage and accessibility. TfNSW is now proposing to progress development of the Newcastle Light Rail project. The construction and operation of the light rail project is referred to as 'the proposal' in this document.

GHD Pty Ltd (GHD) was commissioned by TfNSW to undertake an assessment of the potential environmental impacts of the proposal and prepare a Review of Environmental Factors (REF) in accordance with the provisions of Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act).

1.2 The proposal

1.2.1 Location

The proposal site (the area that would be generally affected by construction works) is located in the Newcastle city centre and extends in an east–west direction within the former rail corridor and road reserves. It is bounded to the west by the Wickham Transport Interchange near Stewart Avenue. From the Wickham Transport Interchange the proposal site extends east along Beresford Street and enters the former rail corridor near the existing Wickham Station buildings. The proposal site is located within the former rail corridor from this point until near Worth Place, where it enters the road corridor and travels along Hunter Street and Scott Street to the eastern boundary of Pacific Park.

The proposal site also includes the proposed location for the two new substations in the former rail corridor to the west of Argyle Street.

The location of the proposal is shown in Figure 1-1.

1.2.2 Overview of key features

The proposal involves the construction and operation of a light rail system in the Newcastle city centre, and associated changes to the road and bus network. This would include:

Light rail infrastructure

- About 2.7 kilometres of light rail track, consisting of about 2.5 kilometres of dual track and 180 metres of single track.
- Six light rail stops and associated infrastructure (such as platforms, shelters and lighting):
  - Wickham Interchange
  - Honeysuckle
  - Civic
  - Crown Street
  - Market Street
  - Pacific Park
- A light rail stabling and maintenance facility at the location of the existing Wickham Station.
- Terminus facilities near the Pacific Park stop.
- Ancillary infrastructure, including two new substations, power supply, wiring and utilities.

Former rail corridor works

- Remove the existing Wickham Station buildings, platforms and pedestrian bridge.
- Remove the pedestrian bridge over the former rail corridor to the west of Market Street.

Transport network works

Bus network

- Remove seven existing bus stops along Hunter and Scott streets and provide four new stops in Watt Street, Wharf Road (two stops) and Centenary Road.

Road network and intersection changes

- Changes to the road configuration along the light rail corridor to accommodate the light rail infrastructure on Beresford, Hunter and Scott streets.
- Changes to the following intersections along the light rail corridor:
  - Stewart Avenue/Beresford Street
  - Steel Street at the former rail corridor
  - Hunter Street/Worth Place
  - Pacific Street/Scott Street
- New signalised road crossings to provide access to light rail stops:
  - At Hunter Street near Crown Street
  - At Scott Street near Market Street
- New signalised road crossings of the former rail corridor at:
  - Steel Street
  - Worth Place

- Changes to the road configuration outside the light rail corridor at the following locations:
  - Honeysuckle Drive and Stewart Avenue/Hannell Street
  - King Street from Union Street to Darby Street
  - King Street intersection northbound on Darby Street
  - Darby Street intersection southbound on Darby Street.

Operation of the proposal

- Mix of segregated, separated and mixed running.
- Light rail services would commence at 5 am and finish at 1 am.
- Between the core hours of 7 am and 7 pm, services would operate every 10 minutes on weekdays and every 15 minutes on weekends.
- Less frequent services would be provided in the early morning, evening and night periods.
- Five light rail vehicles would operate with capacity for a minimum of 100 passengers per vehicle.

1.3 Scope of the assessment

The traffic, transport and access assessment has involved the following tasks:

- Obtaining additional traffic counts at selected intersections in the study area.
- Conducting stakeholder meetings with TfNSW, NSW Roads and Maritime Services (Roads and Maritime) in Newcastle and Newcastle City Council (Council) to confirm the issues and impacts on the road and bus network, pedestrians and cyclists, and other transport modes, such as taxis and kiss and ride activity.
- Investigating the demand for the public transport network in the study area using the post-truncation train, bus and shuttle bus patronage.
- Determining the travel demand for vehicular traffic in the study area based on the land use for the construction period and when the proposal is operational.
- Investigating the travel characteristics and existing road traffic performance based on a Paramics traffic model for the city centre.
- Conducting a site visit to identify land use, properties and access adjacent to the proposal site, and to conduct an audit of the on-street parking spaces, loading zones and side street parking along the light rail alignment in Hunter Street east of Worth Place and Scott Street to Telford Street at Pacific Park.
- Assessing the potential impacts of the proposal on transport using the road network model developed for the proposal.
- Identifying potential mitigation measures to address the impacts identified.

The impacts considered in this report are of a strategic nature, and further work would need to be undertaken to confirm the expected impacts during detailed design. Traffic management plans would be formulated by the selected construction contractor once the preferred construction methodology is known. The findings of this assessment would be considered during development of these comprehensive traffic management plans prior to construction commencement.

1.4 Structure of this report

This report consists of the following sections:

- **Section 1 – Introduction:** provides an overview of the project and the scope of the traffic, transport and access assessment.
- **Section 2 – Existing transport network:** describes the road network, traffic conditions, public transport network, on-street parking and loading zones and the pedestrian and cyclist access within the area affected by the proposal.
- **Section 3 – Proposed development:** describes the proposal and the changes to the road network, public transport system and access for pedestrians and cyclists.
- **Section 4 – Traffic modelling approach:** discusses the methodology to determine the traffic impacts and the assumptions used in the traffic modelling.
- **Section 5 – Impact assessment:** discusses the likely impacts and implications of the changes to traffic on the road network, the transport system, parking and loading zones and access for pedestrians and cyclists to the light rail stops and within the project area.
- **Section 6 – Mitigation measures:** proposes mitigation measures to address the defined impacts on the traffic, transport and access as a result of the proposal.
- **Section 7 – Summary and conclusion:** provides an overview of the work completed and the key findings.

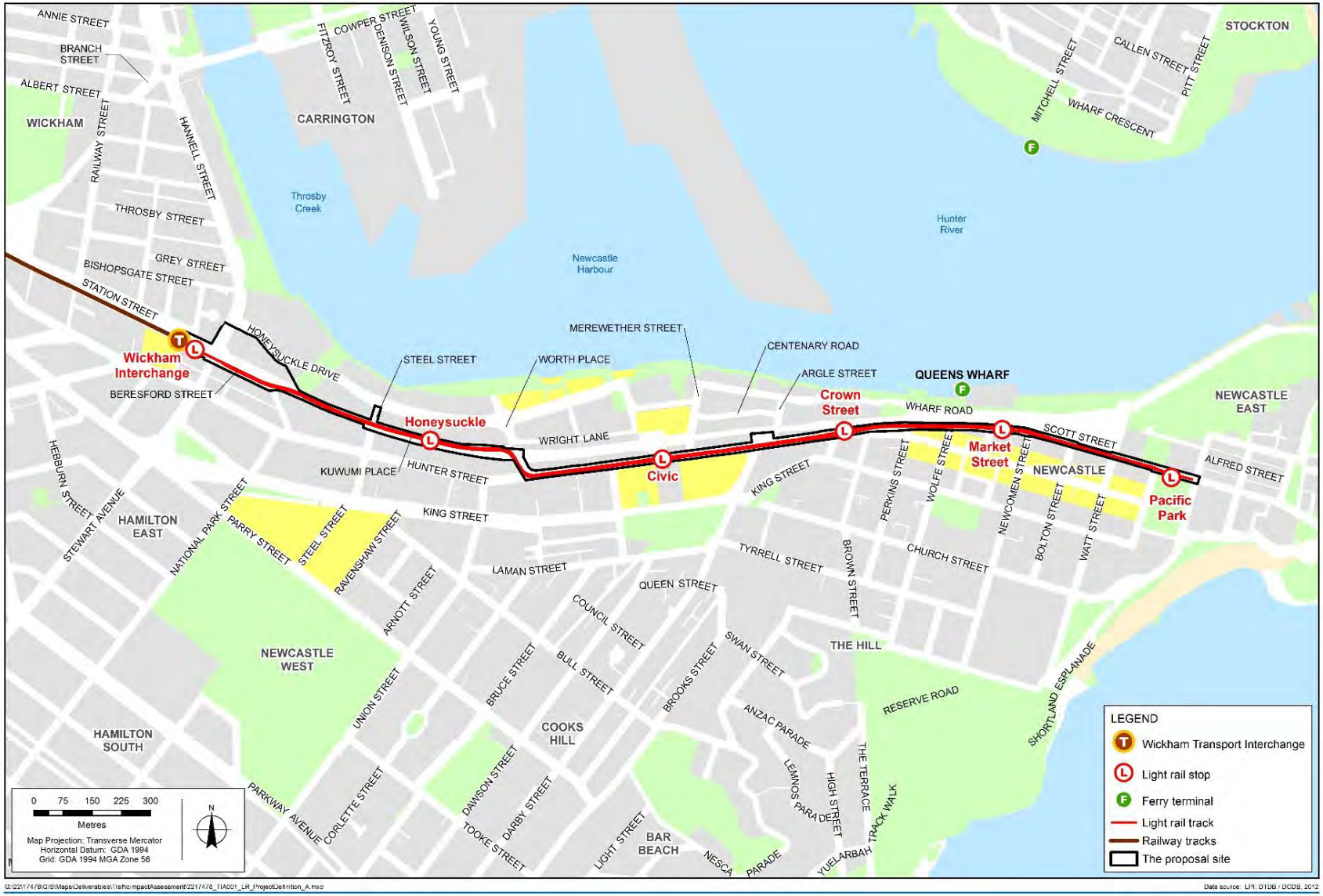


Figure 1-1 Location and key features of the proposal

2. Existing transport network

This section documents the existing conditions for the Newcastle city centre transport system. This includes all transport modes that use the road network, including all vehicular traffic, buses, walking and cycling. Traffic volumes on the road network and at the key intersections are presented on maps and in tables. The existing on-street parking spaces and loading zones within the study area are also quantified.

2.1 Existing road network

The existing road network including key arterial roads and local roads in the suburbs surrounding the proposal site are shown in Figure 2-1.

2.1.1 Classified roads

Roads and Maritime may exercise the powers of a roads authority over roads classified under the *Roads Act 1993*. Council is the roads authority for all public roads (both classified and unclassified). Classified roads in the vicinity of the proposal site are:

- Pacific Highway (State Road) – Stewart Avenue south of Hunter Street (A43), Hunter Street west of Stewart Avenue and Maitland Road.
- Hannell Street (A43) and Industrial Drive.
- Parry Street (A15) and Donald Street.

Stewart Avenue/Hannell Street

Stewart Avenue and Hannell Street form a major arterial road that runs generally north-south through the study area. These roads are currently divided by the railway crossing between Hunter Street and Honeysuckle Drive. This crossing causes significant delays during peak periods. These roads are both dual carriageway with two lanes in each direction. These roads carry traffic from the southern and northern suburbs to Newcastle West.

2.1.2 Non-classified roads

Several other local streets are within the proposal site or in the immediate area surrounding the proposal. They are described as follows:

Hunter Street/Scott Street

Hunter Street is an arterial road that runs in an east-west direction, running parallel to the existing rail line towards the Newcastle central business district (CBD). It is generally a two-way, four lane undivided road that runs for approximately three kilometres. The existing railway line runs on the northern side between Perkins Street and Bolton Street. West of Scott Street, Hunter Street has a sign posted speed limit of 60 kilometres per hour (km/h) and is a four-lane carriageway that carries up to 1,200 vehicles per hour in the peak period. Hunter Street provides access to residential and commercial properties and a local shopping and café precinct in the East End.

King Street/Parry Street

King Street is an arterial road that runs parallel to Hunter Street. Between Stewart Avenue and Union Street, it is a four-lane divided road with a posted speed limit of 60 km/h. East of Jubilee Lane near Auckland Street, King Street is a two-lane undivided road with a speed limit from 25 km/h over the speed hump at the pedestrian crossing adjacent to Civic Park to 50 km/h. East of

Auckland Street, King Street is a two-lane undivided road with a posted 40 km/h speed limit. The adjacent land use is generally commercial, but also has a number of hotels and residential apartment blocks along its length.

To the west of the intersection of Stewart Avenue, King Street becomes Parry Street. At this location, Parry Street is also a four-lane divided road, which connects with Donald Street, Hamilton and ultimately becomes Newcastle Road to the western suburbs and the M1 Pacific Motorway to Sydney and the Central Coast and the M15 Hunter Expressway.

Honeysuckle Drive and Wharf Road

Honeysuckle Drive runs generally east-west between the existing rail line and Newcastle Harbour. It becomes Workshop Way before changing to Wharf Road at Merewether Street. It is bounded by Hannell Street to the west and Merewether Street to the east. Honeysuckle Drive services the commercial office space, residential and restaurant/bar precincts that are adjacent to Newcastle Harbour. East of Merewether Street, there are several medium density residential and commercial developments. The road also provides access to recreation areas of the foreshore and Nobbys Beach.

Union Street

Union Street is a collector road that runs in a north-south direction between Hunter Street and The Junction, terminating at Mitchell Street, Merewether. Union Street is a two-lane carriageway whose speed limit varies between 40 km/h and 60 km/h that carries up to 800 vehicles per hour in the peak period. Union Street has parking spaces along most of its length and provides direct access to a number of residential properties and The Junction shopping precinct.

Darby Street

Darby Street is a collector road that runs in a north-south direction between Hunter Street and Parkway Avenue. Between Bull Street and Queen Street, the sign posted speed limit is 40 km/h and the road is characterised by a bar and café precinct, generating high levels of pedestrian activity. Darby Street is generally a two-lane carriageway that carries approximately 1,000 vehicles per hour in the peak period.

Steel Street

Steel Street is a collector road that runs in a north-south direction between Hunter Street and Parry Street. The sign posted speed limit is 50 km/h and the southern end of Steel Street passes through the Marketown shopping centre. Steel Street is generally a two-lane carriageway with approximately 400 to 600 vehicles per hour in the weekday peak period. It is a cul-de-sac on either side of the railway corridor from each end at Honeysuckle Drive and Hunter Street.

Worth Place

Worth Place is a local access road that runs in a north-south direction between Hunter Street and Honeysuckle Drive that is only open for vehicular traffic north of the railway corridor between Wright Lane and the foreshore with a roundabout at Honeysuckle Drive. The sign posted speed limit is 50 km/h. It is a two-lane carriageway that carries approximately 100 vehicles per hour in the weekday peak period. Worth Place between Hunter Street and the railway corridor is a cul-de-sac.

Watt Street

Watt Street is a local collector road that runs in a north-south direction between Hunter Street and Wharf Road. The sign posted speed limit is 50 km/h.

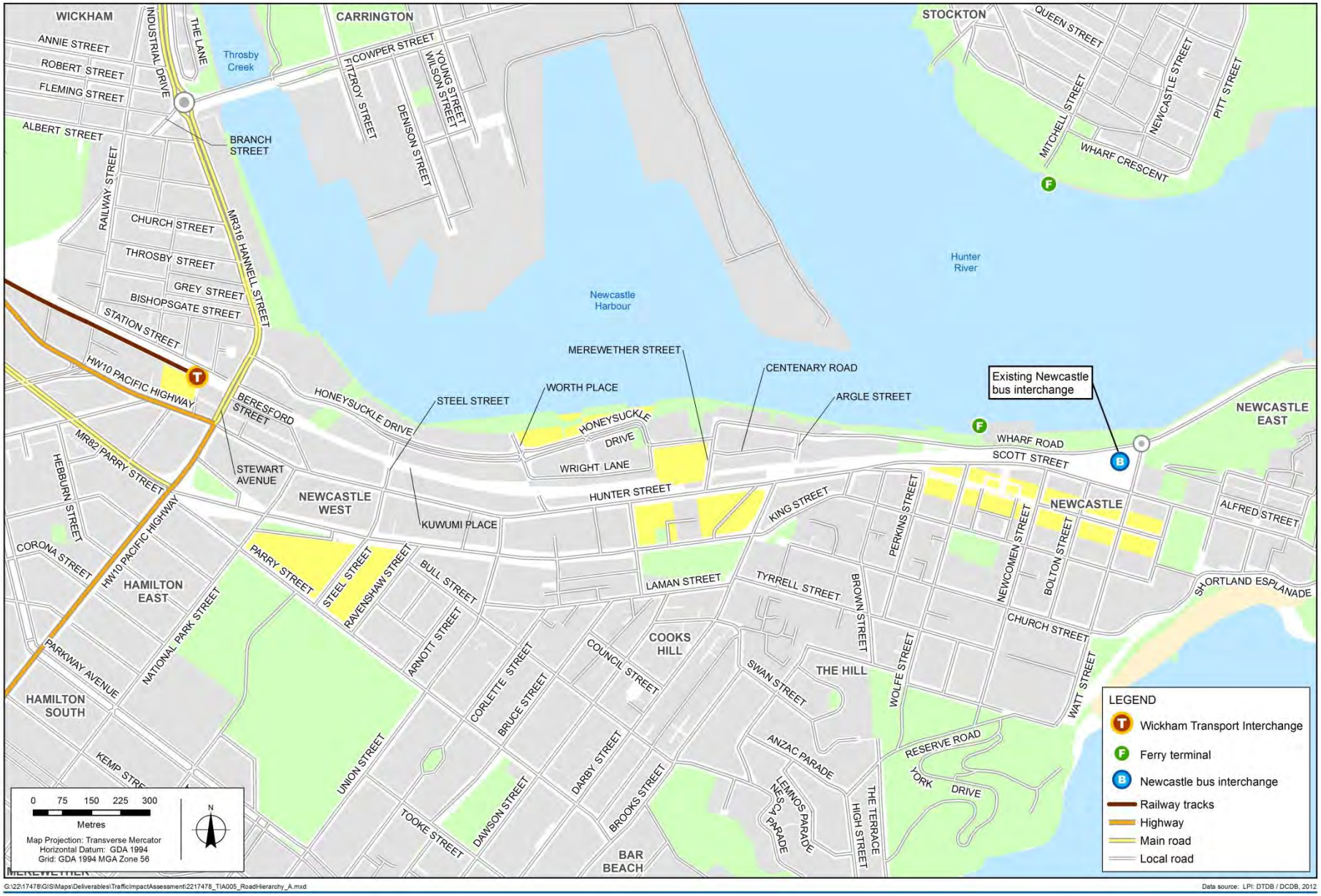


Figure 2-1 Existing road network and hierarchy in the study area

2.1.3 Key intersections

The key intersecting points of the road network relevant to the proposal are described in Table 2-1.

Table 2-1 Key intersections in the proposal study area

Location	Existing arrangements
Within the proposal site	
Stewart Avenue and Beresford Lane	Give way controlled intersection with priority given to Stewart Avenue
Steel Street at the heavy rail corridor	No existing road intersection; pedestrian crossing only
Hunter Street at Worth Place	T-junction with a cul-de-sac in Worth Place between the railway corridor and Hunter Street
Hunter Street and Auckland Street	T-junction with traffic signal controls with no right turns from Hunter Street into Auckland Street
Hunter Street and Merewether Street	T-junction with traffic signal controls
Hunter Street and Darby Street	T-junction with traffic signal controls with all turning movements
Scott Street and Wolfe Street	Give way controlled intersection with priority given to Scott Street
Scott Street and Watt Street	4-way traffic signal controlled intersection
Scott Street and Pacific Street	Give way controlled intersection with priority given to Scott Street
Adjoining the proposal site	
Hannell Street and Thorsby Street	T-junction with traffic signal controls
Honeysuckle Drive and Hannell Street	T-junction with traffic signal controls
Honeysuckle Drive and Steel Street	T-junction with cul-de-sac access in Steel Street north of the railway corridor Local pedestrian access in Steel Street between Hunter Street and Honeysuckle Drive
Hunter Street and Stewart Avenue	Signalised intersection with no right turns on all approaches except the eastern approach
King Street and Stewart Avenue	Signalised intersection
Hunter and Streel Street	Signalised intersection with a cul-de-sac in Worth Place between the railway corridor and Hunter Street
Hunter Street and Union Street	T-junction with traffic signal controls
King Street and Steel Street	Signalised intersection
King Street and Union Street	Signalised intersection
King Street and Darby Street	Signalised intersection

2.1.4 Daily traffic volumes

The daily traffic volumes on roads in the study area have been estimated based on traffic surveys conducted in 2014 and 2015, as well as intersection counts using permanent roadside collection devices operated by Roads and Maritime. The data are shown in Table 2-2.

The traffic surveys were undertaken on 3 June 2014 and 11 March 2015, pre and post truncation of the heavy rail line at Wickham. SCATS detector data was collected on 25 March and 5 May 2015. The daily and calculated AM peak and PM peak traffic volumes are shown in Figure 2-2 and in Table 2-2. Table 2-3 shows the correlation of these calculated values with the permanent roadside collection devices published by Roads and Maritime. These volumes represent typical daily traffic on the key four-lane arterial roads in Newcastle city centre (AADT; average annual daily traffic).

Table 2-2 Estimated 2015 ADT traffic volumes

Street	Daily traffic (vehicles per day)	AM peak (vehicles/ hour)	PM peak (vehicles/ hour)
Stewart Avenue south of Honeysuckle Drive	29,500	2,538	2,738
Hunter Street west of Steel Street	18,300	1,377	1,590
Hunter Street east of Steel Street	18,300	1,305	1,507
King Street east of Union Street	13,700	951	946
Hunter Street east of Darby Street	18,100	1,254	1,615
King Street east of Darby Street	12,500	934	1,473

Source: SkyHigh traffic surveys, June 2014 and March 2015
Note: Daily traffic volumes rounded to the nearest 100 vehicles

Table 2-3 Published AADT data from permanent roadside collection devices

Station	Road	Location	AADT			
			2008	2010	2012	2013
05.593	Stewart Avenue	North of Parry Street	17,500	18,600	Not available	Not available
05.209	Hannell Street	North of Greenway Street	22,500	Not available	28,800	29,000

Source: Roads and Maritime, 2014
Note: Daily traffic volumes rounded to the nearest 100 vehicles

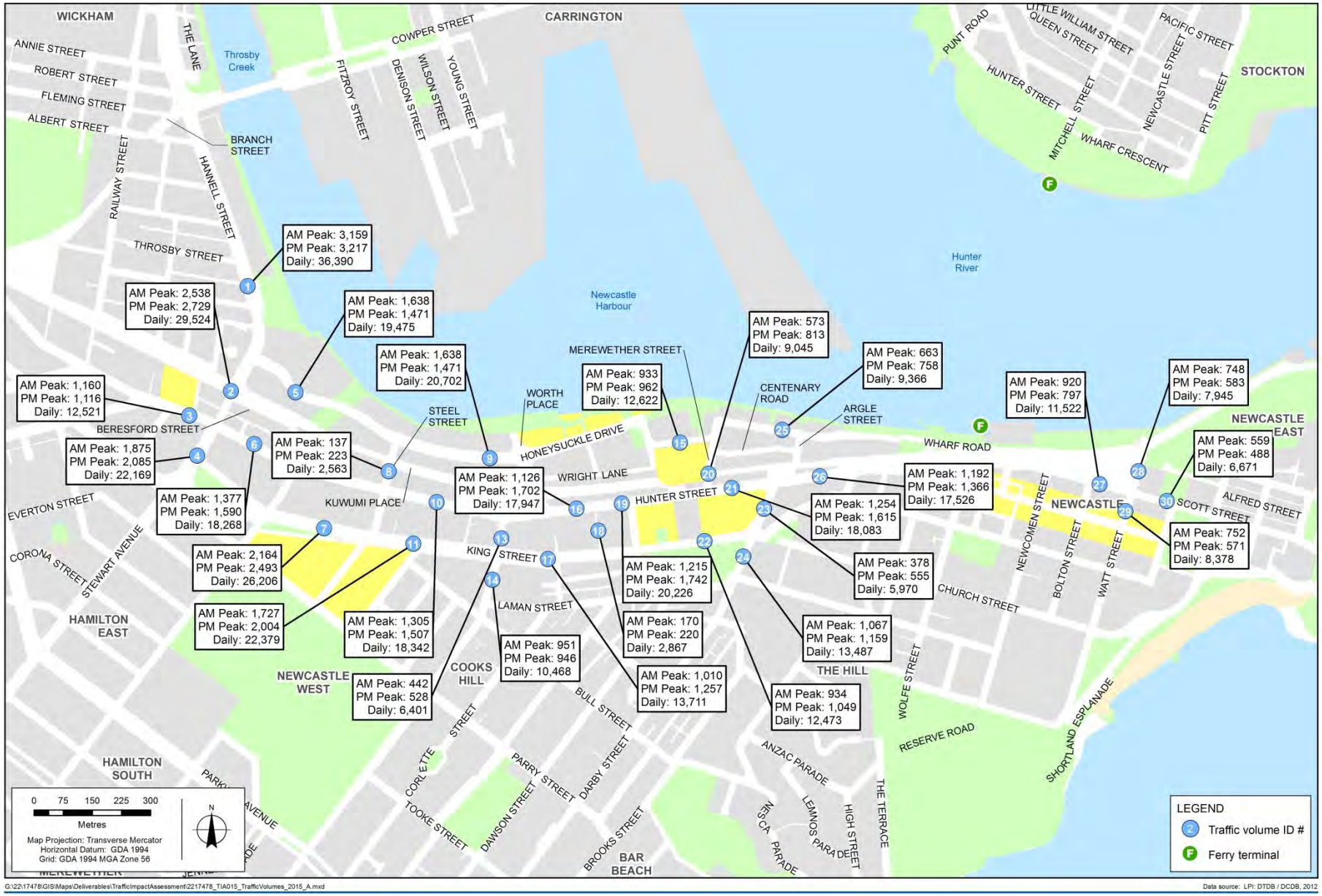


Figure 2-2 Existing traffic volumes in 2015

2.1.5 Intersection traffic volumes

The key intersections identified in section 2.1.3 operate at various degrees of congestion during peak periods. Some delays are apparent due to high traffic volumes and demand for certain movements.

Total volumes passing through these key intersections for both the morning (AM) and afternoon (PM) peak periods are shown in Table 2-4. The intersections on the key Hannell Street/Stewart Avenue north-south route are most utilised, with between 3,000 and 5,000 vehicles per hour passing through the Honeysuckle Drive, Hunter Street and King Street/Parry Street signalised intersections.

Table 2-4 Total traffic volumes for key intersections during peak periods

Intersection location	Type	Total AM peak hour traffic volume	Total PM peak hour traffic volume
Throsby Street/ Hannell Street	3 way signals (T intersection)	3,229	3,270
Honeysuckle Drive/ Hannell Street	3 way signals (T intersection)	3,675	3,694
Hunter Street/ Stewart Avenue	4 way signals	3,585	3,885
King Street/ Stewart Avenue	4 way signals	4,287	4,659
Hunter Street/ Steel Street	4 way signals	1,459	1,783
King Street/ Steel Street	4 way signals	2,088	2,353
Hunter Street/ Union Street	4 way signals	1,527	1,817
King Street/ Union Street	4 way signals	2,039	2,270
Hunter Street/ Merewether Street	3 way signals (T intersection)	1,529	2,065
Hunter Street/ Darby Street	3 way signals (T intersection)	1,416	1,750
King Street/ Darby Street	4 way signals	1,574	1,710

Source: SkyHigh traffic surveys, June 2014 and March 2015

2.2 Existing intersection performance

The performance of the road network is largely dependent on the operating performance of intersections which form critical capacity control points on the road network.

The level of service (LoS) provided to motorists is a measure of intersection performance, factoring in traffic volumes, intersection geometry, turning facilities and traffic signal phasing. It is derived from the overall delay to vehicles averaged over the whole intersection and allocated on an alphabetical scale as defined in Table 2-5. The LoS calculations and definition are also able to be applied on any given leg of the intersection or any movement (through or turning) on individual approaches.

Table 2-5 LoS criteria for intersections

LoS	Average delay per vehicle (seconds/vehicle)	Intersection performance
A	< 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	Incidents would cause excessive delays
F	> 70	At capacity

Source: Roads and Maritime traffic modelling guidelines, 2013

The intersection performance can be derived from traffic modelling of the geometry and traffic volumes in a number of software packages. For this investigation, the outputs from a city centre Paramics model and SIDRA model, developed for the proposal (GHD, 2015) were used (refer to Section 4).

The intersection performance of the existing road network is shown in Table 2-6 and is presented in Figure 2-3. These results indicate that:

- During the morning peak, the intersection at Hunter Street/Stewart Avenue has a LoS F.
- During the afternoon peak, the Hannell Street corridor operates at or near capacity.
- All other intersections operate with an acceptable LoS.

Table 2-6 Existing intersection performance

Intersection	AM peak		PM peak	
	LoS	Average delay (seconds)	LoS	Average delay (seconds)
Throsby Street/ Hannell Street	A	9	A	8
Honeysuckle Drive/ Hannell Street	C	33	F	>70
Hunter Street/ Stewart Avenue	F	> 70	E	70
King Street/ Stewart Avenue	C	35	C	42
Hunter Street/ Steel Street	A	10	A	14
King Street/ Steel Street	B	18	D	52
Hunter Street/ Union Street	B	24	C	29
King Street/ Union Street	D	43	D	44
Hunter Street/ Merewether Street	B	25	C	29
Hunter Street/ Darby Street	C	31	B	25
King Street/ Darby Street	B	28	B	26

Source: Newcastle Light Rail Paramics and SIDRA models (GHD, 2015)

Figure 2-3 Existing intersection LoS in 2015

2.3 On-street parking and loading zones

Kerbside management surveys were undertaken by GHD in October 2015 and November 2015 to determine the number, restrictions and length of all on-street parking spaces, bus zones and loading zones within the proposal study area. All of the streets affected by the proposal construction or operation were surveyed. The detailed results of the kerbside inventory by street section and type of use is provided in Appendix A.

On-street parking and loading zones along the streets within the proposal study area are shown in Figure 2-4. They comprise a range of timed and ticket parking, loading zones for mail pick-ups and business deliveries, no stopping and no parking zones and bus zones. Timed parking restrictions exist on all of the streets in the study area.

The types of on-street parking and kerbside usage are as follows:

- Ticket parking for 1P, 2P, 4P, 8P and all day
- Time restricted parking with 5 minute P, 15 minute P and 30 minute P
- Disabled parking and motorcycle parking
- Unrestricted parking on railway land (not for commuters or employees)
- No parking and no stopping
- Not signposted
- Bus zone and bus bay (indented), taxi zone
- Construction zone, loading zone, mail zone

The number of existing car parking and loading zones by street are given in Table 2-7. A total of 650 car spaces, 32 motorcycle spaces and 48 spaces for loading zones including mail zones exist in the study area, including King Street between Union Street and Darby Street.

Table 2-7 Existing on-street parking and loading zones

Street	Number of existing car parking spaces	Number of existing motorcycle spaces	Number of existing loading zone spaces
Argyle Street	9	6	2
Bellevue Street	10	0	0
Beresford Street	53	0	2
Centenary Road	41	0	3
Honeysuckle Drive	29	0	0
Hunter Street	181	0	29
King Street	100	11	4
Market Street	6	0	0
Merewether Street	0	0	0
Old Hannell Street	32	0	0
Scott Street	117	9	8
Station Street	29	0	0
Steel Street	5	6	0
Stewart Avenue	0	0	0
Telford Street	32	0	0
Watt Street	3	0	0
Worth Place	3	0	0
Total	**650**	**32**	**48**

Source: GHD surveys October and November 2015

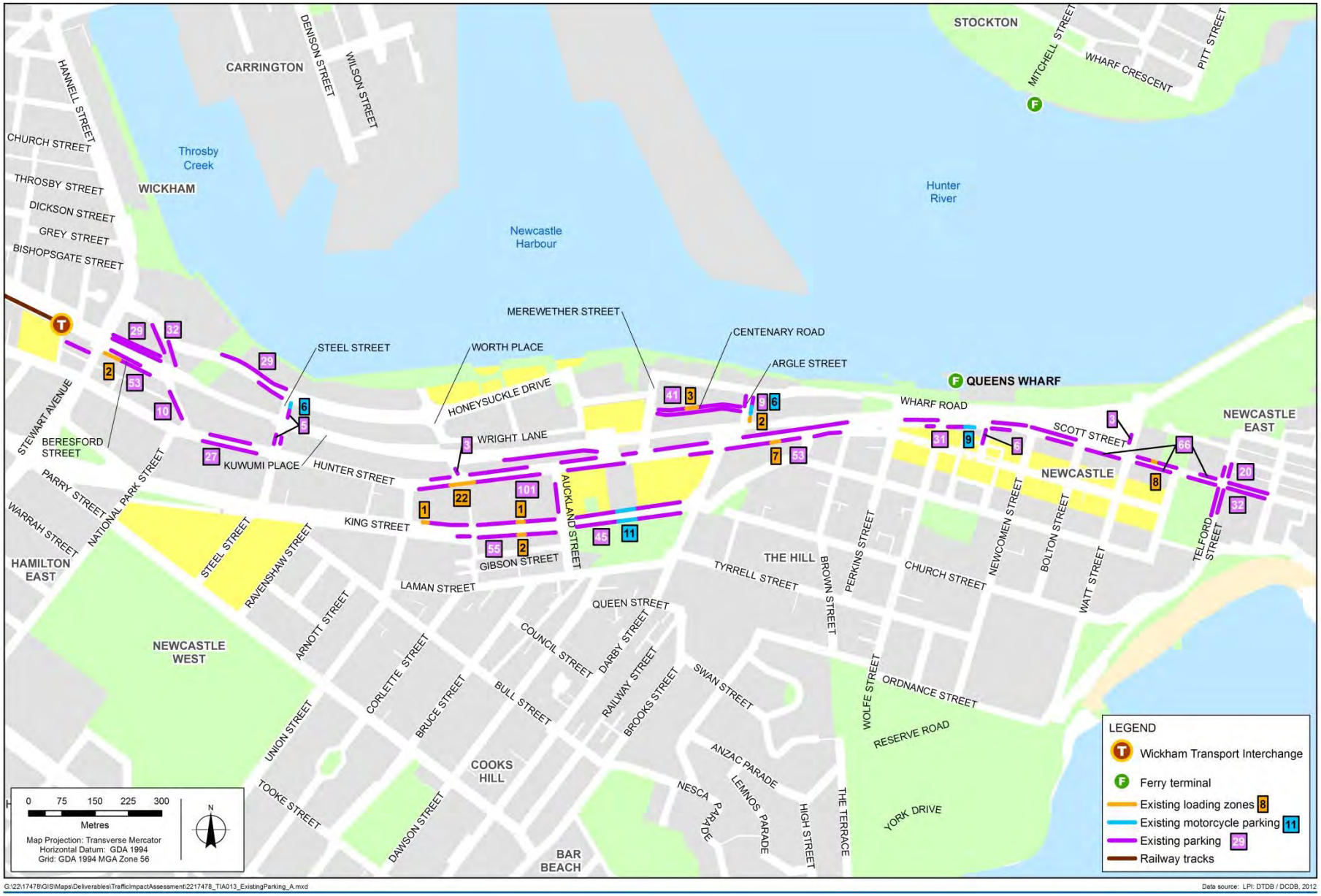


Figure 2-4 Existing on-street parking and loading zones within the study area

2.4 Other transport modes

2.4.1 Bus network

The local and regional bus network in Newcastle is currently provided by five bus operators, namely Newcastle Buses and Ferries (State Transit Authority), Port Stephens Coaches, Hunter Valley Buses, Rover Coaches and Busways. Interstate coaches that stop in Newcastle are operated by Greyhound Australia, Sidd Fogg's and Premier Motor Services. The existing bus network with the bus stops is shown in Figure 2-5. All bus routes and coach services terminate at the Newcastle bus interchange.

Newcastle Buses

Newcastle Buses is operated by the State Transit Authority (NSW Government) and runs bus services throughout Newcastle and Lake Macquarie. There are over 7,000 regular services each week and 1,400 school bus services.

Thirty bus routes currently use Hunter Street to terminate at the Newcastle bus interchange, which is located adjacent to Newcastle Station with access via Watt Street and Wharf Road. A total of ten bus stops exist in each direction along Hunter Street and Scott Street between the Wickham Transport Interchange west of Stewart Avenue and the Newcastle bus interchange in Watt Street.

Regional buses and interstate coaches

The regional buses in Newcastle provide a valuable transport link to communities in the greater Hunter, Port Stephens and Mid-North Coast regions. The interstate coaches run by Greyhound Australia use Newcastle as a stop on their Sydney to Brisbane routes. These services operate from four bus and coach stands at the Newcastle bus interchange. A summary of the number of weekday and AM peak hour (7:30 am to 8:30 am) bus and coach services operated by each company from the Newcastle bus interchange is shown in Table 2-8.

Table 2-8 Weekday regional bus and interstate coach services

Operator	AM peak in	AM peak out	24 hour in	24 hour out
Port Stephens Coaches	3	3	18	18
Hunter Valley Buses	3	3	27	27
Rover Coaches	1	1	4	4
Busways	1	1	4	4
Greyhound Australia	0	0	5	5
Premier Motor Coaches	0	0	1	1
Total	**8**	**8**	**61**	**61**

Source: Bus timetables October 2015

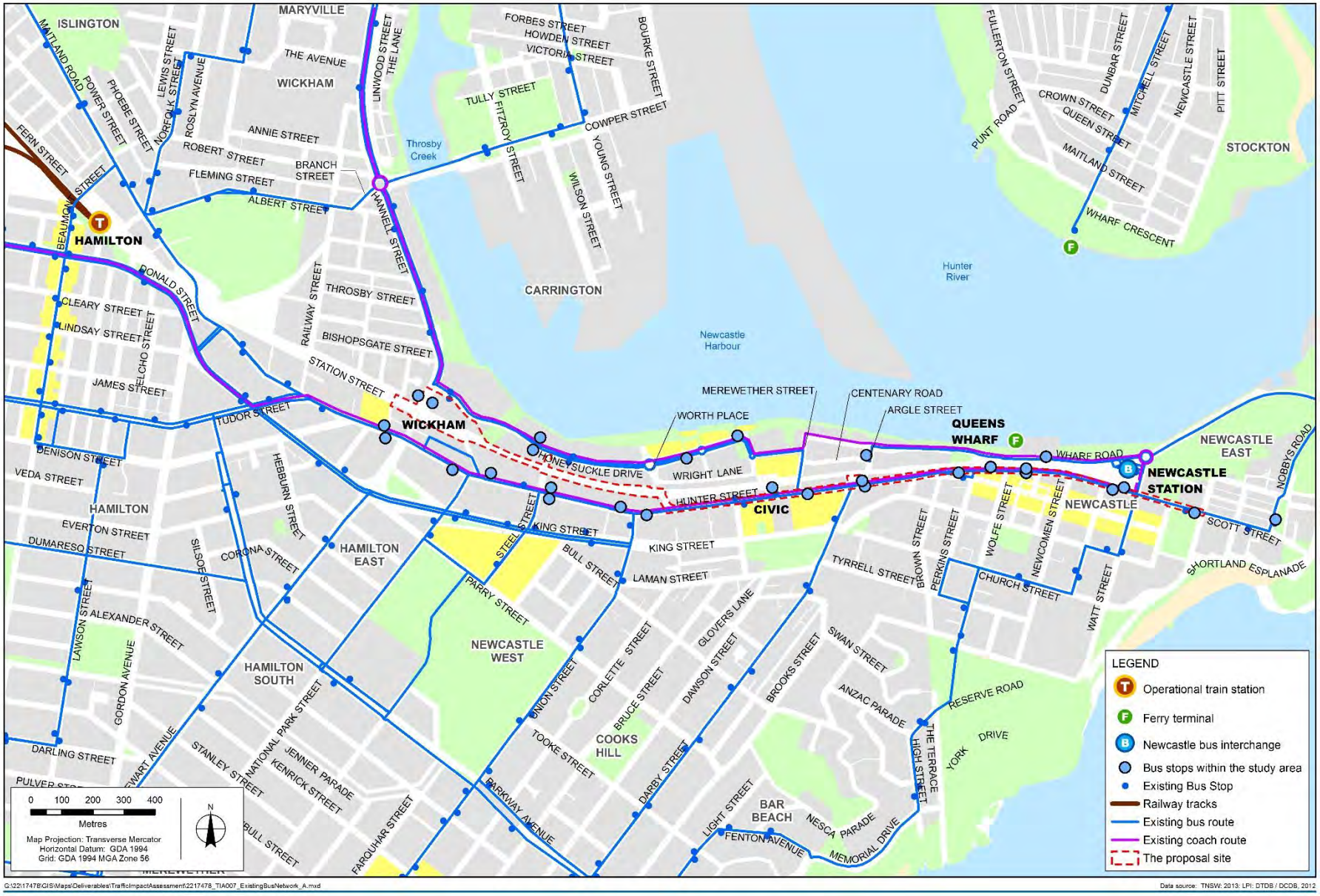


Figure 2-5 Existing bus routes and stops within the study area

The existing number of peak hour bus movements in each direction along Hunter Street and Scott Street are shown in Figure 2-6, based on the bus and coach timetables in October 2015. The maximum number of buses in Hunter Street and Scott Street in the peak hour is east of Darby Street and at the bus interchange with a total of 46 buses per hour.

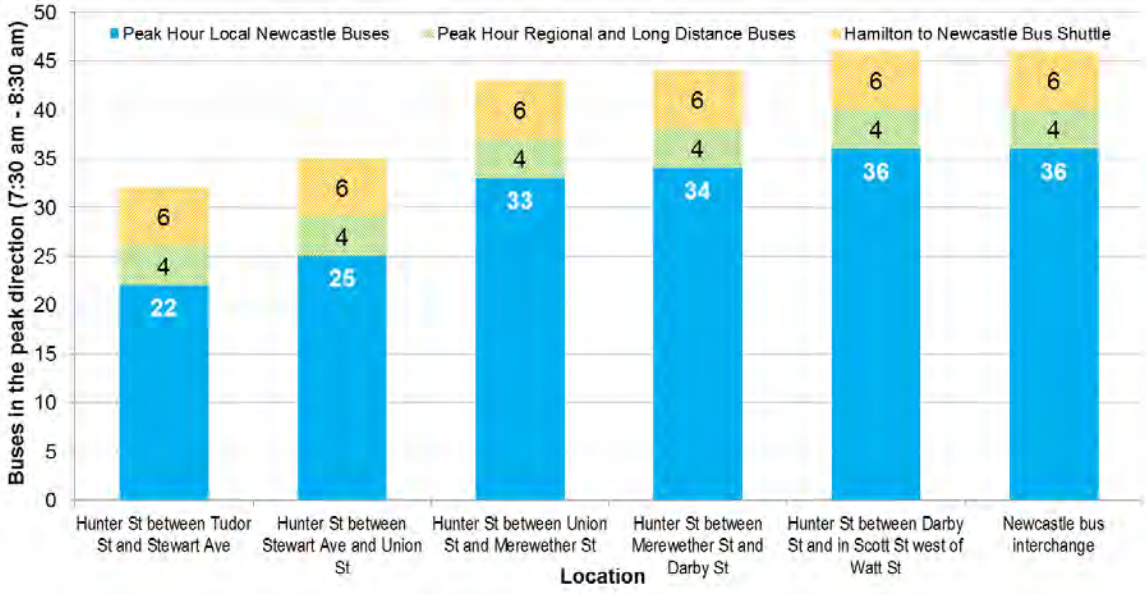


Figure 2-6 Existing peak hour bus movements in the city centre

1.1.1 Train services

The closest train station to the city centre is Hamilton Station with access via Beaumont Street. A shuttle bus services operates between Newcastle and Hamilton stations to meet all arriving and departing trains from the Sydney/Central Coast Line and the Hunter Line. The shuttle bus operates via Hunter Street and Maitland Road in the westbound direction and Beaumont Street, Donald Street, Tudor Street and Hunter Street in the eastbound direction.

2.4.2 Pedestrians

Pedestrian movements in and around the study area consists of three main groups:

- City workers and shoppers walking to and from their parked cars.
- Visitors and workers to the city centre from bus stops.
- Residents.

North–south crossings

The existing north-south pedestrian crossings between Honeysuckle Drive, Workshop Way and Wharf Road and Hunter Street and Scott Street are shown in Figure 2-7. This comprises six overbridges and eight at-grade crossings of the former railway corridor and two at-grade crossings of Scott Street east of Newcastle Station.

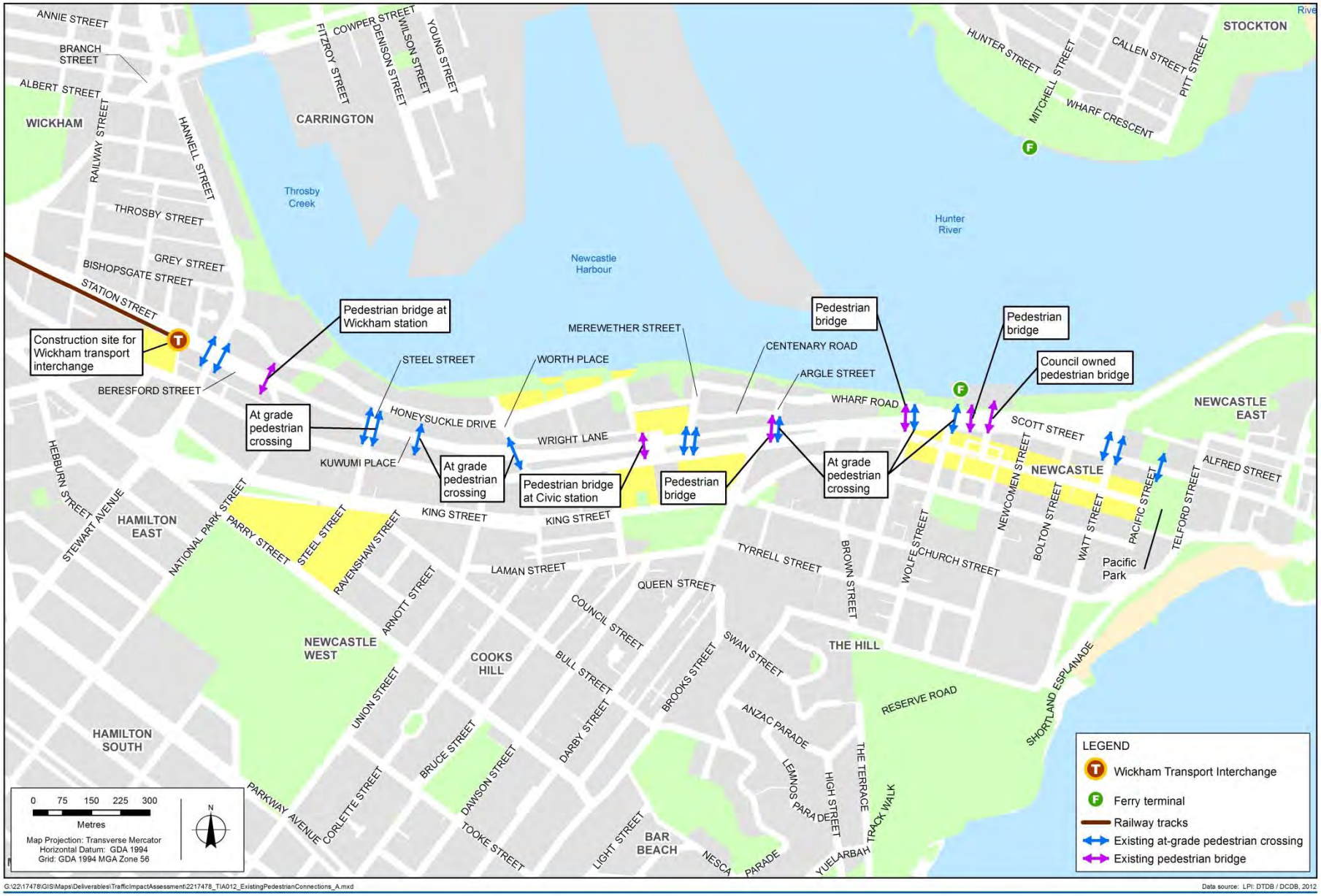


Figure 2-7 Existing north-south pedestrian crossings within the study area

The eight at-grade pedestrian crossings of the former railway are located at:

- Stewart Avenue (east and west sides)
- Steel Street (east and west sides)
- Kuwumi Place
- Worth Place (west side only)
- Merewether Street (east and west sides)
- Argyle Street
- Perkins Street
- Wolfe Street.

The other two at-grade crossings are of Scott Street at:

- Watt Street (east and wide sides)
- Pacific Street (east side only)

The six pedestrian overbridges of the former railway corridor are located at:

- Former Wickham Station at Bellevue Street
- Former Civic Station
- Argyle Street
- Perkins Street
- Wolfe Street
- Market Street which is owned by Council.

East-west crossings

East-west crossings for pedestrians are located at:

- Stewart Avenue/Hunter Street
- Hannell Street/Honeysuckle Drive

Access along the proposal

Existing pedestrian access along the proposal site is provided by the footpaths on the following local streets:

- Beresford Street on the south side east of Stewart Avenue
- Northern and southern sides of Hunter Street between Worth Place and Scott Street
- Northern and southern sides of Scott Street between Perkins Street and Telford Street

2.4.3 Cyclists

Bicycle infrastructure in the form of on-road bicycle lanes exists along the following streets in the proposal study area:

- A narrow, bicyclist lane (about 0.5 metres wide) is provided on Stewart Avenue/Hannell Street between Hunter Street and Honeysuckle Drive. However due to its narrow nature and the large traffic volumes on this road, it is not highly utilised.
- North of Honeysuckle Drive in Hannell Street, the bicycle infrastructure is via a foreshore shared path on the eastern side of Hannell Street.
- On-road bicycle lanes are on both sides of Honeysuckle Drive between Hannell Street and Workshop Way.
- On-road mixed traffic environment on both sides of Workshop Way.
- An on-road mixed traffic environment is on the western side of Merewether Street north of the railway corridor.
- On-road bicycle lanes are on both sides of King Street between Stewart Avenue and Darby Street.
- On-road bicycle lanes in Auckland Street south of Hunter Street as part of the cycle route to the Fernleigh Track.
- A dedicated off-road shared pedestrian and cyclist path exists along the foreshore between Hannell Street and Wharf Road. It passes through the Honeysuckle restaurant and residential precinct.

Cyclists are permitted to use all of the new pedestrian crossings that were opened in 2015 at:

- Steel Street between Honeysuckle Drive and Hunter Street
- Kuwumi Place between Honeysuckle Drive and Hunter Street
- Worth Place between Wright Lane and Hunter Street
- Argyle Street between Centenary Road and Hunter Street
- Perkins Street between Wharf Road and Scott Street
- Wolfe Street between Wharf Road and Scott Street

3. Proposed development

3.1 Operation phase

This section describes the detailed changes to the transport infrastructure and services required for the proposal including:

- Light rail system and stops.
- Bus network changes for the scheduled local bus routes and regional coaches, including removal, relocation and new bus stops.
- Taxi and kiss and ride facilities.
- On-street parking requirements.
- New road and pedestrian connections across the railway corridor.

Further information on the proposal is provided in the main volume of the REF (refer section 6 and 7).

3.1.1 Light rail infrastructure

Track alignment and layout

The light rail corridor would be configured in three different ways, depending on the location:

- Segregated running:
  - In the existing rail corridor where there is no interaction between the proposal and road traffic other than at designated intersections (about 600 metres long).
  - In the vicinity of the Pacific Park stop - between the intersection of Scott Street and Pacific Street, and the terminus located near the intersection of Scott Street and Telford Street (about 60 metres).
- Separated running:
  - Along Beresford Street where the light rail corridor would run along the northern lane adjacent to a one-way traffic lane (about 140 metres).
  - Along Hunter Street where the light rail corridor would run along the two centre lanes adjacent to traffic lanes (about 1,300 metres).
- Shared running along Scott Street where the light rail corridor would run along the traffic lanes with road traffic (about 300 metres).

Light rail stops

Six light rail stops are proposed as listed in Table 3-1. The spacing of the stops ranges from about 400 to 650 metres. The stop names are indicative only at this stage. The final stop names would be determined in consultation with the Geographical Names Board of NSW.

Table 3-1 Proposed light rail stops

Stop	Type of stop	Location of stop	Pedestrian access to stop
Wickham Interchange	Single side platform	Located on the northern side of Beresford Street on the southern side of the Wickham Transport Interchange.	Footpath access from Stewart Avenue
Honeysuckle	Two side platforms	Located within the heavy rail corridor on either side of the two tracks, to the east of the pedestrian crossing at Kuwumi Place.	From the Kuwumi Place pedestrian crossing
Civic	Staggered stops on either side of Hunter Street	Located between the two tracks in Hunter Street, east of Auckland Street. Located to the north of the Newcastle University CBD campus.	Signalised pedestrian crossing at one end of each platform
Crown Street	Single island platform	Located between the two tracks within Hunter Street, to the east of Crown Street.	Signalised pedestrian crossing at one end of the platform
Market Street	Single island platform	Located between the two tracks within Scott Street, to the east of Market Street.	Signalised pedestrian crossing at one end of the platform
Pacific Park	Single side platform	Located on the southern side of the single track section in Scott Street, on the southern side of the street, adjacent to Pacific Park.	Footpath access from Scott Street at Pacific Street with a new traffic signal and Pacific Park

Light rail demand forecasts

Current passenger forecasts for 2021 and 2036 are summarised in Table 3-2 as provided in the *Newcastle City Centre Traffic Model Assumptions Book* (TfNSW, 2015). The urban renewal activities being undertaken as part of the *Newcastle Urban Renewal Strategy* will increase the resident and employee population in the study area, which would ultimately support the increase in forecast patronage.

Table 3-2 Light rail patronage forecasts

Year	Passengers per hour
2021	300 to 430
2036	370 to 530

Source: PB/Aurecon, 2014

Light rail vehicles

A fleet of five one-car vehicles would operate along the route, with four vehicles operating and one spare vehicle available for use if required and/or to rotate into service during scheduled maintenance activities. The vehicles would be procured using proven ‘off the shelf’-type designs, similar to those operating in Sydney along the Inner West Light Rail route. The vehicles would have a standard low-floor design with overhead traction power. Each vehicle would be equipped with modern passenger surveillance and communication systems. They would have full disability access provisions and would incorporate heating and air conditioning.

Hours of operation

The proposal would operate from about 5 am until 1 am the following morning, seven days per week. The minimum service headways would be 10 minutes from 7 am to 7 pm on weekdays. Minimum service headways at other times are provided in Table 3-3. During peak hours or special events, it may be necessary to operate a higher frequency service to coordinate light rail services with heavy rail services and/or to match peak passenger demand.

Table 3-3 Minimum service headways

Time period	Monday to Friday	Saturday	Sunday	Public holiday
Midnight to 1 am	30 mins	30 mins	30 mins	30 mins
1 am to 5 am	Nil	Nil	Nil	Nil
5 am to 7 am	15 mins	30 mins	30 mins	30 mins
7 am to 7 pm	10 mins	15 mins	15 mins	15 mins
7 pm to midnight	15 mins	15 mins	30 mins	30 mins

Ticketing and passenger information

The Opal card electronic ticketing system will be utilised for the proposal. Opal card top-up machines would be installed at selected stops determined during detailed design.

Validators for the Opal card system would be located at stops and passengers would be required to validate their card before boarding and alighting the light rail vehicles.

3.1.2 Maintenance

Track and stops

Maintenance would be required at times along the light rail corridor. Maintenance activities would include:

- Regular activities such as track and overhead wiring inspections, and inspection and cleaning of the track drainage system.
- Preventative maintenance and minor repairs to infrastructure components as required.
- Cleaning of light rail stops and passenger facilities.
- Track maintenance and periodic replacement of track and other light rail infrastructure.
- Tamping of track ballast where not within the roadway.

Depot maintenance activities

Maintenance activities undertaken at the depot would include:

- Vehicle cleaning
- Daily service inspections
- Running repairs
- Unscheduled maintenance
- Component change outs

3.1.3 Road and transport infrastructure works

In order to accommodate the proposal, a number of modifications to the existing road network and associated infrastructure are required. The proposed road network changes are described in Table 3-4 and the proposed intersection/road configuration arrangements are described in Table 3-5. The proposed changes to the road network and intersections are shown in Figure 3-1.

Table 3-4 Proposed road configuration changes

Location	Existing arrangements	Proposed arrangements	Physical works required
Beresford Street			
West of Stewart Avenue	Two lane two way	Closed to traffic in both directions for light rail tracks.	Reconfigure roadway for light rail tracks and single side platform that is part of the interchange.
Stewart Avenue to Bellevue Street	Two lane two way	One way for westbound through traffic, with parking and property access retained to the south.	Reconfigure for two light rail tracks and one-lane westbound roadway.
Hunter Street			
Union Street to Worth Place	Eastbound – two lanes with parking Westbound – two lanes through traffic with parking and a bus zone, widening to two through lanes with a left turn lane on approach to Union Street.	Eastbound – one lane with a widened median and area for parking A left in left out lane would be provided to allow rear access to private properties Westbound – one through lane with parking, widening beyond the intersection to two lanes with a left turn to Union Street Parking would be retained east of the Union Street intersection.	Reconfigure roadway for light rail tracks.
Worth Place to Auckland Street	Four lane two-way with parking on both sides of road.	One lane in each direction, with parking on the northern side of the road removed	Reconfigure roadway for light rail tracks.
Auckland Street to Merewether Street	Four lane two-way with parking on both sides of the road.	One lane in each direction, with parking on both sides of the road removed A dedicated left turning lane would be provided on the eastbound approach to the Merewether Street intersection.	Reconfigure roadway for light rail tracks.
Merewether Street to Darby Street	Four lane two-way with parking on both sides of the road.	One lane in each direction, with parking on the southern side of the road removed A dedicated right turning lane would be provided on the westbound approach to the Merewether Street intersection. A dedicated right turning lane would be provided on the eastbound approach to the Darby Street intersection.	Reconfigure roadway for light rail tracks.

Location	Existing arrangements	Proposed arrangements	Physical works required
Darby Street to Brown Street	Four lane two-way with parking on both sides of the road.	One lane in each direction, with the majority of parking on the northern side of the road removed.	Reconfigure roadway for light rail tracks.
King Street			
Union Street to Darby Street	Two-lane two-way roadway with on-street car and motorcycle parking and loading zones.	Provide two lanes for traffic on weekdays in the eastbound direction before 9 am and in the westbound direction between 5 and 6 pm. Implement a 'No Stopping' zone west of Darby Street and reconfigure the pedestrian crossing. Alternative spaces for the all-day motorcycle parking and affected loading zone will need to be created.	Replace the pedestrian crossing at Civic Park with a traffic signal.
Scott Street			
Brown Street to Wolfe Street	Four lane two-way with a small area of parking on the southern side of the road (immediately west of Wolf Street).	Eastbound – one through lane Westbound – one shared running through lane with parking on the southern side of the road removed.	Reconfigure roadway for light rail tracks.
Wolfe Street to Newcomen Street	Eastbound – two through lanes narrowing to one through lane with parking at Market Street. Westbound – one through lane with parking on the southern side of the road.	Eastbound – one through lane West – one shared running through lane with parking on the southern side of the road removed.	Reconfigure roadway with changes to on-street parking.
Newcomen Street to Watt Street	Newcomen Street to Bolton Street - one lane in each direction with parking on both sides of the road. Bolton Street to Watt Street – two lanes in each direction	One shared running through lane in each direction with parking removed on both sides of the road.	Reconfigure roadway with no on-street parking.
Watt Street to Pacific Street	One lane in each direction with some parking on both sides of the road.	One shared running through lane in each direction with parking removed on both sides of the road.	Reconfigure roadway with no on-street parking.
Pacific Street to Telford Street	One lane in each direction with some parking on both sides of the road.	Eastbound – one through lane with parking to the north to be removed. Westbound – one through lane with parking to the south removed.	Reconfigure roadway with no on-street parking.

Location	Existing arrangements	Proposed arrangements	Physical works required
Steel Street			
Hunter Street to Honeysuckle Drive	Pedestrian crossing between Scott Street and Wharf Road.	Provide new two-lane, two-way road connection.	Construct new roadway with footpaths.
Worth Place			
Hunter Street to Honeysuckle Drive	Pedestrian crossing between Scott Street and Wharf Road	Provide new two-lane, two-way road connection.	Construct new roadway with footpaths

Table 3-5 Proposed intersection changes

Location	Existing arrangements	Proposed arrangements	Physical works required
Stewart Avenue and Beresford Street	Give way controlled intersection with priority given to Stewart Avenue	Traffic signals on Stewart Avenue at Beresford Street to allow safe crossing of Stewart Avenue by the light rail vehicles	Install new traffic signals
Darby Street and King Street	Signalised intersection	Northbound left turn slip lane with existing southbound left turn slip lane from Darby Street to King Street	Install northbound left turn slip lane
Steel Street and existing heavy rail line	No existing road intersection; pedestrian crossing only	New traffic signals at the intersection of Steel Street and the light rail track	Install new traffic signals
Honeysuckle Drive and Steel Street	T-junction with a cul-de-sac access in Steel Street north of the railway corridor; local pedestrian access in Steel Street between Hunter Street and Honeysuckle Drive	New traffic signals at Steel Street connection with Honeysuckle Drive Right turns banned for traffic turning from Honeysuckle Drive into Steel Street	Construct new left-in, left out intersection with a right turn movement from Steel Street into Honeysuckle Drive
Honeysuckle Drive and Stewart Avenue	T-junction with traffic signal controls	Relocation of power pole to widen Honeysuckle Drive to provide additional left turn lane capacity for southbound traffic	Extended left turn lane
Hunter Street and Worth Place	T-intersection with a cul-de-sac access in Worth Place between the railway corridor and Hunter Street; Local pedestrian access in Worth Place between Hunter Street and Honeysuckle Drive	New traffic signals at the Hunter Street/Worth Place for light rail vehicles to connect with Hunter Street Worth Place would open to general traffic and would function as a left-in, left out intersection with Hunter Street	Construct a new T-intersection with traffic lanes immediately east of the light rail tracks and install a new traffic signal
Hunter Street near Wheeler place	Local access to businesses	A new pedestrian crossing of Hunter Street west of Wheeler Place	This is included with the construction of the light rail platform at the Civic stop
Hunter Street at Crown Street	Local access to businesses	A new pedestrian crossing of Hunter Street at Crown Street	This is included with the construction of

Location	Existing arrangements	Proposed arrangements	Physical works required
			the light rail platform at the Crown Street stop
Scott Street at Market Street	Local access to businesses	A new pedestrian crossing of Scott Street at Market Street	This is included with the construction of the light rail platform at the Market Street stop
Scott Street at Newcomen Steet	Give way controlled intersection with priority given to Scott Street	New traffic signals to coordinate change over from separated running to mixed running for eastbound traffic.	Install new traffic signals
Pacific Street and Scott Street	Give way controlled intersection with priority given to Scott Street	New traffic signals at the Scott Street/Pacific Street intersection to facilitate northbound left turning and eastbound right turning light rail vehicles accessing the eastern terminus at Pacific Park	This is included with the construction of the light rail platform at the Pacific Park stop

Figure 3-1 Proposed road and intersection changes

3.1.4 Bus routes and stops

Bus routes

All of the existing bus routes in the city centre operate along Hunter Street east of Darby Street and Scott Street. Most local and regional buses and coaches terminate at the Newcastle bus interchange at Newcastle Station. However, two routes terminate at Parnell Place (Routes 104 and 222) and Route 201 terminates at Marketown. An indicative restructured bus network was used for the purposes of defining the proposal and to assess the transport and traffic impacts of the proposal. TfNSW is undertaking more detailed planning to refine the bus network with the details to be released publicly before proposal commencement to enable timely communication of the changes to customers.

Bus stops

A detailed bus stop inventory and review of all of the bus stops in the study area affected by the proposal is provided in Appendix B. In summary, the bus stop changes include:

- Removal of ten existing bus stops along Hunter and Scott streets.
- Installation of four new stops in Watt Street, Wharf Road (two stops) and Centenary Road.

The proposal involves the removal of existing stops at:

- The southern side of Scott Street west of Telford Street on the northern side of Pacific Park where the light rail terminus would be located.
- Both sides of Scott Street west of Market Street.
- Both sides of Scott Street west of Watt Street.
- The northern side of Honeysuckle Drive north of Workshop Way as the local bus route may be rerouted via Worth Place to Hunter Street for selected eastbound services.
- The southern side of Honeysuckle Drive east of Worth Place as the local bus route may be reroute via Hunter Street and Steel Street for selected westbound services.
- The northern side of Centenary Road west of Argyle Street.
- The southern side of Hunter Street east of Merewether Street.
- The northern side of Hunter Street east of Auckland Street.

The bus stop on the northern side of Scott Street west of Wolfe Street would be relocated immediately west of Perkins Street to be opposite the westbound bus stop in Scott Street to avoid the area required for the light rail stop at Market Street.

New stops would be provided at:

- Both sides of Watt Street north of Scott Street at the former Newcastle Station.
- Both sides of Wharf Road east of Nobbys Road to service Nobbys Beach.
- The northern side of Wharf Road at Queens Wharf ferry terminal.

3.1.5 Pedestrian access and crossing arrangements

Pedestrian access to the light rail platforms and bus stops would be provided. Pedestrian crossings were recently constructed across the heavy rail corridor at Steel Street, Kuwumi Place, Worth Place, Argyle Street, Perkins Street and Wolfe Street. These would continue to be used following construction of the proposal. New pedestrian access/road crossings to be provided are listed in Table 3-6.

Table 3-6 Proposed pedestrian crossings and access to stops

Location	Proposed pedestrian access arrangements	Physical works required
Stewart Avenue	A signalised light rail vehicle crossing with pedestrian controls on the western and eastern sides of Stewart Avenue where the proposal crosses the street south of the Wickham Transport Interchange. East-west pedestrian access across Stewart Avenue would not be allowed at the light rail tracks; north-south movements would be allowed via the eastern and western footpaths. Pedestrians crossing Stewart Avenue must walk to the safe signalised crossings at Stewart Avenue/Hunter Street and Stewart Avenue/ Honeysuckle Drive.	Install new signals with controls on north-south pedestrian movements
Steel Street	The existing pedestrian crossing over the rail corridor between Honeysuckle Drive and Steel Street would be signalised where it crosses the light rail corridor.	Install new signals
Worth Place	A signalised pedestrian crossing of Hunter Street would be provided on the western side of Worth Place as part of the new signalised intersection at Worth Place. No signalised crossing is proposed on the eastern side of Worth Place as it would conflict with light rail movements.	Works undertaken as part of intersection modification works
Hunter Street	A signalised pedestrian crossing of Hunter Street would be provided to the west of Wheeler Place.	Install new signals
Crown Street	A new signalised pedestrian crossing of Hunter Street would be provided as part of the construction of the Crown Street stop.	Road marking and new signals installed as part of the stop platform works
Newcomen Street	Two signalised crossings of Scott Street would be provided on either side of the Newcomen Street intersection as part of the new signalised intersection.	Works undertaken as part of intersection modification works
Market Street	A new signalised pedestrian crossing of Scott Street would be provided as part of the construction of the Market Street stop.	Road marking and new signals installed as part of the stop platform works
Pacific Park	A new signalised pedestrian crossing would be provided as part of proposed Pacific Street signalised intersection.	Works undertaken as part of intersection modification works

Pedestrian overbridges to be removed as part of the proposal are located at:

- Former Wickham Station at Bellevue Street
- Market Street

3.2 Construction phase

3.2.1 Indicative construction methodology

The following outline of construction for the proposal was used as the basis for the impact assessment (Aquenta, 2014). Should the proposed methodology change following appointment of a construction contractor, additional impact assessment, approvals and mitigation may be required.

The proposal would be built using four construction zones as shown in Figure 3-2:

- Zone 1 from the Wickham Transport Interchange, including Beresford Street, the light rail depot site, and the railway corridor to Worth Place. This includes the connection of Steel Street between Hunter Street and Honeysuckle Drive and the new T-intersection at Steel Street/Honeysuckle Drive.
- Zone 2 from Hunter Street at Worth Place to Darby Street.
- Zone 3 from Hunter Street at Darby Street to Scott Street at Wolfe Street.
- Zone 4 from Scott Street at Wolfe Street to Pacific Park in Scott Street at Telford Street.

Construction works would progress generally from west to east, along one side of the road and then the other in all four zones concurrently, with 24 hour access to be maintained for any emergency services access/ provision. A maximum length of 100 metres of roadway would be occupied in any one zone.

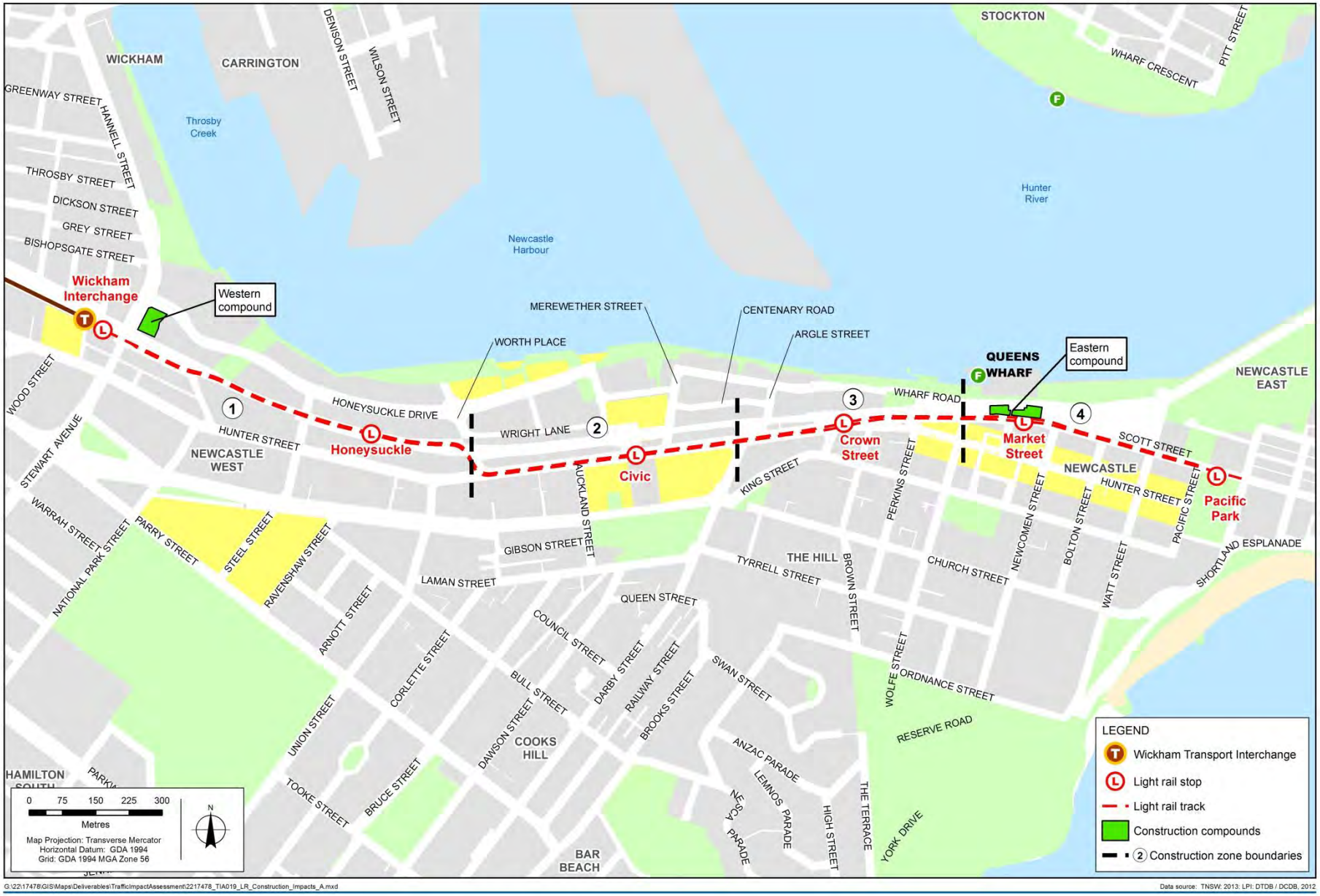


Figure 3-2 Construction zones and site compounds during construction

3.2.2 Assessment assumptions

The following key assumptions were applied for the impact assessment undertaken in section 5.2:

- Night works would occur between 10 pm to 5 am up to a maximum of two nights sequentially per week in accordance with the TfNSW *Construction Noise Strategy* for minor intersections, utility works, and other minor works. Additional night works would include indicative two by three day periods to test and commission the light rail vehicles and to verify the traffic signal operations.
- Weekend closures for intersections would occur between 10 pm Friday night to 5 am Monday for major intersections, overhead wiring, and other works. This would include Stewart Avenue, Darby Street, Merewether and Watt Streets.
- Where works span more than one road lane, the works affecting the inside lane would be completed first and then the outside lane. A single 3.2 metre road lane would be provided at all times in each direction to maintain traffic flows. Trucks are limited to bogies to minimise traffic impacts. Progress is expected to be about 50 metres per month in each zone.
- The major roads crossing Scott Street would remain operational and when works are required across the intersection, these works would be undertaken during pre-programmed weekend closures, one intersection at a time. Existing minor T-intersections and laneways providing local access have been assumed to be either closed or converted to left-in left-out access during the works.
- Traffic systems, rail systems integration and some civil works at intersections would be undertaken during weeknight or weekend shutdowns assuming that full access is available. Works unable to be completed in the one shutdown would be ready for general public access for the following morning and the works completed on the following night/weekend.
- Where parking is being removed for construction works and it is not intended to be replaced following commencement of operations, it would remain removed for the remainder of the construction period.
- Temporary relocations of bus stops may be necessary to avoid work site locations i.e. they might move 50 metres east or west at a time. Where a bus stop would be permanently relocated following commencement of operations, it would be moved at the time of construction and not replaced to the former location.
- Steel Street and Worth Place would remain closed to general traffic for the duration of the construction works. Pedestrian and cyclist movements would remain open and controlled through site supervision.
- Most workers would drive to the main site compound at Wickham and park their cars in the temporary construction staff car park. Construction workers would then be transferred along the route (or walk) to other sites by the contractor.

4. Traffic modelling approach

This section describes the traffic modelling used to determine the impacts of the proposal on the road network based on the assumptions provides in section 3.2.2.

4.1 Background to the microsimulation traffic model

In 2014, GHD was commissioned by TfNSW to update a 2009 microsimulation traffic model for the Newcastle city centre. The extent area of the road network used in the city centre traffic model is shown in Figure 4-1 and is bounded by:

- Samdon Street in Hamilton to the west
- Parkway Avenue to the south
- Shortland Esplanade in Newcastle East to the east
- Cowper Street north to the north

The updated model was calibrated and validated according to the methodology set out in the Roads and Maritime *Traffic Modelling Guidelines, 2013.* A Calibration and Validation Report (GHD, 2014) was prepared to explain the process undertaken to develop the microsimulation model used as part of the previous assessment.

The update was extensive and included information from traffic surveys undertaken by SkyHigh in June 2014. Other significant changes to the road network have occurred since the model was previously developed in 2009 and these were also incorporated into the update including:

- Truncation of the heavy rail line at Hamilton Station.
- Removal of the heavy rail level crossings at Stewart Avenue, Railway Street and Merewether Street.

Four intersections in the Wickham and Newcastle West area were also modified to improve traffic flow. These intersections were:

- Stewart Avenue and Hunter Street
- Stewart Avenue and King Street/Parry Street
- Tudor Street and Parry Street
- Tudor Street and Hunter Street

In order to determine the changes to the traffic conditions and to confirm the previous modelling with the changes resulting from the Wickham Transport Interchange project, the previous modelling was reviewed in consultation with technical staff from TfNSW, Roads and Maritime in Newcastle and Council. The review included:

- Comparing the intersection arrangements modelled before the heavy rail truncation to the actual arrangements installed on site.
- Confirming the redistribution of traffic through new traffic counts, at selected intersections, undertaken in March 2015.
- Review and approval of the base model by Roads and Maritime.

Figure 4-1 Extent of Newcastle city centre microsimulation traffic model

Through meetings with Roads and Maritime, GHD and TfNSW, the changes between the post-truncation model developed in 2014 and the traffic surveys were resolved to be from:

- Seasonal traffic trends and background traffic growth.
- Mode shift.
- Induced traffic demand from the Hunter Expressway ramp upgrade.

The base model was adjusted to account for these changes in traffic conditions and was calibrated based on traffic surveys undertaken in March 2015. The process for adjusting the Newcastle city centre microsimulation model was agreed with Roads and Maritime. This updated model formed the basis for identifying the potential traffic impacts of the proposal.

4.2 Traffic modelling scenarios and assumptions

Three broad scenarios were tested in the traffic model to assess the traffic impacts for the construction and operation of the proposal.

- 2015 representing the existing (baseline) conditions.
- 2018 which is the assumed date for the opening of the proposal.
- 2028 which is the ten year horizon following opening of the proposal and including additional population growth and urban development as a result of the NUTTP by UrbanGrowth NSW.

Both traffic impact assessment scenarios were investigated with and without proposal operation to identify changes which would occur as a result of other factors and therefore to more accurately identify the impacts associated with the proposal.

The analysis was based on traffic modelling assumptions agreed between the key government stakeholders in an Assumptions Book (TfNSW, 2015). These assumptions were used in the development of the traffic model that confirmed the performance of the existing road network and determined the traffic impacts from the proposal. The traffic model was developed with assumptions regarding the following aspects, each of which is described in the following sections:

- The road network with new changes to road connections and intersections that are part of the proposal.
- The road connection at Wolfe Street between Wharf Road and Scott Street which is a project by UrbanGrowth NSW and it is not part of the proposal.
- The route choice through the model with the opening of new streets.
- The public transport system, including the heavy rail services terminating at Hamilton or Wickham and the bus network before and after proposal commencement.
- The light rail alignment and stop locations.
- The pedestrian network.
- The cycling network.

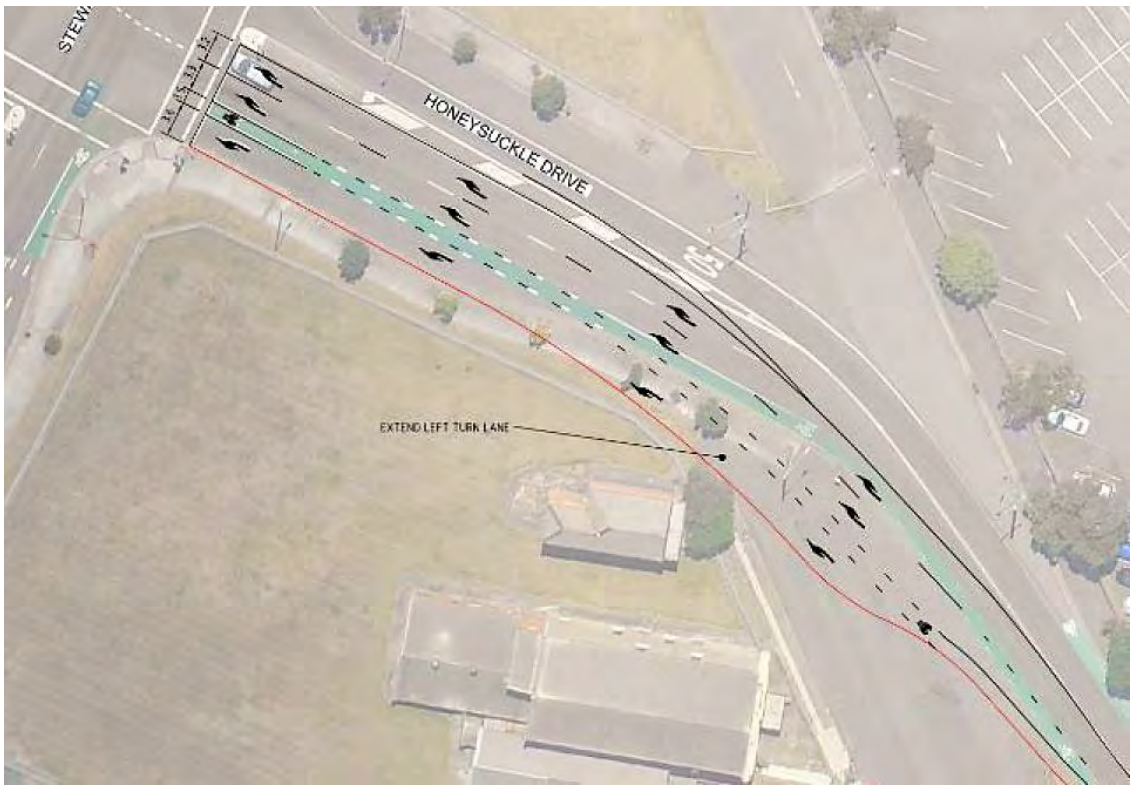
4.2.1 Road network changes and staging

The assumptions for the stages of road network changes used for the traffic modelling scenarios are detailed in Table 4-1.

Table 4-1 Road network changes and staging assumptions

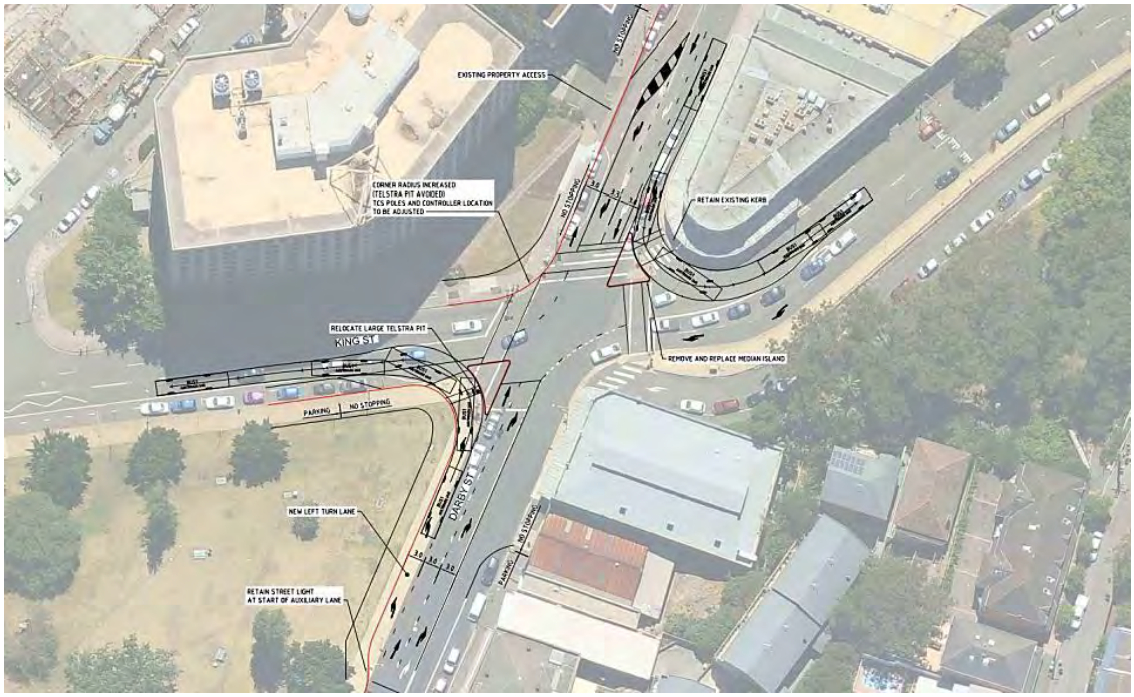
During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2015 to 2018	When proposal is operational in 2018
Current (2015) road network	• Steel Street open for traffic between Honeysuckle Drive and Hunter Street with left in and left out movements at Honeysuckle Drive • Worth Place open for traffic between Wright Lane and Hunter Street	New road connections across the rail corridor at: • Steel Street • Worth Place • Wolfe Street to be provided by UrbanGrowth NSW Road configuration: • Existing rail corridor west of Worth Place • Separated single lane of traffic in Hunter Street • Shared single lane for traffic and light rail vehicles in Scott Street • 'No Stopping' zones in the peak directions on King Street between Darby Street and Union Street eastbound in the AM peak period and westbound in the PM peak period Intersection upgrades: • Extended storage for left turning vehicles westbound on Honeysuckle Drive at Stewart Avenue as shown in Figure 4-2 • Dedicated right turn lane at Darby Street westbound on King Street and a dedicated right turn lane and new left turn slip lane at Darby Street eastbound on King Street as shown in Figure 4-3

Source: PB, October 2015



Source: PB, October 2015

Figure 4-2 Extended left turn lane in Honeysuckle Drive at Stewart Avenue



Source: PB, October 2015

Figure 4-3 Left turn lane slip lanes at King Street and Darby Street

4.2.2 Train services

The assumptions for the staged changes to the train services used for the traffic modelling are detailed in Table 4-2.

Table 4-2 Train service changes and staging assumptions

During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2016 to 2018	When proposal is operational in 2018
• Terminate at Hamilton • No change in service frequency • Train timetable as specified in 5 January 2015	• Terminate at Wickham Transport Interchange • No change in service frequency • New train timetable with opening of the Wickham Transport Interchange	• Terminate at Wickham Transport Interchange • No change in service frequency • New train timetable with opening of the Wickham Transport Interchange

Source: Transport Services and Infrastructure Division, TfNSW

4.2.3 Bus services

The assumptions for the staged changes to bus services used in the traffic modelling are detailed in Table 4-3.

Table 4-3 Bus service changes and staging assumptions

During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2015 to 2018	When proposal is operational in 2018
No change to current (2015) bus operations	• Existing Newcastle bus network maintained with no changes to routes or service frequencies • Operate Wickham to Newcastle shuttle bus service via Hunter Street and Wharf Road to avoid the construction in Scott Street	• Implement the revised city centre bus plan

Source: Transport Services and Infrastructure Division of TfNSW, Bus Plan. May 2015

The bus routes used in the traffic modelling assumed the following changes:

- 14 local bus routes terminating near the existing terminus (the location chosen was in the rail corridor east of Merewether Street but this is yet to be confirmed)
- Nine regional bus routes terminating at a Centenary Road facility west of Argyle Street.
- 16 local and six regional bus routes connecting with the proposal at the Civic transit zone in Hunter Street west of Merewether Street.
- Seven local and six regional bus routes in Hunter Street at the Wickham Transport Interchange.
- Four bus routes along Scott Street servicing Newcastle East, east of Watt Street.
- Three coach routes via Honeysuckle Drive terminating at Queens Wharf in Wharf Road.

- One combined route via Hunter Street and Darby Street with no terminus in the city centre.
- One bus route traveling to Merewether via Hunter Street and Union Street with no terminus in the city centre.

Bus dwell time at stops was estimated to be 25 seconds, which represents a moderate level of passenger boarding and alighting. The number of bus services at key locations in the city centre in one direction in the peak hour is provided in Figure 4-4. The maximum number of buses that would use bus stops in Hunter Street close to Auckland Street to service the Civic precinct and the NewSpace university campus was assumed to be 41 buses per hour per direction.

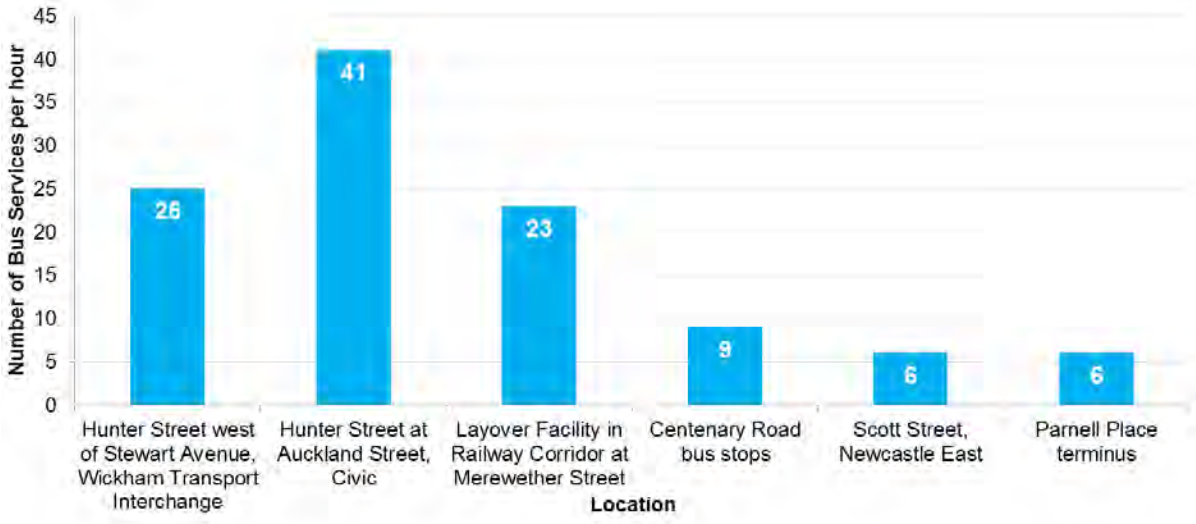


Figure 4-4 Peak hourly bus services in the city centre with proposal

Site observations identified that three bus stops on Scott Street and Hunter Street had longer than average dwell times due to a significant number of boarding passengers during the evening peak. As a result, the dwell time for these stops was increased to adequately reflect site observations. These stopping locations included:

- Scott Street westbound near Bolton Street (dwell time increased to 60 seconds)
- Scott Street westbound near Perkins Street (dwell time increased to 45 seconds)
- Hunter Street westbound near King Street (dwell time increased to 30 seconds)

4.2.4 Light rail services and signalling

The assumptions for the light rail services in the traffic modelling are detailed in Table 4-4.

Table 4-4 Light rail attributes for the traffic modelling scenarios

During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2015 to 2018	When proposal is operational in 2018
Not applicable	Not applicable	• 10 minute headway • 12 minute in-vehicle travel time • Opal fares – light rail fares are the same as bus, and include free transfers with bus, but a second flag-fall with heavy rail

Source: TfNSW Assumptions Book, 2015

Between Worth Place and Wolfe Street, and at Scott Street and Watt Street, the light rail vehicles would by controlled by the existing traffic signals. Right turns across the light rail alignment would be controlled by a dedicated turning phase incorporated into the traffic signal cycle.

The light rail vehicle crossing of Stewart Avenue would also be controlled by traffic signals in Stewart Avenue at Beresford Street and the crossing by the light rail vehicles would be coordinated with the traffic signal phasing to give priority for north-south traffic movements in Stewart Avenue.

At Steel Street, Wolfe Street, Market Street and Pacific Park, the light rail vehicle would be given priority over the vehicular traffic at the intersections as follows:

- Steel Street – The approach of a light rail vehicle is detected and cancels the current phase for the north-south traffic in Steel Street.
- Wolfe Street – The approach of a light rail vehicle is detected and cancels the current phase (except if the phase has been operating for less than eight seconds, eight seconds of green time would be supplied to allow for the clearance of pedestrians). The phase which incorporates the east/west light rail movement is then called. The purpose of this phasing is to minimise the delay to light rail vehicles.
- Market Street – Light rail is operated in conjunction with the east/west movements. However, at this location, the eastbound light rail mixes with regular traffic in the shared running scenario. Therefore if the eastbound light rail vehicle is detected on approach to the signals, a light rail only phase is called. The light rail only phase stops the eastbound traffic and allows the light rail vehicle a “jump start”. The length of the jump would allow an adequate amount of crossing time for the light rail vehicle to clear the intersection before the remainder of eastbound traffic receive a green signal. This would prevent vehicles from attempting to cut in front of the light rail vehicle.
- Pacific Street – To allow light rail vehicles to enter and leave the terminus, additional on call light rail phases would be provided for when a light rail vehicle is detected approaching or leaving the terminus.

Light rail dwell times at each stop were estimated to be 40 seconds, which represents a moderate level of passenger boarding and alighting. The light rail would terminate on the western side of Stewart Avenue and would also cross Steel Street and Worth Place before accessing the Hunter Street dedicated light rail travel lane.

4.2.5 Pedestrian infrastructure

The assumptions for the staged changes to pedestrian infrastructure are detailed in Table 4-5.

Table 4-5 Pedestrian infrastructure changes and staging assumptions

During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2015 to 2018	When proposal is operational in 2018
Current (2015) network	Pedestrian bridge at Wickham Station removed. New pedestrian crossing at Market Street.	New pedestrian crossings at Market Street

Source: Laing O'Rourke and Aurecon, May 2015

New north-south pedestrian connections were implemented across the disused railway corridor in 2015 at the following locations:

- Kuwumi Place between Hunter Street and Honeysuckle Drive.
- Steel Street and Worth Place between Hunter Street and Honeysuckle Drive.
- Argyle Street between Hunter Street and Centenary Road.
- Perkins Street and Wolfe Street between Scott Street and Wharf Road.

These pedestrian crossings were not included in the traffic model as they are exclusively for pedestrians and do not affect traffic on the roads. However, they were considered as part of the assessment of potential impacts on pedestrians.

The impact of additional pedestrian movements on the traffic intersection performance was considered at the following locations:

- Intersections of Stewart Avenue with Hunter Street and Honeysuckle Drive with increased pedestrian movements to and from the Wickham Transport Interchange.
- Intersection of Hunter Street and Auckland Street with increased pedestrian movements to and from the NewSpace campus of the University of Newcastle.
- Midblock crossings of King Street at Civic Park with the existing uncontrolled pedestrian crossing and to and from the NewSpace campus of the University of Newcastle.
- Midblock crossings of Hunter Street at the Civic stop that would service the increased pedestrian demand to the NewSpace campus of the University of Newcastle with 400 pedestrians per hour.

4.2.6 Bicycle infrastructure

The assumptions for the staged changes to bicycle infrastructure are detailed in Table 4-6.

Table 4-6 Bicycle infrastructure changes and staging assumptions

During construction of Wickham Transport Interchange from 2015 to mid 2017	During proposal construction from 2015 to 2018	When proposal is operational in 2018
Current (2015) network	No changes to the existing bicycle lanes in King Street and no additional bicycle lanes in Hunter Street	No changes to the existing bicycle lanes in King Street and no additional bicycle lanes in Hunter Street

4.3 Future traffic demand growth

The future traffic demand growth adopted in the modelling was based on the traffic forecast data generated from the Public Transport Project Model (PTPM) provided by TfNSW. The methodology used to apply this data to the microsimulation model is as follows:

- SGS Economics prepared population and employment forecasts for the 2018 and 2028 scenarios without and with the proposal, and with and without the NUTTP in 2028.
- BTS prepared the land use forecasts through the STM / PTPM models and created the sub-area car travel demand matrices for the Newcastle city centre. This model includes the change in mode share and patronage as a result of the proposal.
- GHD calculated the growth in travel demand based on the sub-area matrices, further disaggregated to the more refined Paramics model zone system based on land use forecasts prepared by Cox Architects.

Therefore, the future traffic demand is based on the population, employment and land use changes as a result of the NUTTP managed by UrbanGrowth NSW. This includes the NewSpace campus of the University of Newcastle and the new government buildings in the Justice precinct at Hunter Street and Darby Street. The traffic demands used in each model scenario in the AM peak period are summarised in Table 4-7. The growth attributed to the urban renewal projects in the city centre was provided by UrbanGrowth NSW. The proposed urban development is likely to be primarily residential that would not attract high private vehicle growth.

Table 4-7 Traffic demand forecasts

Year	AM peak 8:00 am – 9:00 am	PM peak 5:00 pm – 6:00 pm
2015	17,990	18,960
2018	18,540	19,520
2028	19,810	20,780

Note: PM peak future traffic demands were synthesised by transposing the growth of car demands in the AM peak period and superimposing into the existing PM peak period matrices.

5. Impact assessment

This section identifies the effects of the proposal on vehicular traffic, buses, pedestrians and cyclists during the operation and construction phases. Predicted traffic volumes on the road network and at the key intersections are compared before and after the implementation of the proposal in 2018 and 2028. Impacts on the wider transport network, such as on buses, train services and pedestrian and cyclist access and safety are also discussed.

5.1 Operation phase

5.1.1 Assessment of traffic in 2018

Traffic volumes

A detailed analysis of the changes to traffic volumes between 2015 and 2018, with and without the proposal are provided at 30 locations in Appendix C. The key streets affected are summarised below and shown in Figure 5-1. The forecast traffic volumes are summarised in Table 5-1 and Table 5-2.

The inclusion of a separated light rail lane on Hunter Street removes one lane for vehicular traffic in each direction. Traffic on Hunter Street is predicted to reduce by approximately 5,800 vehicles per day. The predicted daily volume of 12,300 vehicles on Hunter Street can be safely accommodated by a single traffic lane in each direction as proposed.

An additional 7,600 vehicles daily are estimated to use King Street as shown in Table 5-1. While the total traffic volume of 20,100 vehicles per day can be accommodated by King Street in its current configuration, works at the Darby Street intersection and a peak period 'No Stopping' zone in King Street between Darby Street and Union Street is also proposed to ensure that the intersection continues to function efficiently during peak periods and can accommodate the higher traffic volumes at these times. West of Union Street, predicted traffic volumes can be accommodated in the existing four lane roadway.

Traffic on Scott Street is expected to reduce by 800 vehicles per day, as shown in Table 5-1. This reduction is a result of the vehicles redistributing on to King Street and Wharf Road to avoid the separated light rail lane on Hunter Street. As Wharf Road and King Street are low volume roads in the area east of Darby Street, the increase in traffic can be safely accommodated.

Table 5-1 Predicted traffic volumes for King Street and Hunter/Scott Street in 2018

Year	Location	Daily traffic volumes
2015 Existing	Hunter Street (Merewether Street to Darby Street)	18,100
	King Street (Auckland Street to Darby Street)	12,500
	Scott Street (Bolton Street to Watt Street)	11,500
2018 Year of opening	Hunter Street (Merewether Street to Darby Street)	12,300
	King Street (Auckland Street to Darby Street)	20,100
	Scott Street (Bolton Street to Watt Street)	10,700

Source: GHD traffic modelling, 2015
Note: Daily traffic volumes rounded to the nearest 100 vehicles

When completed, the Steel Street link between Hunter Street and Honeysuckle Drive would result in an additional 5,100 vehicles per day on Steel Street between Hunter Street and Honeysuckle Drive. These changes in traffic volume, as shown in Table 5-2, can be accommodated by implementing traffic signals at Honeysuckle Drive and Steel Street and adjusting the traffic signal phasing at Hunter Street and Steel Street.

Table 5-2 Predicted traffic volumes for Steel Street and Stewart Avenue

Year	Location	Daily traffic volumes
2015 Existing	Stewart Avenue (Hunter Street to Honeysuckle Drive)	29,500
	Steel Street (Hunter Street to Honeysuckle Drive)	2,600[1]
2018 Year of opening	Stewart Avenue (Hunter Street to Honeysuckle Drive)	28,700
	Steel Street (Hunter Street to Honeysuckle Drive)	7,700

Source: Roads and Maritime, 2015

Note: Daily traffic volumes rounded to the nearest 100 vehicles

1. Note this link does not exist in 2015. 2015 traffic volumes were measured on Steel Street north of Hunter Street.

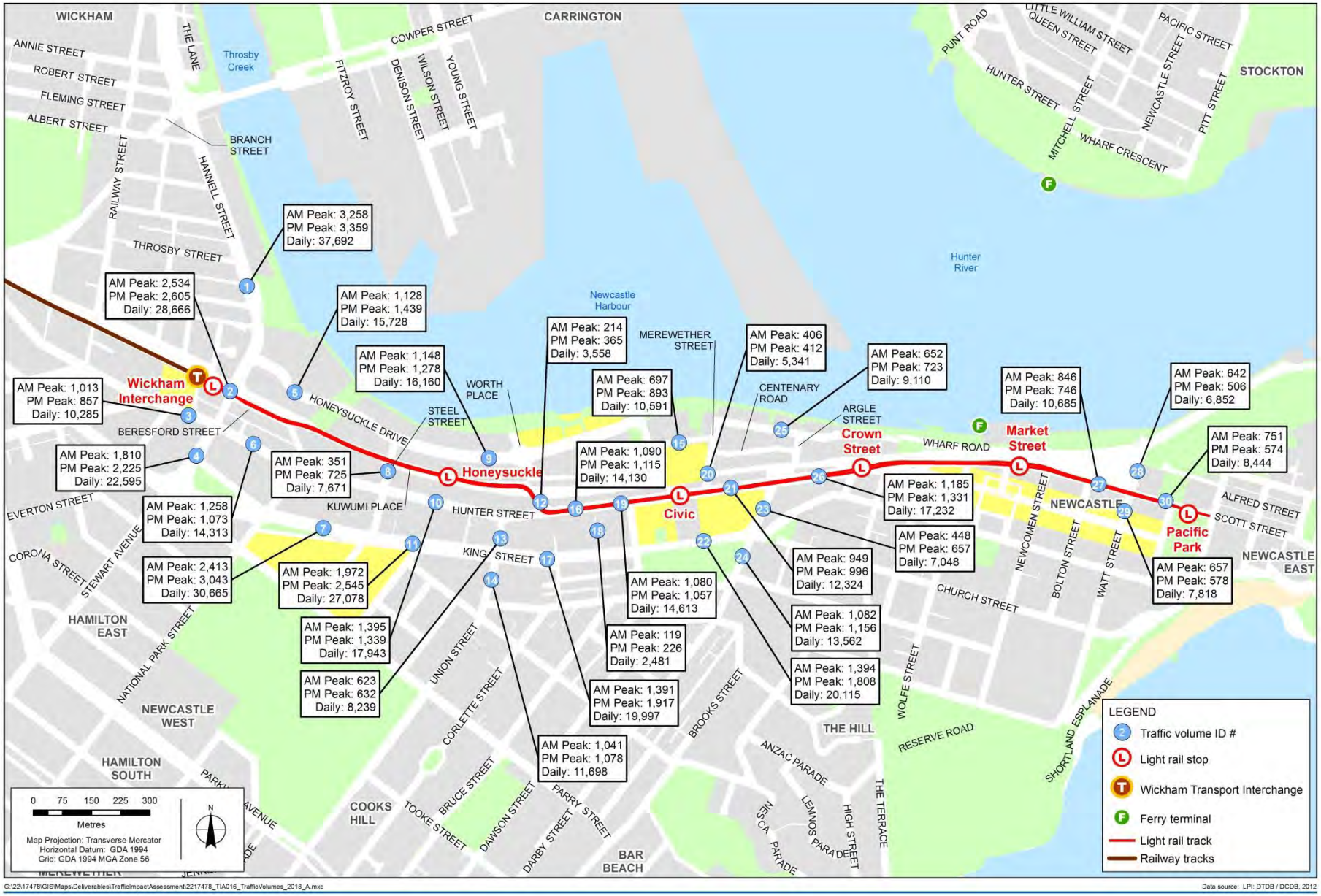


Figure 5-1 Traffic volumes with proposal in 2018

Intersection performance

King Street

The diversion of traffic on to King Street results in some changes to intersection performance in 2018. The key changes are indicated on Figure 5-2 and summarised in Table 5-3. In the AM peak, the LoS is relatively similar without or with the proposal. In the PM peak, the LoS is reduced from D to E in King Street at Union Street.

Table 5-3 Intersection performance along King Street

Location	2015 existing		2018 without proposal		2018 with proposal	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
King Street and Darby Street	B	B	C	C	B	C
King Street and Union Street	D	D	D	D	D	E

Source: GHD traffic modelling, 2015

Hunter Street

The results for the intersection performance in Hunter Street are shown in Table 5-4. The existing LoS is relatively similar for the scenarios without and with the proposal.

Table 5-4 Intersection performance along Hunter Street

Location	2015 existing		2018 without proposal		2018 with proposal	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hunter Street and Darby Street	C	B	C	B	C	C
Hunter Street and Union Street	B	B	B	C	B	B

Source: GHD traffic modelling, 2015

Scott Street

An assessment of the performance in Scott Street with the proposal did not identify any substantial changes in vehicular traffic. This is due to the relatively low traffic levels in this area with traffic volumes in the AM and PM peaks on Scott Street heading east/west across Newcomen Street in the order of 400 and 600 vehicles per hour per direction.

Other locations

A summary of intersection performance in the AM and PM peak periods at key intersections in 2018 is provided in Table 5-5 and shown in Figure 5-2.

Table 5-5 Summary of intersection performance at key locations in 2018

Location	2015 existing		2018 without proposal		2018 with proposal	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Throsby Street / Hannell Street	A	A	A	B	B	B
Honeysuckle Drive / Hannell Street	C	F	C	F	B	C
Hunter Street / Stewart Avenue	F	E	F	F	C	C
King Street / Stewart Avenue	C	C	C	D	D	D
Hunter Street / Steel Street	A	A	A	B	B	C
King Street / Steel Street	B	D	A	C	B	B
Hunter Street / Union Street	B	C	B	C	B	B
King Street / Union Street	D	D	D	D	D	E
Hunter Street / Merewether Street	B	C	B	C	B	B
Hunter Street / Darby Street	C	B	C	B	C	C
King Street / Darby Street	B	B	C	C	B	C

Source: GHD traffic modelling, 2015

The results indicate that the majority of intersections would operate at LoS D or better with proposal operation. The exception is at the intersection of King Street and Union Street which reduces in performance to LoS E. At this location, local mitigation measures may be required to maintain a satisfactory level of traffic performance in the future.

At other locations, the intersection performance would improve to LoS B or C with the connections in the road network at Steel Street and Worth Place redistributing traffic in the western part of the project area. Overall, the traffic performance on the road network in 2018 with the proposal is considered satisfactory.

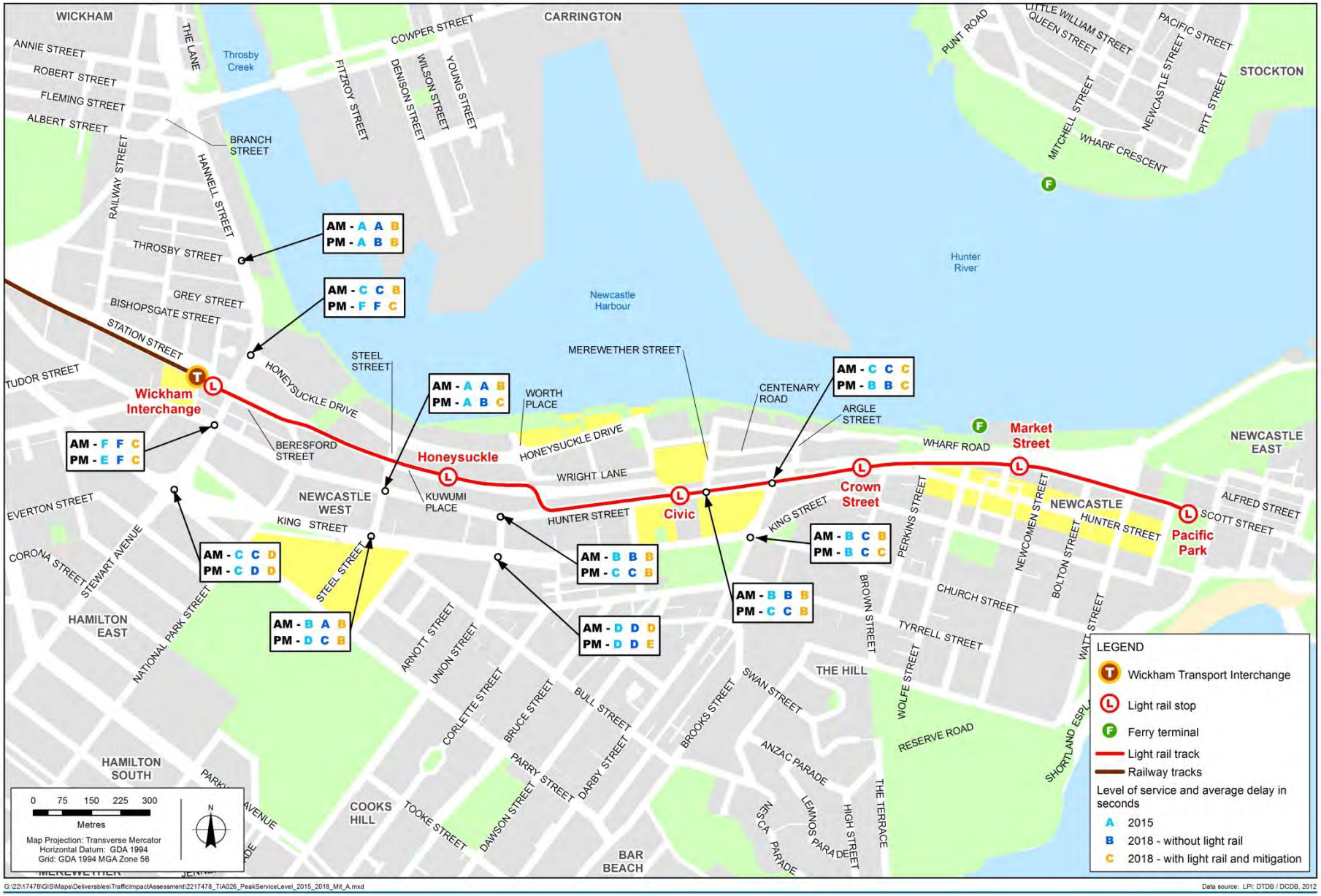


Figure 5-2 Intersection LoS with and without proposal in 2018

Impacts of the light rail vehicles on traffic at crossings

Travel times on the Stewart Avenue/Hannell Street corridor would increase slightly with the implementation of the proposal, but still significantly less than when heavy rail operated prior to December 2014. The light rail crossing of Stewart Avenue is not considered to have an adverse effect on the traffic performance of the Stewart Avenue/Hannell Street corridor.

Similarly, at Steel Street, the traffic model indicated the light rail crossing would have minimal effect on traffic performance due to the relatively low traffic volumes on Steel Street and the low frequency and short duration of the light rail vehicles crossing the roadway.

5.1.2 Assessment of traffic in 2028

Traffic volumes

The performance of the road network was also investigated in 2028. Between 2018 and 2028, there are no traffic network changes associated with the proposal. Therefore, the results provide an indication of potential future impacts resulting from assumed urban development and associated traffic and population growth. A comprehensive list of traffic modelling results for 2028, including both with and without the proposal is provided in Appendix C and Figure 5-3.

Traffic volumes on King Street are predicted to increase by up to 1,700 vehicles daily west of Union Street and up to 700 east of Union Street. Similarly on Hunter Street, daily traffic volumes are predicted to increase by up to 1,000 vehicles west of Union Street and by up to 600 vehicles east of Union Street. Traffic volumes on Scott Street are predicted to increase by less than 200 vehicles daily. None of these changes are beyond the capacity of the existing road system or would be expected to result in traffic or capacity impacts.

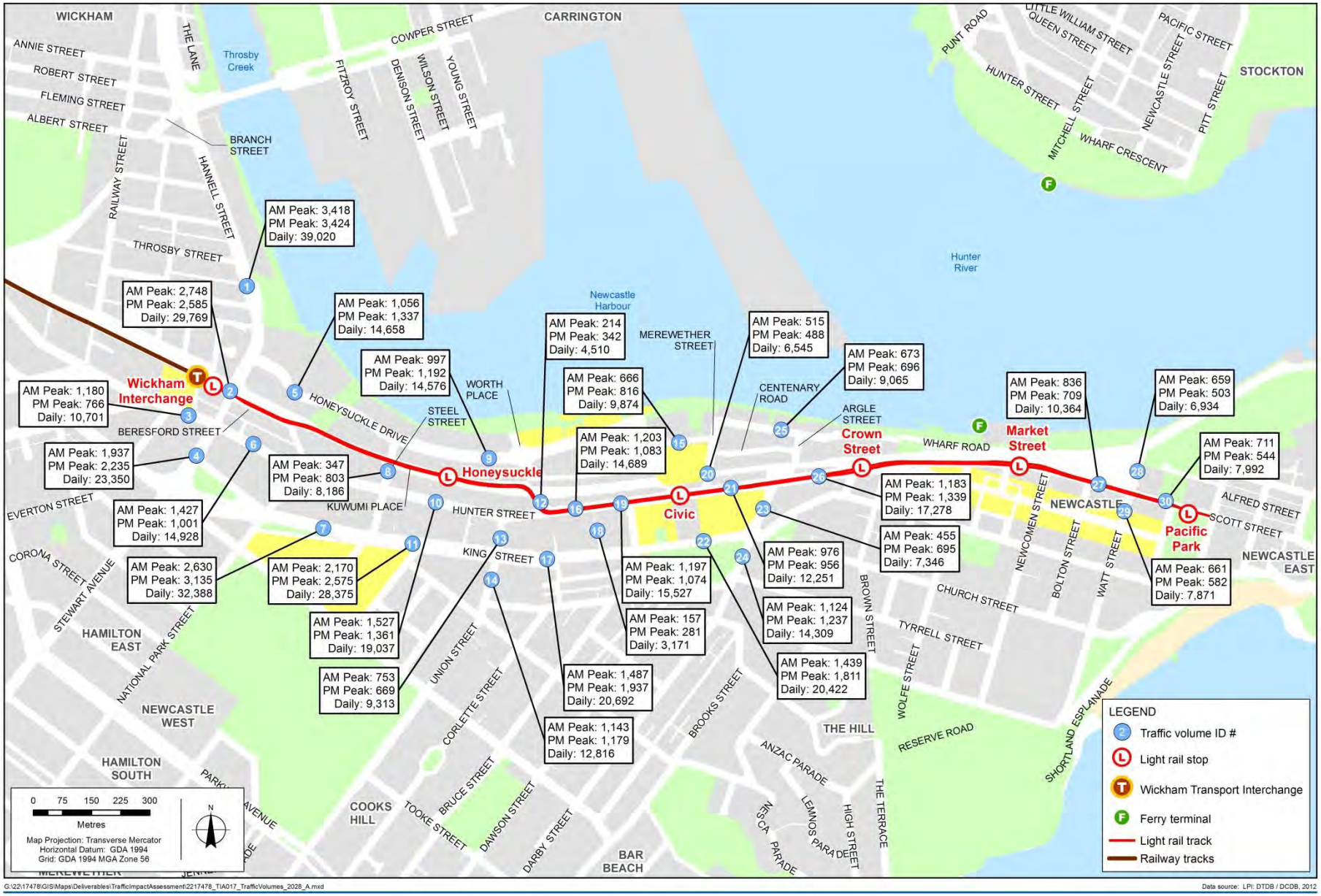


Figure 5-3 Traffic volumes with proposal in 2028

Intersection performance

A summary of results at key intersections is provided in Figure 5-4 and Table 5-6.

Table 5-6 Summary of intersection performance in 2028

Location	2018 with proposal		2028 without proposal		2028 with proposal	
	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Throsby Street / Hannell Street	B	B	A	F	B	C
Honeysuckle Drive / Hannell Street	B	C	C	F	B	F
Hunter Street / Stewart Ave	C	C	F	F	C	D
King Street / Stewart Avenue	D	D	C	C	E	D
Hunter Street / Steel Street	B	C	A	B	B	D
King Street / Steel Street	B	B	B	C	C	B
Hunter Street / Union Street	B	B	B	C	C	B
King Street / Union Street	D	E	D	D	D	F
Hunter Street / Merewether Street	B	B	B	C	B	B
Hunter Street / Darby Street	C	C	C	B	C	D
King Street / Darby Street	B	C	C	C	C	D

Source: GHD traffic modelling, 2015

With proposal operation, the road network would generally operate at a satisfactory level with only two intersections operating at LoS F, namely the intersections of King Street and Union Street and Honeysuckle Drive and Hannell Street in the PM peak period. The intersection of Honeysuckle Drive and Hannell Street performs at LoS F without the proposal which is due to issues currently experienced at this intersection.

The intersection of King Street and Union Street is predicted to operate at LoS F due to the performance of the southern approach to the intersection and the predicted increase in traffic volumes. All of the other approaches operate satisfactorily. LoS F means this intersection has reached capacity and unreasonable delays would be experienced by drivers. These delays would result in vehicles diverting away from Union Street and using other roads to access King Street and continue through the city centre. This approach to the intersection is predicted to incur delays even without the proposal. Similar to the 2018 scenario, the performance of this intersection is being investigated to consider whether any changes are required to reduce delays.

The intersection of King Street/ Stewart Avenue is predicted to operate at LoS E in the AM peak. Excessive delays would result if an incident occurred.

Impacts of the light rail vehicles on traffic at crossings

A comparison of the light rail vehicle journey times between the 2018 and 2028 scenarios shows no change. The performance of the proposal is not affected by the predicted changes to the traffic performance in Hunter Street or Scott Street because it is mostly operating in lanes separated from the traffic movements.

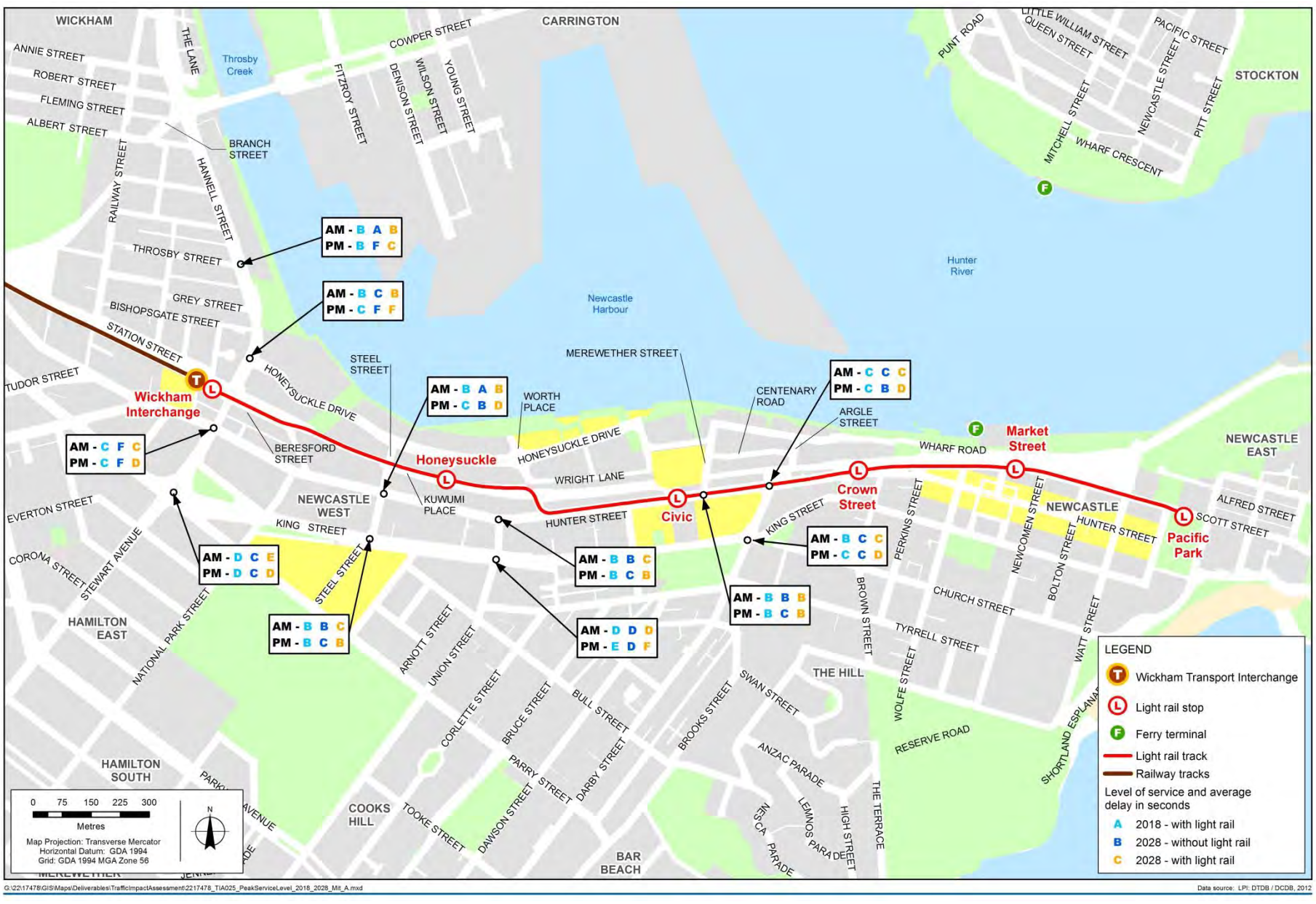


Figure 5-4 Intersection LoS with and without proposal in 2028

5.1.3 Parking spaces, taxi ranks and loading zones

The number of parking spaces for cars and motorcycles affected by the proposal are provided in Table 5-7 and Table 5-8 respectively and are shown in Figure 5-5.

A total of 363 on-street car parking spaces are estimated to be affected by the proposal in Beresford Street, Station Street, Steel Street, Hunter Street, Worth Place, Centenary Road, Scott Street and King Street. Of the 363 car parking spaces affected, 182 spaces (50 per cent) are in marked bays and the remainder are unmarked. A total of 267 car parking spaces would be permanently removed with 27 additional spaces removed on the north side of King Street during the AM peak period and 56 additional spaces removed on the south side of King Street during the PM peak period as part of the peak period 'No Stopping' zones in King Street.

In addition, 17 motorcycle parking spaces would be removed.

Table 5-7 Changes to car parking spaces in the study area

Street	Number of existing car parking spaces	Number of car parking spaces removed	Number of car parking spaces retained
Argyle Street	9	0	9
Bellevue Street	10	0	10
Beresford Street	53	43	10
Centenary Road	41	0	28
Honeysuckle Drive	29	0	29
Hunter Street	181	112	69
King Street	100	0	100
Market Street	6	0	6
Old Hannell Street	32	0	32
Scott Street	117	75	42
Station Street	29	29	0
Steel Street	5	5	0
Telford Street	32	0	32
Watt Street	3	0	3
Worth Place	3	3	0
Total	**650**	**267**	**383**

Source: GHD survey, October and November 2015

Table 5-8 Changes to motorcycle parking spaces in the study area

Street	Number of existing motorcycle parking spaces	Number of motorcycle parking spaces removed	Number of motorcycle parking spaces retained
Argyle Street	6	0	6
King Street	11	11	0
Scott Street	9	0	9
Steel Street	6	6	0
Total	**32**	**17**	**15**

Source: GHD survey, October and November 2015

A number of loading zones would also be affected as provided in Table 5-9 and shown in Figure 5-5. A total of 29 spaces in loading zones in the study area, including three mail zones, would be assessed to confirm requirements and may need to be relocated to other streets in the city centre if necessary.

Table 5-9 Changes to loading zone spaces in the study area

Street	Number of spaces in loading zones removed	Number of spaces in loading zones retained
Argyle Street	0	2
Beresford Street	0	2
Centenary Road	0	3
Hunter Street	20	9
King Street	3	1
Scott Street	6	2
Total	**29**	**19**

Source: GHD, October 2015

Investigation of options to mitigate the removal of these on-street parking spaces and loading zones are currently being undertaken. Specific sites being considered include the former heavy rail corridor between Merewether Street and Argyle Street and between Worth Place and west of Wheeler Place. The investigation also requires consideration of the strategic transport policy of Council and others who control or manage roads in the Newcastle CBD. Therefore, consultation with a range of stakeholders including affected businesses, Roads and Maritime and Council would be undertaken before a preferred location is identified.

Taxi ranks in Hunter Street at Civic Station and in Watt Street at Newcastle Station may need to be relocated to provide space for a proposed new development project at Civic and a bus stop in Watt Street at Newcastle Station respectively. Consultation with Council and the taxi industry would be conducted to identify suitable locations for replacement taxi ranks.

Figure 5-5 Changes to parking and loading zones with light rail operational

5.1.4 Bus routes and stops

A revised city centre bus plan would be developed for implementation by TfNSW. This plan would confirm which bus routes would operate in Hunter Street and Scott Street following implementation of the proposal. However, the design indicates a total of nine of the 20 bus stops in the immediate construction zone would be permanently removed or would need to be repositioned. These bus stops are summarised in Table 5-10 and shown in Figure 5-6. The two bus bays located in Stewart Avenue south of Honeysuckle Drive would be retained and all of the bus stops in Hunter Street west of Union Street and in Honeysuckle Drive west of Steel Street. Bus stops in King Street and Darby Street were excluded as they would not be affected.

Table 5-10 Bus stops affected by the proposal

Street	Location	Side of street	Length (m)	Stop capacity	Status with proposal
Stewart Avenue	South of Dangar Street	West	40	1	retained
Stewart Avenue	South of Honeysuckle Drive	East	40	1	retained
Honeysuckle Drive	West of Steel Street	North	20	1	retained
Honeysuckle Drive	West of Steel Street	South	20	1	retained
Hunter Street	East of Steel Street	North	25	2	retained
Hunter Street	East of Steel Street	South	25	2	retained
Hunter Street	East of Union Street	South	60	4	retained
Hunter Street	West of Union Street	North	40	3	retained
Hunter Street	West of Auckland Street	North	20	1	repositioned
Hunter Street	East of Auckland Street	South	35	2	repositioned
Hunter Street	At Civic Station	North	20	1	removed
Hunter Street	East of Darby Street	North	35	2	retained
Hunter Street	East of Darby Street	South	30	2	retained
Scott Street	East of Perkins Street	North	130	10	repositioned
Scott Street	West of Perkins Street	South	80	6	retained
Scott Street	West of Market Street	North	45	3	removed
Scott Street	West of Market Street	South	25	2	removed
Scott Street	West of Watt Street	North	55	4	removed
Scott Street	West of Watt Street	South	70	5	removed
Scott Street	West of Telford Street	South	50	4	removed

Source: GHD, October 2015

Other bus stops that may be affected by bus route changes are:

- An additional layover space for the rail replacement shuttle bus Route 110 during construction period.
- A new bus stop in Watt Street north of Scott Street which is currently at taxi zone.
- A new bus stop in Watt Street north of Scott Street opposite Newcastle Station.
- Two new bus stops in Wharf Road at Nobbys Road to service Nobbys Beach.

Bus stops in Honeysuckle Drive east of Worth Place may no longer be required for regular bus services.

Figure 5-6 Proposed changes to bus stops with proposal operation

The draft city centre bus plan that was used in the traffic modelling would be confirmed with stakeholder and community engagement to determine the requirements for bus stop locations in Hunter Street, Scott Street and Watt Street and the route and timetable implications of the reconfigured bus services for each bus operator. The bus plan would consider that each bus and coach operator that currently services Newcastle city centre has different requirements for their customers and drivers. For example, the long distance coach operations, such as Busways, require end of trip waiting facilities for their customers with luggage and drivers who have completed long regional trips. Whereas the local Newcastle bus operators with routes that only service the Lower Hunter region, require toilet and short break facilities for their drivers at the designated layover areas. The customers on the local bus routes would have bus stops with shelters on the footpaths in Hunter Street or Scott Street.

5.1.5 Pedestrians

Three types of impacts would affect pedestrians in the city centre when the proposal is operational:

- Pedestrian access to the light rail stops
- Pedestrian crossings of the light rail
- Pedestrian movements along the footpaths

Access to the light rail platforms

The impacts and risks for pedestrian access to the light rail stops are provided in Table 5-11.

Table 5-11 Pedestrian access to the light rail stops

Light rail stop	Pedestrian access	Impacts and risks
Wickham Transport Interchange	Western side of Stewart Avenue from Honeysuckle Drive or Hunter Street Cooper Street from Hunter Street while The Store site is still available for public access. When The Store site is acquired, a new pedestrian access route between Hunter Street and the Transport Interchange would be provided Station Street through the Wickham Transport Interchange public plaza area	Hannell Street at Honeysuckle Drive and Stewart Avenue at Hunter Street are both signalised providing safe pedestrian access to cross Stewart Avenue Cooper Street is a narrow street between The Store and the southern side of the Transport Interchange which is not an attractive or safe route for pedestrians at night
Honeysuckle	North-south pedestrian crossing between Kuwumi Place and Honeysuckle Drive to access the side platforms immediately east of the crossing	Honeysuckle pedestrian crossing with no signal controls; warning bells and signage would be required at the crossing to warn pedestrians of a light rail vehicle
Civic	North-south movements via the pedestrian crossing between Wheeler Place and Civic Plaza	Without a pedestrian traffic signal to the staggered platforms, blind and mobility impaired pedestrians and light rail passengers would be disadvantaged at this crossing
Crown Street	North-south movements across Hunter Street on the eastern side of Crown Street	The pedestrian traffic signal at Crown Street would provide safe access across Hunter Street from the north and south to the light rail platform
Market Street	North-south movements across Hunter Street on the eastern side of Crown Street	The pedestrian traffic signal at Market Street would provide safe access across Scott Street from the north and south to the light rail platform

Light rail stop	Pedestrian access	Impacts and risks
Pacific Park	Southern footpath of Scott Street	Traffic signals at Pacific Street would allow for pedestrians to safely access the south side of Scott Street and the platform on the northern footpath of Pacific Park

Crossings of the light rail tracks

Pedestrians would have a total of 16 locations to cross the light rail tracks at:

- West and east sides of Stewart Avenue that would be signalised at the light rail tracks.
- West and east sides of Steel Street that would be opened as a roadway and signalised at the light rail tracks.
- The Honeysuckle pedestrian crossing at Kuwumi Place.
- West side of Worth Place that would be opened as a roadway.
- Hunter Street and Union Street with the existing signalised intersection.
- Hunter Street and Auckland Street with the existing signalised intersection.
- The Civic light rail platforms in Hunter Street with a signalised crossing.
- Hunter Street and Merewether Street with the existing signalised intersection.
- Hunter Street and Darby Street with the existing signalised intersection.
- Hunter Street at Crown Street with a new signalised intersection.
- Hunter Street at Perkins Street with the existing signalised pedestrian crossing.
- Scott Street at Wolfe Street with no signalised crossing provided by UrbanGrowth NSW.
- Scott Street at Market Street with a new signalised intersection.
- Scott Street at Newcomen Street with a new signalised intersection.
- Scott Street at Watt Street with the existing signalised intersection.
- Scott Street at Pacific Street with a new signalised intersection.

All of these locations would require clear visibility to cross the street or light rail tracks with appropriately designed wayfinding signage. A Crime Prevention Through Environmental Design (CPTED) assessment would be conducted during the detailed design stage. All pedestrian crossings would be designed to be compliant with the *Disability Standards for Accessible Public Transport* (DSAPT) adopted by the Commonwealth Government in 2002 and amended in 2010.

A high risk area for pedestrians is on Stewart Avenue at Beresford Street where pedestrians may risk crossing Stewart Avenue when light rail vehicles have stopped the north-south traffic.

Pedestrian access across the light rail tracks would be removed between Bellevue Street and Hannell Street where the existing pedestrian bridge at Wickham station exists. The alternate route for pedestrians would be via Beresford Street to Stewart Avenue and Honeysuckle Drive. This is approximately 270 metres longer than the existing pedestrian route via the Wickham Station pedestrian bridge. This would be an inconvenience for these pedestrians who could alternatively walk between Honeysuckle Drive and Hunter Street via Steel Street. This results because no access for pedestrians would be allowed through the light rail depot which is to be constructed at the former Wickham Station site.

Access along the light rail alignment

Mature hedges or a picket fence would be installed along the light rail alignment within the former rail corridor to prevent/deter people from walking along the alignment. Existing fencing along the rail corridor may be left in place where required for safety and security reasons.

Pedestrian access along the light rail alignment would not be allowed between:

- Bellevue Street / Hannell Street at the former Wickham Station and Steel Street along the former railway corridor.
- Steel Street and the Honeysuckle pedestrian crossing at Kuwumi Place.
- The eastern end of the Honeysuckle light rail platforms and Worth Place.

5.1.6 Cyclists

Cyclists using Hunter and Scott streets could cross the light rail tracks at a number of locations. A potential safety risk for cyclists travelling parallel to the light rail alignment within the road corridor is bicycle tyres getting caught in the grooves of the light rail tracks. The installation of light rail signals and pedestrian crossings connecting to light rail stops may also present additional risks for cyclists and make these routes less attractive. Alternative east-west cyclist routes are along Honeysuckle Drive and Wharf Road, although depending on the destination, these may be less desirable.

The locations where cyclists would interact with the proposal are described in Table 5-12.

Table 5-12 Cyclist impacts with the implementation of proposal

Location	Change for cyclist movement	Impact
Stewart Avenue	No change with on-road bicycle lanes on both sides	Risk for cyclists to watch and wait for light rail vehicles crossing Stewart Avenue at Beresford Street
Honeysuckle Drive	No change with on-road bicycle lanes on both sides	Intersection of Honeysuckle Drive and Steel Street would affect the east-west cyclist connections; commuters cycling to the Wickham Transport Interchange would access the station via Dangar Street and Charles Street
Steel Street	Opportunity to implement on-road bicycle lanes	Risk for cyclists to watch and wait for light rail vehicles crossing Steel Street
Worth Place	Maintain bicycle lane in the Worth Place connection	Risk for cyclists to watch and wait for light rail vehicles crossing Worth Place and Hunter Street
Hunter Street	No bicycle lanes would be provided	Cyclists have alternate east-west routes via Honeysuckle Drive and Wharf Road and via King Street

As a result of the proposed peak period ‘No Stopping’ zone in King Street east of Union Street, a review of options to support cycling east-west along King Street would be undertaken. This review of alternative measures would be completed and communicated with the community prior to proposal implementation.

5.1.7 Light rail travel time

With proposal operation, the travel time from Wickham Transport Interchange to Pacific Park, including an estimate for boarding and alighting activity at the intermediate stops, is estimated at 12 minutes. An average waiting time for random or uncoordinated arrivals at the light rail stop at either terminus of the line is one-half of the headway or five minutes. Therefore, the total average time for a light rail customer to travel from the Wickham Transport Interchange to Pacific Park including waiting and walking time at Wickham is estimated to be about 17 minutes.

5.2 Construction phase

5.2.1 Access to the city centre during construction

Key CBD access routes

The key roads leading into the city centre would be managed during construction to limit the disruption and inconvenience to motorists, potential traffic congestion during peak periods and to minimise the noise for residents. Heavy vehicles would mostly likely use the following streets:

- Hannell Street to Industrial Drive from Stewart Avenue and Honeysuckle Drive to the off-site spoil locations.
- Stewart Avenue to Parry Street, Donald Street and Griffiths Road for materials from the freeway from Sydney and points west of Newcastle.
- Stewart Avenue between Honeysuckle Drive and Hunter Street from the western compound to access the light rail stabling and depot construction area and the western end of Hunter Street at Steel Street and Worth Place.
- Honeysuckle Drive from the western compound to Steel Street and Worth Place to access the construction sites for the railway corridor works and the new road connections.
- Wharf Road near the eastern compound with a temporary road connection for construction vehicles only at Wolfe Street to access Scott Street.
- Wharf Road from the eastern compound to Watt Street and Scott Street to access the Scott Street and Pacific Park construction area.
- Hunter Street between Stewart Avenue and Perkins Street to remain open for one-lane of traffic in each direction.
- Scott Street between Perkins Street and Telford Street to remain open for one-lane of traffic in each direction.

Key intersections

Key intersections in the city centre would require particular management measures to reduce congestion and disruption during the construction works. These measures would reduce unnecessary traffic congestion and inconvenience to motorists but may also apply to pedestrians and cyclists as well. These intersections would be a special focus and included in the construction traffic management plan to be prepared by the construction contractor. The intersections at most risk of delay, congestion and inconvenience as a result of construction are at:

- Stewart Avenue at Honeysuckle Drive and at Hunter Street that must remain open throughout the construction phase. No construction work would be conducted during the peak periods on weekdays.

- Steel Street from Honeysuckle Drive to King Street, in particular at Steel Street at Honeysuckle Drive where a new T-intersection is proposed.
- Worth Place from Honeysuckle Drive to Hunter Street with the new road connection.
- Hunter Street at Merewether Street that must remain open for traffic movements between Merewether Street and Hunter Street east.
- Hunter Street at Darby Street that must remain open for all traffic movements.
- Scott Street at Watt Street that must remain open for north-south traffic.
- Scott Street at Telford Street that must remain open for local access for residents.

Pedestrians

For the majority of construction works, pedestrian movements along the route would be maintained. Where construction encroaches on to footpaths, the footpaths would be either temporarily narrowed past the work site, pedestrians diverted using appropriate barriers and signage or temporary structures installed to facilitate access over the work sites. In all circumstances, requirements of the *Disability Standards for Accessible Public Transport* (DSAPT) would be adopted. Footpath widths would be sufficient to allow two-way pedestrian traffic, with space to accommodate prams and wheelchairs.

Cyclists

The main potential for impact to cyclists is where existing routes need to be diverted and/or where conflicts occur, such as at the site compound access points or more generally where cycle routes mix with local traffic which may become congested.

Where existing cycle routes or facilities are occupied by work sites, detours would be identified. Existing cycle paths located within the construction corridor but not occupied by work sites would be maintained during construction.

Emergency access

Access for emergency services vehicles would be maintained at construction sites and measures to facilitate the movement of emergency vehicles would be defined in the traffic management plan for each work site.

Emergency services would be consulted regarding proposed changes to traffic arrangements to identify any specific requirements which need to be incorporated into the traffic management plans.

Special events management

The traffic and transport requirements of special events may require adjustment to construction hours, particularly night works at key intersection locations. The construction contractor would be responsible for incorporating special events into the works program and construction traffic management plan. Consultation would also be sought with other relevant stakeholders, including Council, Roads and Maritime, emergency services and event organisers.

5.2.2 Construction vehicle movements

Construction of the proposal would involve vehicle movements in and around the construction site and compound areas.

The number of additional heavy vehicles for each of the four construction zones is shown in Table 5-13 and was calculated based on cut, fill and track slab earthworks truck movement estimates provided by TfNSW. The number of heavy vehicle movements is estimated to be eight to 12 vehicles per zone per day with an average daily total of 38 heavy vehicles. This number of additional vehicles in the city centre road network would not noticeably affect the traffic performance because it is less than 0.5 per cent of total traffic volumes in Hunter Street. These heavy vehicles would be distributed over the working day and would be managed with traffic control staff as specified in a comprehensive construction traffic management plan prepared by the contractor.

Table 5-13 Estimate of daily heavy vehicles for construction

Construction zone	Cut	Fill	Track slab	Total	Number of project days	Number of trucks per day
Zone 1: Railway corridor west of Worth Place	780	714	1,529	3,023	269	12
Zone 2: Hunter Street between Worth Place and Darby Street	733	522	1,119	2,374	287	9
Zone 3: Hunter Street east of Darby Street and Scott Street to Wolfe Street	568	405	867	1,840	222	9
Zone 4: Scott Street east of Wolfe Street	688	488	985	2,161	286	8
Total	**2,769**	**2,129**	**4,500**	**9,398**		**38**

Source: Constructability Assessment, Aquenta, September 2014

The delivery of some infrastructure components, such as roofing panels and beams, may be considered oversized deliveries. These deliveries would be undertaken in accordance with the requirements of relevant authorities, so as not to cause undue interruption or compromise the safety of the road network and might therefore be undertaken outside of normal working hours.

The total number of light vehicle movements is estimated to be about 140 vehicles per day. These movements will primarily be to the western site compound as workers will be required to park at this location and be shuttled to the work sites by high capacity private vehicles or small buses. Other light vehicle trips would include supervisory staff and other ancillary requirements.

Overall, the total numbers of heavy and light vehicle movements around the construction site would be low compared to the overall traffic volumes on these roads. This would not result in a substantial impact on the local roads or the road network.

To determine the effects of reducing small sections of Hunter Street to one lane in each direction, as required to construct the proposal, a SIDRA analysis was undertaken on the section of Hunter Street between Auckland Street and Union Street. This section of Hunter Street was chosen for the analysis as it has the highest daily traffic volume (as shown in Figure 5-1) and therefore was considered representative of the worst case. The analysis indicated that, while there was a small increase in travel time due to the reduction in lane capacity to one lane, the overall LoS at the intersections did not change. This indicates that with appropriate traffic management, the effects of reducing Hunter Street to one lane in short sections would be minimal.

5.2.3 Parking

Construction worker parking

It is anticipated that up to about 100 staff and workers would be required on-site during the peak construction period. An average of approximately 70 staff and workers would be required at other times. Separate crews would undertake construction in each zone concurrently and at times, on multiple work stages. For these staff, parking would be encouraged either within the site compound or adjacent to the rail corridor to minimise inconvenience to residents and local businesses during the construction period. Where parking is allocated next to the rail corridor, effective means of maintaining safety of workers from moving components would be provided. The contractor would provide a worker shuttle bus for workers to travel from the staff parking areas and compounds to the zone where the workers would be assigned for each day. Construction worker parking could be assigned to specific zones to minimise the requirements for car parking in a single location and the need for a worker shuttle bus service.

Since the proposal construction zone is within an easy walking distance (less than 10 minutes walking time from either compound), workers who do not have to carry heavy equipment may walk to their daily work zone. This would reduce the number of light vehicles and shuttle bus services operating in the construction zone.

On-street parking and loading zones

As already stated, construction vehicles would park in designated areas provided within the western construction compound to limit impacts on local businesses and residents. The construction contractor would provide a high capacity private vehicle (shuttle bus or the like) for workers to travel from the western construction compound to the zone where the workers would be assigned each day.

Loss of or change to parking and loading spaces, as detailed in Section 5.1.3, would require alternative locations for parking to be identified. Changes to parking and loading zones are required to provide sufficient width for construction and to maximise the width of traffic lanes available.

Parking and loading zones would be removed progressively along the corridor as construction moves along the proposal alignment to minimise impacts on users.

5.2.4 Public transport services

Bus and coach services

Public transport arrangements during construction would be unchanged from their current routes and frequency. Some bus stops would be repositioned in order to avoid conflict with proposed construction work areas, which are typically up to 100 metres in length. In these situations, bus stops would be temporarily repositioned either 50 metres east or west of the proposed work site to avoid potential conflict.

Heavy rail passengers

Heavy rail services would not be affected during proposal construction.

The current shuttle bus to and from Hamilton Station would remain unchanged until the Wickham Transport Interchange is opened. Once the interchange is operational, the shuttle bus would include an additional stop in Hunter Street to service this location.

When the Wickham Transport Interchange is operational in 2017 and before proposal commencement, rail passengers from Newcastle and the East End would be required to use a shuttle bus service to access the train stations at Wickham or Hamilton to connect with trains on the Hunter Line or the Sydney/Central Coast Line. Train customers who are within walking distance of the Wickham Transport Interchange would have shorter journey times as they would no longer need to use the shuttle bus to travel to and from Hamilton Station. This would reduce patronage on the shuttle bus service and consequently fewer shuttle buses may be required to service the demand during the peak train commuter periods.

The proposed shuttle bus route during proposal construction is shown in Figure 5-7. It is the same as the existing shuttle bus service between Hamilton and Newcastle stations that operates via Hunter Street and Scott Street, except with one additional stop in Hunter Street west of Stewart Avenue to provide a connection with the Wickham Transport Interchange.

The eastern bus terminus would be at the existing Newcastle bus interchange until this area is developed by UrbanGrowth NSW. The eastern terminus would change to a bus stop in Watt Street north of Scott Street or via Merewether Street and Wharf Road when proposal construction affects access for buses in Scott Street. The western terminus would be at Hamilton Station vis the existing arrival and departure bus stops in Beaumont Street.

During proposal construction in Hunter Street east of Worth Place and in Scott Street, the shuttle bus service may need to be diverted to use Honeysuckle Drive and Wharf Road. Temporary bus stops would be located at:

- Honeysuckle Drive at the Kuwumi Place pedestrian connection.
- Honeysuckle Drive north of Workshop Way to access the Civic precinct.
- Wharf Road at Argyle Street to access the Hunter Street and Darby Street area.
- Wharf Road at Perkins Street to access the Hunter Street Mall via the Perkins Street pedestrian connection.

The shuttle bus service would operate to connect with all trains at Hamilton Station and at Wickham when appropriate. Train passengers would have the option to connect with trains at Wickham from bus stops in Hunter Street or at Hamilton at the two existing bus stops in Beaumont Street.

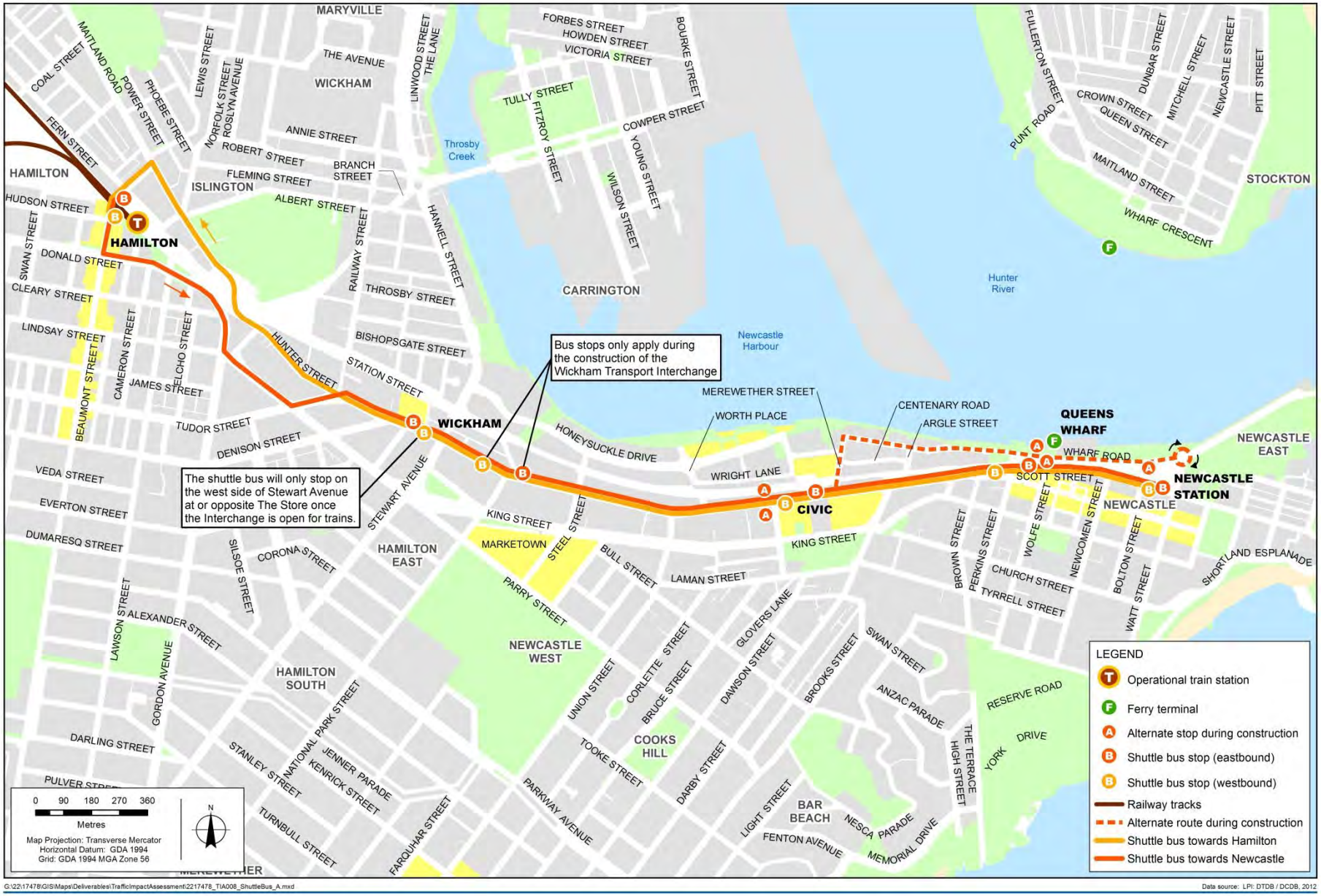


Figure 5-7 Proposed shuttle bus route during construction

5.2.5 Comprehensive traffic, transport and access management plan

Potential construction traffic impacts would be managed by the implementation of measures provided in section 6. The elements detailed below would form part of the plan, but would be elaborated on by the construction contractor. Any substantive changes to the proposed construction methodology would require an analysis of potential traffic impacts and approval by TfNSW, along with necessary mitigation measures.

A construction traffic, transport and access management plan would be developed for each construction zone and work site within each zone (including the construction compounds). A particular focus of the plan would be the key CBD access routes and intersections outlined in section 5.2.1. Consultation with adjacent work sites, such as at the Wickham Transport Interchange, and key stakeholders would be undertaken regularly to facilitate the efficient delivery of the works and to minimise congestion and inconvenience to road users, including:

- Council
- Bus and coach operators
- Taxis
- Roads and Maritime
- Emergency services
- Businesses in the city centre, in particular along Hunter Street and Scott Street.
- Other agencies, such as the University of Newcastle and major employers in the city centre.

5.3 Cumulative impacts

5.3.1 Wickham Transport Interchange and the proposal

The construction phases for the Wickham Transport Interchange and the proposal would coincide with the interchange scheduled to be operational in 2017 and the proposal in late 2018. Assuming construction commences in mid 2016, there would be a period of approximately 6-12 months when both projects are under construction concurrently and potential impacts on the road network in the Wickham and Newcastle West areas, in particular along Stewart Avenue, Hannell Street and Honeysuckle Drive may result.

The construction activities and vehicle movements for the Wickham Transport Interchange are mostly located west of Stewart Avenue and north of the railway line with the site compound located near Railway Street and Station Street. Access for heavy vehicles to the Wickham Transport Interchange construction site is from the north via Albert Street and Railway Street.

Most of the proposal construction activities would be located east of Stewart Avenue and along Honeysuckle Drive where the light rail maintenance and stabling facility would be built and where the western construction compound is proposed.

With most of the construction activities for the two projects are located on either the western or eastern sides of Stewart Avenue, cumulative impacts during the construction phase are likely to be minimal for both traffic, pedestrians and cyclists passing near the construction zone.

The following construction activities have the potential to result in cumulative impacts in the vicinity of Stewart Avenue:

- The light rail platform and overhead catenary on the southern side of the interchange in Beresford Street west of Stewart Avenue.
- The light rail tracks and catenary in Beresford Street on either side of Stewart Avenue.
- The light rail depot and stabling facility north of the existing Wickham Station and in Station Street east of Stewart Avenue and south of Honeysuckle Drive.
- Changes to the footpaths as part of the interchange plaza area and along Stewart Avenue.
- Changes to the footpaths near the light rail depot in Beresford Street and Station Street.
- Fencing in the median of Stewart Avenue.
- Changes to the pavement line marking and signage in Stewart Avenue.
- Road works at Stewart Avenue and Honeysuckle Drive for the new left turn slip lane.
- The light rail tracks and new traffic signals across Stewart Avenue that would be installed during a weekend shutdown period.

Heavy vehicle movements in the Wickham area and in Stewart Avenue and Hannell Street would be restricted to outside of weekday peak hours and would be preferably in the evenings or on weekends when the traffic volumes in the city centre are lower to reduce the potential for cumulative traffic impacts. A key strategy would also be regular and continuous liaison between the two construction projects, particularly for works involving Stewart Avenue/Hannell Street, to maximise the opportunities for coordination of works and reduce the likelihood and severity of any cumulative impacts.

The proposal would result in the removal of 280 on-street car parking spaces, located mostly in Hunter, Scott and Beresford Streets. An additional 83 on-street car parking spaces would be removed temporarily during the peak periods on King Street between Darby and Union streets for the proposed peak period 'No Stopping' zone, which would apply on the north side in the AM peak period before 9 am and on the south side between 5 pm and 6 pm on weekdays. The cumulative reduction of on-street car parking, including 75 car parking spaces from the Wickham Transport Interchange project, would be 438 spaces. A total of 17 motorcycle parking spaces would also be removed in Steel and King Streets.

The removal of the heavy rail line east of Stewart Avenue and installation of new pedestrian crossings of the former heavy rail has improved access to some of the larger off-street paid car parking areas and parking located along the foreshore areas, which were previously not easily accessed from Hunter Street and surrounds.

As outlined in sections 5.1.3 and 6.1.2, investigation of options to mitigate the removal of on-street parking and loading zones as a result of the proposal is currently being undertaken by TfNSW. Specific sites being considered include the former heavy rail corridor between Merewether Street and Argyle Street and between Worth Place and west of Wheeler Place. Other upcoming development sites would also be considered. Consultation with affected businesses in Hunter, Scott and King Streets would be undertaken and with road owners and managers, including Roads and Maritime and Council.

6. Mitigation measures

The section outlines the mitigation measures to reduce the impacts of the proposal during construction and operation.

6.1 Pre-construction

6.1.1 Traffic volumes and intersection performance

TfNSW and Roads and Maritime are currently developing a package of additional road intersection improvements to complement the implementation of the proposal. These measures are aimed at removing existing pinch points in the road network to ensure traffic continues to moves freely and efficiently. These works are likely to include increased queueing space for turning vehicles at intersections, local road widenings and changes to line marking. As identified by this assessment, the intersection of King Street and Union Street will be one of the locations considered. Preliminary design for these proposed works are provided in Appendix D.

6.1.2 Car parking, loading zones and taxi ranks

A review of options to mitigate the loss of on-street parking and loading zones would be undertaken. The review would include both existing on-street and off-street parking locations as well as the opportunities provided by new or proposed developments or Government-owned land close to the proposal site. The review would:

- Be undertaken in accordance with the objectives and requirements of the *Newcastle Urban Renewal Strategy* and the NUTTP
- Involve an audit of the use of existing spaces including turnover
- Include an assessment of the potential options and identification of a preferred option/s
- Be undertaken in consultation with relevant stakeholders, including surrounding businesses/organisations and Council.

Taxi ranks in Hunter Street at Civic Station and in Watt Street at Newcastle Station may need to be relocated to provide space for a new development project at Civic and for a bus stop in Watt Street at Newcastle Station. Consultation with Council and the taxi industry would be conducted to identify suitable locations for replacement taxi ranks.

6.1.3 King Street bicycle lanes

A review of options to support the provision of a dedicated east-west bicycle facility on King Street would be undertaken. This review of alternative measures would be completed and communicated with the community prior to proposal implementation. The review would:

- Be undertaken in accordance with the objectives and requirements of the *Newcastle Urban Renewal Strategy* and the NUTTP.
- Involve an audit of the use of existing spaces including turnover.
- Include an assessment of the potential options and identification of a preferred option/s.
- Be undertaken in consultation with relevant stakeholders, including surrounding businesses/organisations and Council.

6.2 Construction

Prior to the commencement of construction, a comprehensive construction traffic, transport and access management plan would be prepared in accordance with applicable standards and in consultation with relevant stakeholders as part of the construction environmental management plan (CEMP). The plan would address each construction zone and work site within each zone (including the construction compounds) and include consultation with adjacent work sites and with key stakeholders.

The following measures would be implemented based on the indicative construction methodology outlined in this report. If the proposed methodology changes substantially, additional planning approvals and mitigation measures may be required.

6.2.1 Traffic management

The following mitigation measures would be included:

- Maintain access and manage traffic flows around the area affected by the works, including required regulatory and directional signposting, line marking and variable message signs and all other traffic control devices necessary. Particular reference would be made to the key access routes and intersections outlined in section 5.2.1.
- Traffic and access would be managed in accordance with *Traffic Control at Work Sites* (Roads and Maritime 2010) and in consultation with Roads and Maritime and Council.
- Construction vehicles would park within the construction compound/rail corridor safe zone.
- Adequate signage to inform motorists, pedestrians and cyclists of the work and ensure that the risk of accidents and disruption to surrounding land uses is minimised.
- Adequate sight lines to allow for safe entry and exit from the site.
- The timing of deliveries accessing the site to ensure there is sufficient space within the proposal site to accommodate deliveries.
- The queuing and idling of construction vehicles in residential streets would be minimised.
- Routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses.
- Ongoing consultation with Council for any works within the road reserve of local roads.
- Co-ordination with other constructors, such as Wickham Transport Interchange, particularly regarding works required at the Stewart Avenue/ Hannell Street intersection.
- Ongoing consultation and feedback from key stakeholders including Roads and Maritime and Council would be co-ordinated by TfNSW to facilitate the efficient completion of the works and ensure awareness of proposed road network or intersection changes and the efficacy of mitigation proposals.

6.2.2 Transport and access

The following mitigation measures would be included:

- A pedestrian and cyclist management plan to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements. Particular reference would be made to key access routes and intersections outlined in section 5.2.1.
- Impacts and changes to on and off-street parking and requirements for any temporary replacement provision.
- Consultation with the local, regional and interstate bus operators to determine their requirements, including any rerouting of services if required.
- Details for the relocation of kiss-and-ride, taxi ranks and bus stops if required, including appropriate signage to direct patrons, in consultation with the relevant operator.
- Adequate signage at all stops along the bus routes to clearly show the location of stops and routes.
- Access to all private properties adjacent to the proposal site would be maintained during construction, unless otherwise agreed with relevant property owners.

7. Summary and conclusion

The proposal is a key infrastructure element in the *Newcastle Urban Renewal Strategy* (Department of Planning and Infrastructure, 2012) and the NUTTP. The proposal would facilitate urban redevelopment of public, residential and commercial lands by providing an efficient and accessible form of transport for Newcastle city centre. The truncation of the heavy rail at Wickham and development of the new transport interchange at Stewart Avenue is an important precursor. This has already resulted in improved connectivity in the city with six new pedestrian and cycle crossings across the heavy rail corridor improving access to the foreshore.

This assessment has identified traffic, transport and access benefits and impacts during construction and operation of the proposal and proposes mitigation measures to reduce identified impacts.

They key impacts during proposal operation and construction are summarised as follows.

Operation

2018

The inclusion of a separated running lane for light rail on Hunter Street, removes one lane for vehicular traffic on Hunter Street in each direction. The reduced lane capacity in Hunter Street may divert some traffic on to other roads, such as King Street. The predicted changes in traffic volumes in 2018 can be accommodated within the remaining road capacity.

The intersection LoS results indicate that at some intersections, performance would improve (compared to without the proposal) with the connections in the road network at Steel Street and Worth Place redistributing traffic in the western part of the study area. Most intersections would operate at LoS D or better. The road network performance is considered satisfactory.

2028

The results provide an indication of potential future impacts assuming a constant growth in traffic volumes and population growth associated with proposed future urban development.

The intersection LoS results indicate that the majority of intersections would operate at LoS D or better throughout the network. The intersection of King Street/ Stewart Avenue is predicted to deteriorate to LoS E in the AM peak period (compared to D in 2018) and Honeysuckle Drive/ Hannell Street and King/ Union Street to LoS F in the PM peak period compared to C and E respectively in 2018.

Roads and Maritime in conjunction with TfNSW are currently investigating locations for other road upgrade works to complement the proposal. These measures are aimed at removing existing pinch points in the road network to ensure traffic continues to move freely and efficiently.

Light rail vehicle journey time is not affected by changes in vehicular traffic performance between 2018 and 2028.

Car parking, taxi ranks and loading zones

A total of 280 car parking spaces would be removed to provide the necessary width for the light rail and remaining roadway. A further 83 and 17 motorcycle parking spaces would be temporarily removed in Steel Street and in King Street for the peak period ‘No Stopping’ zone.

In addition to the parking spaces removed, a total of 29 spaces in loading zones, including three mail zones, would be removed. Loading zone requirements would be confirmed and may need to be relocated to other streets in the city centre.

Taxi ranks in Hunter Street at Civic Station and in Watt Street at Newcastle Station may need to be relocated to provide convenient access for taxi customers.

Bus movements and bus zones

A revised city centre bus plan would be developed for implementation by TfNSW. The plan would confirm which bus routes would operate in Hunter Street and Scott Street following proposal commencement. The current design indicates a total of 7 of the 20 bus stops in the construction zone would be removed or relocated permanently

The route and stops for the shuttle bus service operating between Hamilton and Newcastle stations may need to be temporarily adjusted to avoid construction activities in Hunter Street east of Worth Place and in Scott Street.

Cyclists

The proposed peak hour "No Stopping" along King Street may impact on east-west bicycle movements. TfNSW will undertake a review of alternative measures to support cycling in King Street. The review would:

- Be undertaken in accordance with the objectives and requirements of the *Newcastle Urban Renewal Strategy* and the NUTTP.
- Involve an audit of the use of existing spaces including turnover.
- Include an assessment of the potential options and identification of a preferred option/s.
- Be undertaken in consultation with relevant stakeholders, including surrounding businesses/organisations and Council.

Construction

Traffic generation

The number of heavy vehicle movements is estimated to be eight to 12 vehicles per zone per day with an average daily total of 38 heavy vehicles. This number of additional vehicles in the city centre road network would not noticeably affect traffic performance because it is less than 0.5 per cent of current traffic volumes in Hunter Street.

Light vehicles would comprise a contractor shuttle bus or light truck to transport workers and equipment from dedicated parking areas to the works sites and a few management staff vehicles. The total number of light vehicle movements is estimated to be less than 20 vehicles per day. In total, the number of heavy and light vehicle movements around the construction site would be low compared to the existing traffic volumes.

To determine the effects of reducing short sections of Hunter Street to one lane in each direction, as required during proposal construction, a SIDRA analysis was completed on the section of Hunter Street between Steel Street and Union Street. The analysis indicated that, while there was a small increase in travel time due to the reduction to one lane, the overall LoS at the intersections did not change.

Worker parking

It is anticipated that up to about 100 staff and workers would be required on-site during the peak construction period and an average of approximately 70 staff and workers at other times. For these staff, parking would be encouraged either within the site compound or adjacent to the rail corridor to minimise inconvenience to residents and local businesses.

On-street parking and loading zones

Removal and relocation of parking spaces is required to provide sufficient width for construction and to maximise the width of traffic lanes available.

Parking and loading zones would be removed progressively along the corridor in each construction zone to minimise impacts.

The removal of on-street parking and relocation of loading zones would be further discussed with key stakeholders, including affected businesses, Council and others who are responsible for the management of streets in the city centre to determine appropriate mitigation.

Bus and coach services

Public transport arrangements during construction would be unchanged from their current routes and frequency. Some bus stops would be repositioned in order to avoid conflict with proposed construction works areas, which are typically up to 100 metres in length. In these situations, bus stops would be temporarily repositioned either 50 metres east or west of the proposed work site to avoid the potential conflict.

Pedestrians and cyclists

Pedestrians and cyclists who currently use the footpaths along Honeysuckle Drive near Stewart Avenue and in Stewart Avenue between Honeysuckle Drive and Hunter Street would be provided with safe routes through the construction zone when activity is occurring in these streets. The other north-south connections between the foreshore and Hunter Street, such as Steel Street, Worth Place, Merewether Street and Perkins Street, may also be affected by construction activities. Signage at the entry points into the city centre and an information brochure of the safe routes to and through the city centre would be prepared prior to the start of the construction works.

Cumulative impacts

The construction phases for the Wickham Transport Interchange and the proposal would coincide with the interchange scheduled to be operational in 2017 and the proposal in late 2018.

With most of the construction activities for the two projects located on either the western or eastern sides of Stewart Avenue, cumulative impacts during the construction phase are likely to be minimal for both traffic, pedestrians and cyclists passing near the construction zones. Regular and continuous liaison between the two construction projects, and particularly for works involving Stewart Avenue/Hannell Street, will maximise the opportunities for coordination of works and reduce the likelihood and severity of any cumulative impacts.

Proposal construction and operation would result in the removal of 280 on-street car parking spaces, located mostly in Hunter, Scott and Beresford streets. An additional 83 on-street car parking spaces would be removed temporarily during the peak periods on King Street, between Darby and Union streets, for the proposed peak period ‘No Stopping’ zone. The cumulative reduction of on-street car parking, including 75 car parking spaces from the Wickham Transport Interchange project, would be 438 spaces.

Investigation of options to mitigate the removal of on-street parking and loading zones as a result of the proposal are currently being undertaken by TfNSW. Consultation with affected businesses in Hunter, Scott and King streets as well as Roads and Maritime and Council would be undertaken.

8. References

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Appendices

Appendix A – Kerbside street usage inventory

This table provides the details of the on-street car parking, loading zones, mail zones and other kerbside restrictions by street section as determined from the GHD kerbside street usage surveys conducted in October 2015. The bus zones are listed separately in Appendix B.

Street	Number of parking and loading zones	Number of spaces in parking and loading zones
Argyle Street		
4P (ticket)	2	9
Loading Zone	1	0
Motorcycle Parking	1	6
Bellevue Street		
2P (ticket)	2	10
No parking	1	0
No Stopping	2	0
Beresford Street		
2P (ticket)	1	10
Loading Zone	1	0
No Stopping	3	0
Not signposted	1	8
Railway Parking	1	35
Centenary Road		
2P (ticket)	4	32
Loading Zone	1	0
No parking	1	0
No Stopping	2	0
30 min P	1	3
15 min P	2	6
Honeysuckle Drive		
1P (ticket)	1	7
2P (ticket)	1	2
4P (ticket)	1	18
5 min P	1	2
2P (ticket)	16	169
Construction Zone	1	0
Disabled Parking	2	2
Mail Zone	2	0
No parking	3	0
No Stopping	5	0
Taxi Zone	1	0
30 min P	1	1
15 min P	3	9

Street	Number of parking and loading zones	Number of spaces in parking and loading zones
King Street		
15 min P	1	3
2P (ticket)	4	97
Motorcycle Parking	2	11
Market Street		
5 min P	1	6
Merewether Street		
No Stopping	2	0
Old Hannell Street		
8P (ticket)	2	32
No Stopping	1	0
Scott Street		
2P (ticket)	15	106
Disabled Parking	1	1
Loading Zone	3	0
Mail Zone	1	0
No parking	1	0
No Stopping	12	0
5 min P	2	5
15 min P	2	5
Station Street		
8P (ticket)	2	29
No parking	1	0
No Stopping	1	0
Steel Street		
Disabled Parking	1	2
Motorcycle Parking	1	6
No Stopping	2	0
Not signposted	1	0
15 min P	1	3
Telford Street		
2P (ticket)	1	5
4P (ticket)	2	22
All Day P (Ticket)	1	5
Watt Street		
2P (ticket)	1	3
No parking	1	0
No Stopping	1	0
Taxi Zone	1	0
Worth Place		
No Stopping	2	0
30 min P	1	3

Street	Number of parking and loading zones	Number of spaces in parking and loading zones
Stewart Avenue		
No Stopping	5	0
Total	**152**	**682**

Appendix B – Changes to bus stops with proposal

This table provides the details of the bus stop and layover zones in the proposal study area as determined from the GHD surveys conducted in October 2015 and compared to the amended definition design drawings prepared by PB (issued on 9 October 2015).

Sequence number	Street	Location	Description of adjacent land use	Side of street	Existing type	Bus stop status with proposal
Hunter Street, Scott Street for eastbound bus services and Watt Street						
1	Hunter Street	West of Stewart Avenue	The Store	North	Stop only	retained
2	Hunter Street	East of Bellevue Street	Ibis Hotel and clinic	North	Stop only	retained
3	Hunter Street	East of Steel Street	Hunter Regional Health	North	Stop only	retained
4	Hunter Street	West of Union Street	Hunter Street shops	North	Stop only	retained
5	Hunter Street	West of Auckland Street	Bridal shops	North	Stop only	repositioned
6	Hunter Street	At Civic Station	Civic Station	North	Stop only	removed
7	Hunter Street	East of Darby Street	Vacant land	North	Stop only	retained
8	Scott Street	East of Perkins Street	Railway corridor	North	Stop only	removed
9	Scott Street	West of Market Street	Railway corridor	North	Stop only	removed
10	Scott Street	West of Watt Street	Newcastle Railway Station	North	Stop only	removed
11	Watt Street	North of Scott Street	Taxi zone at station	West	Stop only	new
Parnell Place, and Scott Street and Hunter Street for westbound bus services						
1	Parnell Place	North of Scott Street	Parnell Park	South	Stop only	retained
2	Scott Street	East of Pacific Street	Pacific Park	South	Stop only	removed
3	Scott Street	East of Bolton Street	Chiefly Hotel	South	Stop only	removed
4	Scott Street	West of Market Street	Market Street access to Hunter Street Mall	South	Stop only	removed

Sequence number	Street	Location	Description of adjacent land use	Side of street	Existing type	Bus stop status with proposal
5	Hunter Street	West of Perkins Street	Western end of Hunter Street Mall	South	Stop only	removed
6	Hunter Street	East of Darby Street	Darby Street businesses	South	Stop only	removed
7	Hunter Street	East of Merewether Street	Justice Precinct construction zone	South	Stop only	removed
8	Hunter Street	East of Auckland Street	NewSpace construction zone	South	Stop only	repositioned
9	Hunter Street	East of Union Street	Hunter Street shops	South	Stop only	retained
10	Hunter Street	East of Steel Street	Public bar	South	Stop only	retained
11	Hunter Street	West of National Park Street	Spotlight store	South	Stop only	retained
12	Hunter Street	West of Stewart Avenue	Old Newcastle Museum	South	Stop only	retained
Honeysuckle Drive and Wharf Road for eastbound bus services						
1	Honeysuckle Drive	West of Steel Street	Vacant land along foreshore	North	Stop only	retained
2	Honeysuckle Drive	North of Workshop Way	Newcastle Tourist Information Centre and Maritime Museum	North	Stop only	removed
3	Wharf Road	At Queens Wharf	Queens Wharf ferry terminal	North	Stop only	retained
Wharf Road and Honeysuckle Drive for westbound bus services						
1	Wharf Road	At Queens Wharf	Railway corridor	South	Parking	new
2	Honeysuckle Drive	East of Worth Place	Vacant land opposite Lee Wharf apartments	South	Stop only	removed
3	Honeysuckle Drive	West of Steel Street	Hunter Water	South	Stop only	retained
Stewart Avenue bus bays						
1	Stewart Avenue	Beresford Street	Honeysuckle Drive	West	Bus bay	retained
2	Stewart Avenue	Honeysuckle Drive	Station Street	East	Bus bay	retained

Appendix C – Comparison of traffic volumes for the 2018 and 2028 scenarios

Station	Location	Direction	2015			2018 – without proposal			2018 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
1	Stewart Avenue between Throsby Street and Honeysuckle Drive	Northbound	1,500	1,620	19,001	1,500	1,620	18,997	1,502	1,641	19,141	140	0.7%
		Southbound	1,659	1,598	17,389	1,700	1,598	17,607	1,756	1,718	18,551	1,162	6.7%
2	Stewart Avenue between Honeysuckle Drive and Hunter Street	Northbound	1,524	1,337	17,108	1,582	1,337	17,453	1,454	1,164	15,653	-1,454	-8.5%
		Southbound	1,014	1,392	12,416	1,042	1,392	12,563	1,081	1,441	13,012	596	4.8%
3	Hunter Street between Wood Street and Stewart Avenue	Westbound	365	482	4,659	372	482	4,698	305	392	3,831	-827	-17.8%
		Eastbound	795	635	7,863	828	635	8,047	708	465	6,454	-1,409	-17.9%
4	Stewart Avenue between Hunter Street and King Street	Northbound	1,101	902	10,735	1,125	902	10,865	1,039	978	10,812	77	0.7%
		Southbound	774	1,184	11,434	747	1,184	11,275	771	1,247	11,783	349	3.1%
5	Honeysuckle Drive between Hannell Street and Steel Street	Westbound	492	760	7,110	497	760	7,139	523	872	7,928	818	11.5%
		Eastbound	1,146	711	12,365	1,169	711	12,518	605	567	7,800	-4,565	-36.9%
6	Hunter Street between Stewart Avenue and Steel Street	Westbound	675	956	10,732	703	956	10,914	602	641	8,179	-2,553	-23.8%
		Eastbound	702	634	7,536	772	634	7,932	656	431	6,134	-1,402	-18.6%
7	King Street between National Park Street and Steel Street	Westbound	946	1,496	14,112	958	1,496	14,179	938	1,794	15,789	1,676	11.9%
		Eastbound	1,218	997	12,094	1,264	997	12,344	1,475	1,250	14,876	2,782	23.0%
8	Steel Street between Honeysuckle Drive and Hunter Street	Northbound	67	125	1,276	61	125	1,237	220	343	3,747	2,471	193.6%
		Southbound	70	98	1,287	73	98	1,305	131	382	3,924	2,637	205.0%
9	Honeysuckle Drive between Steel Street and Worth Place	Westbound	492	760	8,337	497	760	8,370	523	689	8,076	-261	-3.1%
		Eastbound	1,146	711	12,365	1,169	711	12,518	625	589	8,084	-4,281	-34.6%

Station	Location	Direction	2015			2018 – without proposal			2018 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
10	Hunter Street between Steel Street and Union Street	Westbound	605	943	10,957	660	943	11,345	715	880	11,291	334	3.0%
		Eastbound	700	565	7,385	777	565	7,834	681	458	6,652	-734	-9.9%
11	King Street between Steel Street and Union Street	Westbound	658	995	10,514	659	995	10,521	671	1,314	12,627	2,113	20.1%
		Eastbound	1,069	1,009	11,864	1,108	1,009	12,090	1,300	1,230	14,451	2,587	21.8%
12	Worth Place between Honeysuckle Drive and Hunter Street	Northbound	-	-	-	-	-	-	94	258	2,015	2,015	-
		Southbound	-	-	-	-	-	-	120	107	1,543	1,543	-
13	Union Street between Hunter Street and King Street	Northbound	282	294	3,510	300	294	3,621	387	394	4,762	1,252	35.7%
		Southbound	160	234	2,891	176	234	3,010	236	238	3,477	586	20.3%
14	Union Street between Laman Street and Hunter Street	Northbound	329	343	3,708	353	343	3,841	411	428	4,631	923	24.9%
		Southbound	622	603	6,760	637	603	6,845	631	650	7,067	307	4.5%
15	Honeysuckle Drive between Worth Place and Workshop Way	Westbound	412	452	5,752	417	452	5,788	327	397	4,822	-930	-16.2%
		Eastbound	521	510	6,870	528	510	6,916	370	496	5,769	-1,102	-16.0%
16	Hunter Street between Worth Place and Auckland Street	Westbound	556	959	10,434	622	959	10,894	590	708	8,942	-1,492	-14.3%
		Eastbound	570	743	7,513	658	743	8,016	500	407	5,188	-2,325	-30.9%
17	King Street between Union Street and Auckland Street	Westbound	482	683	7,164	501	683	7,283	568	1,100	10,259	3,096	43.2%
		Eastbound	529	573	6,547	553	573	6,693	822	817	9,738	3,191	48.7%
18	Auckland Street between Hunter Street and King Street	Northbound	88	124	1,482	97	124	1,546	97	160	1,796	315	21.2%
		Southbound	82	96	1,385	84	96	1,402	21	66	685	-700	-50.6%
19	Hunter Street between Auckland Street and Merewether Street	Westbound	602	994	10,871	668	994	11,318	551	637	8,090	-2,781	-25.6%
		Eastbound	613	747	9,354	709	747	10,016	529	420	6,523	-2,831	-30.3%
20	Merewether Street between Centenary Road and Hunter Street	Northbound	276	322	4,107	304	322	4,300	223	130	2,423	-1,684	-41.0%
		Southbound	297	491	4,938	328	491	5,131	184	282	2,918	-2,020	-40.9%

Station	Location	Direction	2015			2018 – without proposal			2018 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
21	Hunter Street between Merewether Street and Darby Street	Westbound	619	827	9,940	683	827	10,384	503	533	7,121	-2,819	-28.4%
		Eastbound	636	788	8,143	738	788	8,725	447	463	5,203	-2,940	-36.1%
22	King Street between Auckland and Darby Street	Westbound	469	602	7,328	493	602	7,495	648	1,064	11,710	4,382	59.8%
		Eastbound	465	447	5,145	469	447	5,167	746	744	8,405	3,260	63.4%
23	Darby Street between Hunter Street and King Street	Northbound	184	158	2,378	194	158	2,448	182	198	2,641	264	11.1%
		Southbound	194	397	3,592	191	397	3,574	266	459	4,407	815	22.7%
24	Darby Street between Tyrrell Street and King Street	Northbound	631	531	7,038	649	531	7,152	626	537	7,050	12	0.2%
		Southbound	436	628	6,449	438	628	6,460	456	619	6,512	63	1.0%
25	Wharf Road between Merewether Street and Argyle Street	Westbound	286	373	4,131	294	373	4,184	256	302	3,498	-633	-15.3%
		Eastbound	377	384	5,235	390	384	5,324	396	421	5,611	377	7.2%
26	Hunter Street between Darby Street and Perkins Street	Westbound	596	804	9,589	651	804	9,964	569	677	8,530	-1,059	-11.0%
		Eastbound	596	563	7,938	600	563	7,967	616	654	8,702	764	9.6%
27	Scott Street between Bolton Street and Watt Street	Westbound	432	416	5,694	436	416	5,718	448	422	5,838	144	2.5%
		Eastbound	488	381	5,828	508	381	5,963	398	324	4,847	-981	-16.8%
28	Watt Street between Wharf Road and Scott Street	Northbound	414	186	3,581	377	186	3,356	328	156	2,889	-691	-19.3%
		Southbound	334	397	4,364	331	397	4,347	314	349	3,963	-401	-9.2%
29	Watt Street between Hunter Street and Scott Street	Northbound	344	197	3,419	318	197	3,256	394	275	4,235	815	23.8%
		Southbound	409	375	4,959	409	375	4,959	263	303	3,583	-1,376	-27.8%
30	Scott Street between Watt Street and Pacific Street	Westbound	324	245	3,628	324	245	3,628	342	253	3,791	163	4.5%
		Eastbound	235	243	3,042	260	243	3,204	409	321	4,653	1,610	52.9%

Note change in traffic volumes presents the comparison of 2015 conditions with the 2018 with light rail scenario

Station	Location	Direction	2015			2028 – without proposal			2028 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
1	Stewart Avenue between Throsby Street and Honeysuckle Drive	Northbound	1,500	1,620	19,001	1,531	1,667	19,472	1,563	1,748	20,163	1,162	6.1%
		Southbound	1,659	1,598	17,389	1,708	1,631	17,829	1,855	1,676	18,858	1,469	8.4%
2	Stewart Avenue between Honeysuckle Drive and Hunter Street	Northbound	1,524	1,337	17,108	1,587	1,417	17,966	1,552	1,191	16,408	-700	-4.1%
		Southbound	1,014	1,392	12,416	1,051	1,398	12,638	1,196	1,394	13,361	945	7.6%
3	Hunter Street between Wood Street and Stewart Avenue	Westbound	365	482	4,659	388	542	5,114	373	370	4,087	-572	-12.3%
		Eastbound	795	635	7,863	915	645	8,579	807	396	6,614	-1,249	-15.9%
4	Stewart Avenue between Hunter Street and King Street	Northbound	1,101	902	10,735	1,156	932	11,191	1,125	984	11,300	565	5.3%
		Southbound	774	1,184	11,434	771	1,213	11,583	812	1,251	12,050	617	5.4%
5	Honeysuckle Drive between Hannell Street and Steel Street	Westbound	492	760	7,110	483	710	6,776	443	864	7,425	315	4.4%
		Eastbound	1,146	711	12,365	1,167	715	12,530	1,042	655	11,299	-1,066	-8.6%
6	Hunter Street between Stewart Avenue and Steel Street	Westbound	675	956	10,732	688	1,070	11,566	657	658	8,653	-2,079	-19.4%
		Eastbound	702	634	7,536	827	637	8,257	770	343	6,275	-1,261	-16.7%
7	King Street between National Park Street and Steel Street	Westbound	946	1,496	14,112	943	1,697	15,263	925	1,914	16,412	2,299	16.3%
		Eastbound	1,218	997	12,094	1,405	1,015	13,215	1,705	1,221	15,976	3,882	32.1%
8	Steel Street between Honeysuckle Drive and Hunter Street	Northbound	67	125	1,276	59	128	1,249	276	513	5,257	3,981	312.0%
		Southbound	70	98	1,287	69	102	1,302	141	394	4,090	2,804	217.9%
9	Honeysuckle Drive between Steel Street and Worth Place	Westbound	492	760	8,337	483	710	7,945	443	864	8,706	369	4.4%
		Eastbound	1,146	711	12,365	1,167	715	12,530	1,042	655	11,299	-1,066	-8.6%
10	Hunter Street between Steel Street and Union Street	Westbound	605	943	10,957	628	1,100	12,236	773	976	12,380	1,423	13.0%
		Eastbound	700	565	7,385	822	578	8,177	755	385	6,656	-729	-9.9%
11	King Street between Steel Street and Union Street	Westbound	658	995	10,514	664	1,247	12,155	644	1,322	12,505	1,991	18.9%
		Eastbound	1,069	1,009	11,864	1,239	1,021	12,906	1,526	1,253	15,870	4,006	33.8%

Station	Location	Direction	2015			2028 – without proposal			2028 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
12	Worth Place between Honeysuckle Drive and Hunter Street	Northbound	-	-	-	-	-	-	98	252	2,000	2,000	-
		Southbound	-	-	-	-	-	-	117	90	1,408	1,408	-
13	Union Street between Hunter Street and King Street	Northbound	282	294	3,510	343	315	4,016	448	450	5,475	1,965	56.0%
		Southbound	160	234	2,891	197	283	3,514	305	219	3,838	947	32.8%
14	Union Street between Laman Street and Hunter Street	Northbound	329	343	3,708	419	406	4,558	463	522	5,437	1,729	46.6%
		Southbound	622	603	6,760	669	655	7,308	680	657	7,379	619	9.2%
15	Honeysuckle Drive between Worth Place and Workshop Way	Westbound	412	452	5,752	409	461	5,797	274	405	4,519	-1,232	-21.4%
		Eastbound	521	510	6,870	543	521	7,081	392	412	5,355	-1,516	-22.1%
16	Hunter Street between Worth Place and Auckland Street	Westbound	556	959	10,434	581	1,139	11,851	639	731	9,439	-995	-9.5%
		Eastbound	570	743	7,513	682	799	8,468	559	352	5,212	-2,301	-30.6%
17	King Street between Union Street and Auckland Street	Westbound	482	683	7,164	498	899	8,595	525	1,170	10,422	3,258	45.5%
		Eastbound	529	573	6,547	638	597	7,341	962	767	10,270	3,723	56.9%
18	Auckland Street between Hunter Street and King Street	Northbound	88	124	1,482	111	141	1,759	140	167	2,142	660	44.5%
		Southbound	82	96	1,385	82	139	1,725	18	114	1,030	-356	-25.7%
19	Hunter Street between Auckland Street and Merewether Street	Westbound	602	994	10,871	620	1,205	12,428	585	704	8,779	-2,092	-19.2%
		Eastbound	613	747	9,354	743	806	10,651	612	369	6,747	-2,607	-27.9%
20	Merewether Street between Centenary Road and Hunter Street	Northbound	276	322	4,107	341	362	4,836	305	117	2,900	-1,207	-29.4%
		Southbound	297	491	4,938	306	613	5,759	210	371	3,645	-1,293	-26.2%
21	Hunter Street between Merewether Street and Darby Street	Westbound	619	827	9,940	648	925	10,817	523	516	7,142	-2,798	-28.2%
		Eastbound	636	788	8,143	721	826	8,850	453	440	5,109	-3,034	-37.3%
22	King Street between Auckland and Darby Street	Westbound	469	602	7,328	497	713	8,278	630	1,111	11,904	4,576	62.4%
		Eastbound	465	447	5,145	497	469	5,450	810	701	8,518	3,373	65.6%

Station	Location	Direction	2015			2028 – without proposal			2028 – with proposal			Change in daily volume with proposal	Change in daily volume with proposal (%)
			AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily		
23	Darby Street between Hunter Street and King Street	Northbound	184	158	2,378	196	185	2,648	209	206	2,880	502	21.1%
		Southbound	194	397	3,592	189	413	3,658	246	488	4,466	874	24.3%
24	Darby Street between Tyrrell Street and King Street	Northbound	631	531	7,038	690	586	7,728	655	581	7,489	451	6.4%
		Southbound	436	628	6,449	473	691	7,059	470	656	6,820	371	5.8%
25	Wharf Road between Merewether Street and Argyle Street	Westbound	286	373	4,131	291	413	4,407	232	341	3,592	-539	-13.0%
		Eastbound	377	384	5,235	436	394	5,704	441	355	5,473	238	4.5%
26	Hunter Street between Darby Street and Perkins Street	Westbound	596	804	9,589	597	882	10,130	555	670	8,390	-1,199	-12.5%
		Eastbound	596	563	7,938	597	573	8,016	629	669	8,889	951	12.0%
27	Scott Street between Bolton Street and Watt Street	Westbound	432	416	5,694	414	420	5,596	458	408	5,814	119	2.1%
		Eastbound	488	381	5,828	504	418	6,185	378	300	4,551	-1,278	-21.9%
28	Watt Street between Wharf Road and Scott Street	Northbound	414	186	3,581	400	195	3,552	334	169	3,002	-579	-16.2%
		Southbound	334	397	4,364	328	403	4,365	325	334	3,932	-432	-9.9%
29	Watt Street between Hunter Street and Scott Street	Northbound	344	197	3,419	326	205	3,360	410	288	4,422	1,003	29.3%
		Southbound	409	375	4,959	406	380	4,978	251	294	3,449	-1,510	-30.5%
30	Scott Street between Watt Street and Pacific Street	Westbound	324	245	3,628	310	254	3,598	321	246	3,609	-19	-0.5%
		Eastbound	235	243	3,042	247	286	3,396	390	298	4,383	1,340	44.1%

Appendix D – Preliminary road improvement designs

LEGEND

- NEW KERB AND GUTTER
- NEW LINEMARKING
- OFFROAD CYCLE PATH

PRELIMINARY DRAWING

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DRAWING FILE LOCATION / NAME	DESIGN LOT CODE	DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	PLOT DATE / TIME	PLOT BY
K:\Comment\Ton\T65\2014-075428 - Light Rail\CADD Data\01-Design\Light Rail Overall Works\NEWCASTLE LIGHT RAIL - ROADWORKS.dgn		NEWCASTLE LIGHT RAIL - ROADWORKS.dgn	3/12/2015 9:06:47 AM	SimkinC

EXTERNAL REFERENCE FILES	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
	01	17-12-15	ISSUED FOR PRELIMINARY DESIGN		

SCALES ON A3 SIZE DRAWING: 0 15 30 45 60 — SCALE 1:1500m

CO-ORDINATE SYSTEM: MGA ZONE 56 — HEIGHT DATUM: AHD

DRAWINGS / DESIGN PREPARED BY: NSW GOVERNMENT Transport Roads & Maritime Services

	NAME	DATE
DRAWN	J.TAYLOR	
DRG CHECK		
DESIGN		
DESIGN CHECK	P.MCLACHLAN	
DESIGN MNGR	P.MCLACHLAN	
PROJECT MNGR		

CLIENT: NSW GOVERNMENT Transport Roads & Maritime Services

NEWCASTLE - NEWCASTLE CITY COUNCIL
HW10 - PACIFIC HIGHWAY
LIGHT RAIL MITIGATION ROADWORKS
AT INTERSECTION OF KING STREET AND STEEL STREET
NEWCASTLE

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EXTERNAL REFERENCE FILES	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
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CO-ORDINATE SYSTEM: MGA ZONE 56 — HEIGHT DATUM: AHD

DRAWINGS / DESIGN PREPARED BY: NSW GOVERNMENT Transport Roads & Maritime Services

	NAME	DATE
DRAWN	J.TAYLOR	
DRG CHECK		
DESIGN		
DESIGN CHECK	P.MCLACHLAN	
DESIGN MNGR	P.MCLACHLAN	
PROJECT MNGR		

CLIENT: NSW GOVERNMENT Transport Roads & Maritime Services

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DRAWINGS / DESIGN PREPARED BY: NSW GOVERNMENT Transport Roads & Maritime Services

TITLE	NAME	DATE
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DRG CHECK		
DESIGN		
DESIGN CHECK	P.MCLACHLAN	
DESIGN MNGR	P.MCLACHLAN	
PROJECT MNGR		

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TITLE	NAME	DATE
DRAWN	J.TAYLOR	
DRG CHECK		
DESIGN		
DESIGN CHECK	P.MCLACHLAN	
DESIGN MNGR	P.MCLACHLAN	
PROJECT MNGR		

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TITLE	NAME	DATE
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DRG CHECK		
DESIGN		
DESIGN CHECK	P.MCLACHLAN	
DESIGN MNGR	P.MCLACHLAN	
PROJECT MNGR		

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			CO-ORDINATE SYSTEM MGA ZONE 56	HEIGHT DATUM AHD	

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		Name	Signature	Name	Signature	Date
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1	M. Brooks J Devney	G McCabe L King		G. Marshall		01/04/2016

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