The Empire

Diocese of Maitland-Newcastle

Traffic Impact Assessment

August 2016

SECAsolution

The Empire
Mixed-use development, Steel Street, Newcastle

Traffic Impact Assessment

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1 Introduction

Background

Seca Solution Pty Ltd has been commissioned by the Diocese of Maitland-Newcastle to prepare a traffic, access and parking assessment for the proposed residential and commercial development at the corner of Steel Street and Hunter Street, Newcastle. The plans for the development allow for a development incorporating a mixture of residential units with a commercial element on the ground floor. Three levels of parking will be provided on the site with all vehicle access directly onto Steel Street. The access will allow for all movements in and out with a driveway separated to cater for access to the ground floor parking and to the first and second level resident parking.

As part of the project, Seca Solution have collected current traffic data at the key locations and have observed the traffic operations in the locality of the site during peak periods.

1.1 Scope of Report

The scope of this report is to review the external traffic movements associated with the proposed development and to review the parking demands. The report provides advice on access issues and green travel opportunities.

1.2 Issues and Objectives of the study

The issues relative to the proposal are:

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

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

1.3 Planning Context

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

- RTA Guide to Traffic Generating Developments, Version 2.2 Dated October 2002;
- RMS TDT 2013/04 “Update Traffic surveys August 2013”.
- SEPP 65
- Newcastle City Council Development Control Plan
- Australian / New Zealand Standard – Parking Facilities Part 1 : off-street car parking (AS2890.1:2004);

2 Existing Situation

2.1 Site Description and Proposed Activity

The subject site is located within the Newcastle city centre. Once the location of The Empire Hotel, the site has been vacant for a number of years and was cleared in 2011. It is bounded by commercial development to the west along Hunter Street and the Travelodge Hotel Newcastle on the southern boundary of the site.

The proposed development is to include 128 studio, 1 and 2 bedroom apartments with a ground floor commercial tenancy and parking across three levels.

2.2 Site Location

The site is located off Steel Street, Newcastle and has street frontage to both Steel Street (eastern frontage) and Hunter Street (northern frontage).

The location of the site is shown below in Figure 2-1.

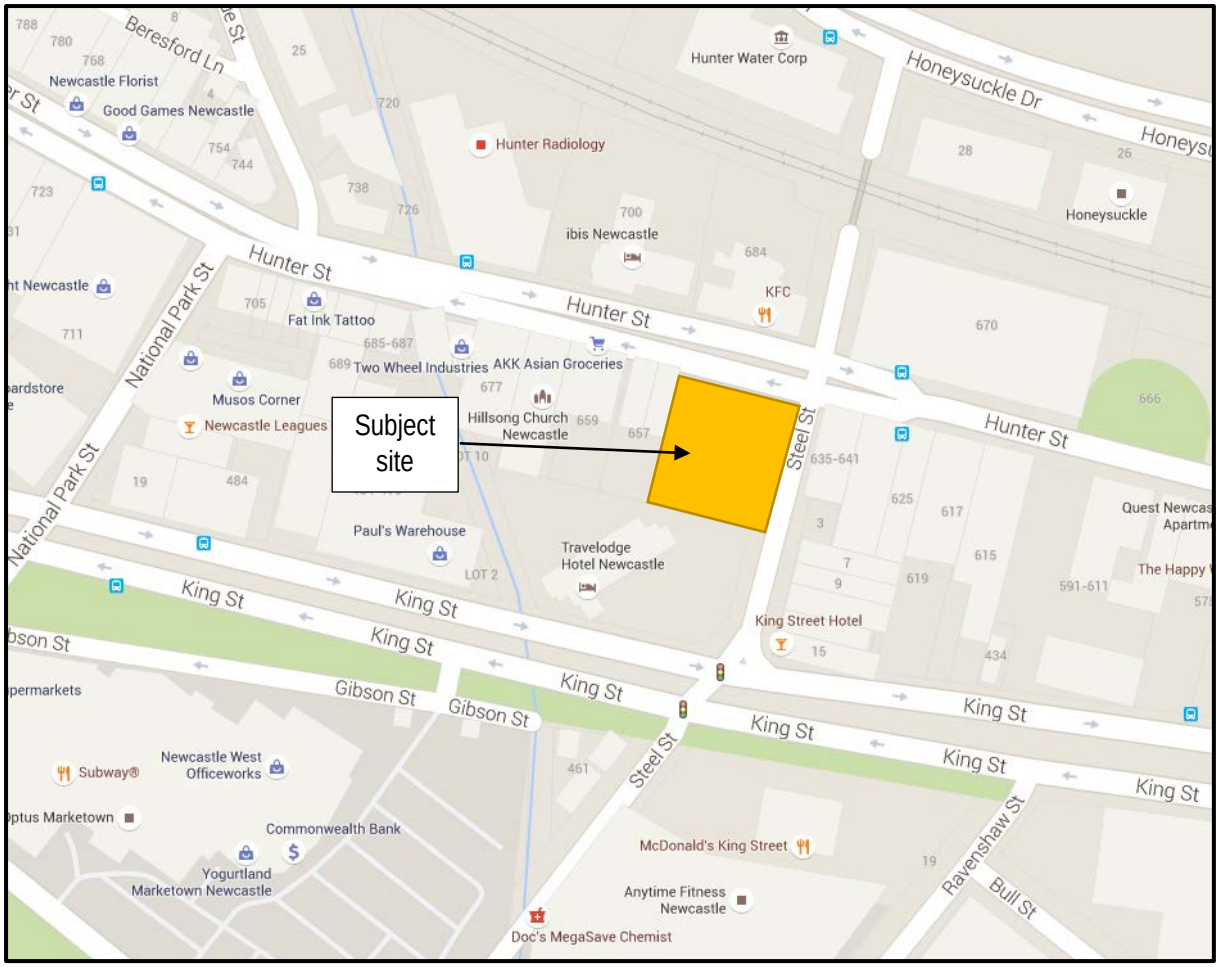


Figure 2-1 - Site Location (Source: Google maps)

2.2.1 Zoning and Adjacent Land Use

Zoning for the land is B3 Commercial with existing land use adjacent to the site being commercial developments as part of the Hunter Street retail strip and B4 Mixed Use forming part of the Newcastle CBD.

2.3 Site Access

All vehicle access to the site will be restricted to Steel Street only via a new driveway which is separated to cater for the ground level commercial parking and the upper level resident parking.

This access point will cater for all turning movements in and out of the site.

2.4 Existing Traffic Conditions

2.4.1 Road Hierarchy

Hunter Street

The main road through the locality is Hunter Street that runs along the northern boundary of the site with an east to west orientation. It provides predominately two lanes of travel in each direction with a wide (17.5m) pavement width that permits parking along both sides of the road for the majority of its length. The termination of parking on the approach to intersections caters for vehicles wishing to turn left off Hunter Street. Vehicles turning right can prop if necessary and can be seen by through traffic which can then either wait or manoeuvre around via the kerb side lane. Hunter Street is a local road which carries significant traffic volumes through the Newcastle CBD from Newcastle West to the beach side precinct of Newcastle East. It connects to the regional road network at Stewart Avenue to the west of the site. The majority of intersections in the locality are signal controlled including full pedestrian phases. Hunter Street operates under a speed limit of 60km/hr in this location.

Parking is available along Hunter Street and is generally controlled through timed parking meters.

There are footpaths provided along both sides of the road as well as street lights. Newcastle City Council is the road authority for any new works on or adjacent to this road.

Photo 1 Pedestrian crossing across Hunter Street with subject site to the rear of photo and Steel Street to the top left

King Street

To the south of the site is King Street, a local road running parallel to Hunter Street and providing access to various commercial spaces and residential apartments throughout the CBD. Operating in a similar way to Hunter Street, in the vicinity of the site King Street has two lanes of travel in each direction with widening to accommodate turning lanes. It has footpaths along both sides, reflecting the high pedestrian demands associated with the city centre.

Main intersections along King Street are signalised allowing generally for all turning movements and pedestrian phases on all legs. King Street in this location operates under a speed limit of 60km/hr.

Photo 2 Intersection of King Street and Steel Street to the south of the subject site

Steel Street

Steel Street connects with both Hunter Street and Steel Street and follows a generally north-south orientation. It terminates at Parry Street to the south which is the southern boundary of the CBD and to the north it terminates at the heavy rail corridor. At this point it forms a shared pedestrian and cycling area and crosses the rail corridor following the truncation of the heavy rail line to the west at Hamilton. This shared space connects with the Honeysuckle precinct and harbour foreshore.

Steel Street between King Street and Hunter Street operates with a 50km/hr speed zone. It has kerb side time controlled parking along its length with an accessible parking space adjacent to the site frontage.

The intersection of Steel Street and Hunter Street is controlled by traffic signals and allows for all turning movements as well as pedestrian crossing on all legs.

The intersection of Steel Street and King Street, to the south of the site, is also signalised with a non-signalised left turn slip from Steel Street to King Street.

Photo 3 Steel Street showing typical cross section with site to the right of photo

2.4.2 Roadworks

There are currently no other road works occurring in the immediate vicinity of the subject site.

2.4.3 Traffic Management Works

There are currently no traffic management works occurring in the immediate vicinity of the subject site.

However, significant changes will occur with the introduction of the light rail system, which is planned to operate along Hunter Street immediately adjacent to the subject site. This project is being completed by Transport for NSW and as part of the project work, a Technical Working Paper has been prepare by GHD that has assessed the impact of the light rail on the road network.

The report has modelled the current operations, future 2018 with light rail and future 2028 with light rail, allowing for background growth. A summary of the results of this modelling is shown below.

The Transport for NSW report provides a number of intersection upgrade requirements and does not identify any works required at either Steel Street and Hunter Street or Steel Street with King Street.

Figure 2-3 Existing intersection LoS in 2015

Figure 2-2 – Extract from Transport for NSW report (Figure 2-3) showing existing intersection operations in the Newcastle CBD area

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

Figure 2-3 - Extract from Transport for NSW report (Figure 5-2) showing intersection operations in the Newcastle CBD area in 2018, with and without the light rail project

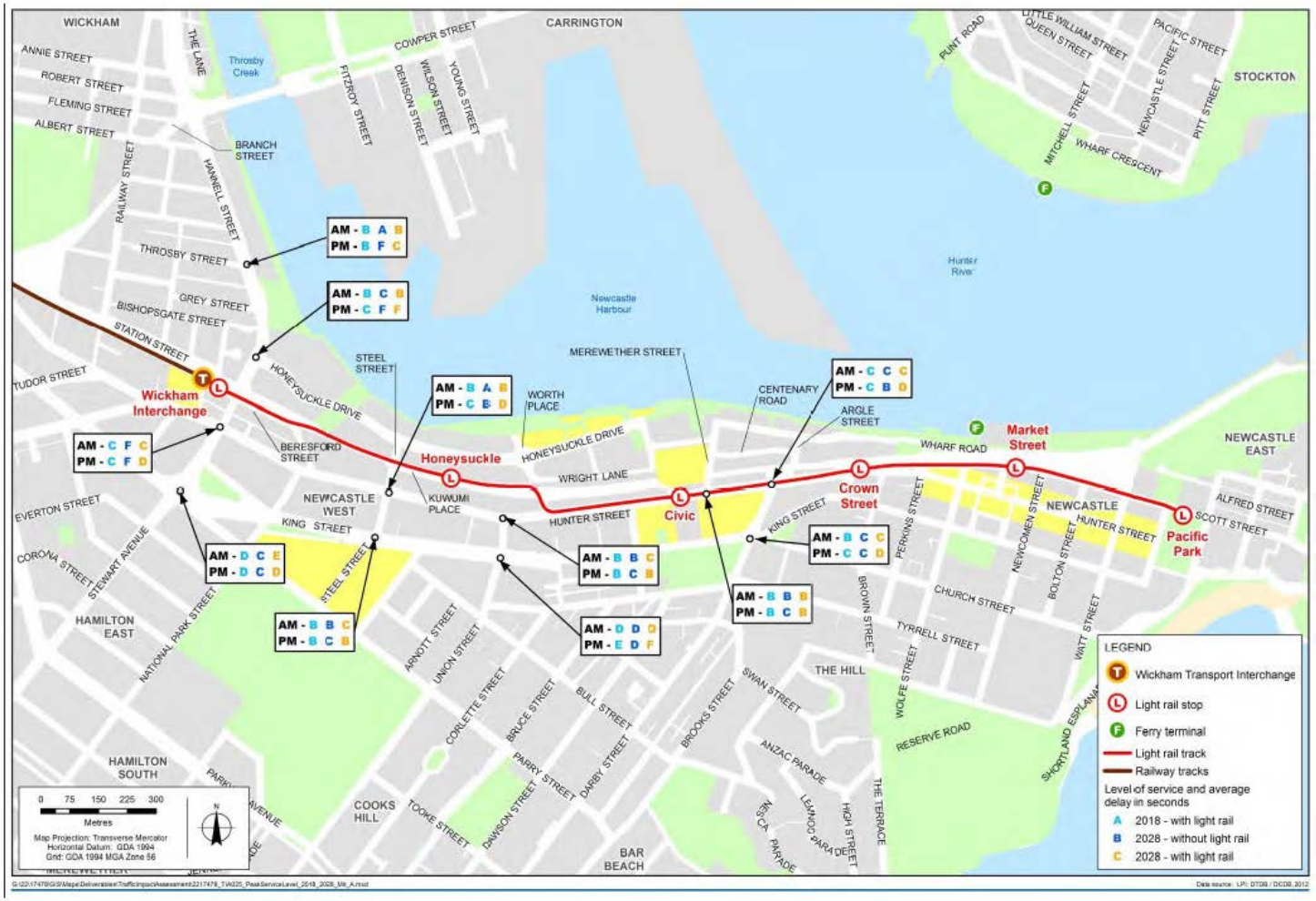


Figure 5-4 Intersection LoS with and without proposal in 2028

Figure 2-4 - Extract from Transport for NSW report (Figure 5-4) showing intersection operations in the Newcastle CBD area in 2028, with and without the light rail project

Transport for NSW, in discussion with the Roads and Maritime Services (RMS), has identified a number of intersection upgrade requirements but does not identify any works required at either Steel Street and Hunter Street or Steel Street with King Street, for the future 2028 design year allowing for the light rail and the background growth in traffic in the Newcastle CBD.

2.4.4 Pedestrian and Cycling Facilities

There are extensive pedestrian footpaths in the vicinity of the site, which extend into the CBD to the east as well as the local attractions, including Honeysuckle Precinct, Marketown, Darby Street entertainment precinct and the major new developments including the NeW Space University and Law Courts. There are footpaths along both sides of the roads in this location, with all major crossings controlled by traffic signals which incorporate pedestrian phasing, ensuring that pedestrian movements can be safely managed and controlled. These pedestrian crossings include drop kerbs to cater for wheel chair users as well as prams etc.

Cyclists are able to ride on the roads, with a number of section of parking / cycle lanes provided in the locality of the site. There are a number of regional and local cycle routes signposted in this location, which allow for access to the major attractions including Honeysuckle, the beaches and wider areas such as University of Newcastle (Callaghan),Kotara, Glenrock and the Fernleigh Track as well the sporting / entertainment precinct at Broadmeadow. The northern end of Steel Street provides a shared pathway to connect with cycling paths along the harbour, the foreshore and regional cycling route 6.

Photo 4 Shared pathway across heavy rail corridor on northern leg of Steel Street

2.5 Traffic Flows

2.5.1 Peak Hour Flows

The proposed development provides primarily residential units with a small area of commercial on the ground floor. It is considered that the development will predominately generate traffic movements during the traditional morning and afternoon peak periods.

As part of the project work, Seca Solution collected traffic data at the intersections of Steel Street with Hunter Street and Steel Street with King Street on Thursday 28th April 2016, between 7.30 and 9.30 AM and 3.30 to 6.00 PM.

The summary of these traffic surveys is provided below.

Street	Peak period	Direction flow	Direction flow	Two-way flow
Steel Street	AM peak	175 northbound	153 southbound	328
	PM peak	177 northbound	260 southbound	437
King Street west of Steel Street	AM peak	1320 eastbound	694 westbound	2014
	PM peak	968 eastbound	1351 westbound	2319
Steel Street south of King Street	AM peak	211 northbound	294 southbound	505
	PM peak	316 northbound	461 southbound	777
Hunter Street west of Steel Street	AM peak	831 eastbound	661 westbound	1492
	PM peak	668 eastbound	1059 westbound	1727

It is noted that all of the results show that the afternoon peak period has a higher level of traffic demands.

The RMS Guide to Traffic Generating Developments provides the following advice with regard to road capacity applicable to Hunter Street and King Street, as 4 lane carriageways:

- 1800 vehicles per direction, giving 3,600 vehicles per hour two way.

For Steel Street, as a 2 lane carriageway the road capacity is given as:

- 900 vehicles per direction, giving 1,800 vehicles per hour two-way.

The traffic data collected for the project shows that the roads in the vicinity of the subject site are all well within capacity. This is reflective of street observations which shows that traffic flows well in the locality, with the only delays created by the various traffic signal along both Hunter Street and King Street.

2.5.2 Daily Traffic Flows

The RMS Guide to Traffic Generating Developments indicates that peak hour flows typically represent 10% of the daily traffic flows, and using the above data this would indicate the following daily traffic flows in this location:

- Steel Street, adjacent to the subject site, 3,800 vehicles per day;
- King Street west of Steel Street, in the vicinity of the subject site, 21,700 vehicles per day;
- Steel Street, south of King Street, 6,400 vehicles per day
- Hunter Street west of Steel Street, adjacent to the subject site, 16,100 vehicles per day

2.5.3 Daily Traffic Flow Distribution

The daily traffic volumes are reasonably balanced in both directions, with the above data indicating a bias in movements eastbound towards the Newcastle CBD in the morning peak period on both King Street and Hunter Street, reflective of commuter traffic demands. The reverse bias occurs in the afternoon peak period.

Steel Street has a dominant southbound flow in the morning and afternoon peaks. Steel Street, south of King Street has Marketown Shopping Centre, a significant nexus for trips. As well Steel Street provides connection southbound to King Street and Parry Street and the suburbs south of the city.

2.5.4 Vehicle Speeds

No speed surveys were completed as part of the study work. It is considered however that traffic does not speed in this location due to its interaction with the various signal controlled intersections as well as drivers manoeuvring in and out of the parking spaces along the streets.

2.5.5 Existing Site Flows

The site is currently vacant and therefore generates no traffic movements. The site was formally occupied by The Empire Hotel, which had limited parking on site and required patrons to park on street as required.

2.5.6 Heavy Vehicle Flows

A reasonably high volume of heavy vehicles use Hunter Street, mainly public buses which provide a connection between the outlying suburbs of greater Newcastle and the Newcastle CBD. These flows were much lower on King Street, as there are less bus services along this road. Other heavy vehicle movements were low, reflective of the lack of through traffic movements. A number of large delivery trucks were observed, associated with deliveries to shops and businesses in the Newcastle CBD.

2.5.7 Current Road Network Operation

Observations on site during the peak periods shows that traffic movements in the vicinity of the site operate well, with delays only created by the signal controlled intersections along both Hunter Street and King Street. To confirm the operation of these traffic signals, a Sidra assessment has been completed on both the signal controlled intersection of Steel Street with Hunter Street and Steel Street with King Street. The results of this assessment are provided below.

Table 2-1 - 2016 Existing Traffic Flows – Steel Street and King Street

Approach	Level of service	Delay (seconds)	Queue (metres)
Steel Street south	D / C	46.3 / 35.7	49.2 / 56.9
King Street east	B / C	16.3 / 37.8	62.5 / 203.1
Steel Street north	C / D	35.9 / 45.8	38.8 / 91.2
King Street west	B / C	22.4 / 34.2	150.4 / 104.0
Overall	B / C	23.7 / 37.0	150.4 / 203.1

N.B results for AM / PM peak

The above results show that the intersection operates to a satisfactory level of service with acceptable delays and congestion when reviewed against the requirements of the RMS.

Table 2-2 - Existing Traffic Flows – Steel Street and Hunter Street

Approach	Level of service	Delay (seconds)	Queue (metres)
Steel Street south	D / D	44.2 / 43.1	32.6 / 29.6
Hunter Street east	A / A	6.9 / 8.3	43.8 / 83.5
Steel Street north	C / C	40.3 / 41.5	13.3 / 36.8
Hunter Street west	A / A	8.3 / 10.8	74.8 / 90.9
Overall	A / A	12.7 / 14.1	74.8 / 90.9

N.B results for AM / PM peak

The above results show that the intersection operates to a satisfactory level of service with acceptable delays and congestion when reviewed against the requirements of the RMS.

2.6 Traffic Safety and Accident History

The roads in the vicinity of the subject site are well laid out, with good forward visibility to the traffic signals on all approaches. All of the major intersections are controlled by traffic signals, to manage both turning traffic movements as well as pedestrian movements. It is considered that the road network in the vicinity of the site provides a safe overall layout and ensures that there are no road safety concerns.

A review of crash data provided by the RMS (Appendix B) for the past five years since 1st July 2010 shows 36 crashes along Steel Street including the two intersections of Hunter Street and Steel Street and King Street and Steel Street.

- 16 of these accidents (44%) involved opposing movements turning at the intersections.
- 13 of the accidents occurred at night between 10pm and 3am
- 6 accidents involved pedestrians
- There have been no fatalities during this period

This data reflects the high number of vehicles using these thoroughfares across both the day and night.

2.7 Parking Supply and Demand

2.7.1 On-street Parking Provision

Currently, vehicles can be parked on both sides of the roads in the vicinity of the site, which are time controlled by parking meters (2 hour) during the normal working day and 9-12 on Saturdays. Developments in the locality e.g. Marketown and Newcastle Travelodge provide adequate off street parking so as to reduce the demands for on-street parking in this area.

2.7.2 Off-Street Parking Provision

There is ample off-street parking in the general locality of the subject site associated with Marketown Shopping Centre. 1 hour public parking is available in the carpark behind KFC on Steel Street (north) whilst unlimited public parking is available along the train corridor to the east of Steel Street.

However it is noted that the majority of established developments along Hunter Street, King Street and Steel Street do not provide any off street parking and are reliant upon on-street parking.

2.7.3 Parking Demand and Utilisation

There is generally a high demand for parking in the locality of the site, both on-street and off street. This is associated with the various retail outlets and businesses located along Hunter Street and King Street that do not provide any off street parking.

2.7.4 Short term Set down or pick up areas

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

An afterhours taxi rank is located on King Street to the east of Steel Street.

2.8 Public Transport

2.8.1 Rail Station Locations

The site is located close to the former heavy railway line that served the centre of Newcastle. This railway has been truncated at Wickham, approximately 500 metres from the subject site. As part of the development of the light rail in Newcastle, a train interchange will be provided at Wickham that will allow for connections to the greater train network at this location.

During the period of the works for the interchange and light rail the heavy rail service terminates at Hamilton with a train bus operating along Hunter Street to replicate rail services to Wickham, Civic and Newcastle stations.

The trains at this location allow for connection south towards the Central Coast and beyond to Sydney as well as to the north to Maitland and beyond, with a high level of train frequency to cater for commuter demands as well as other casual demands.

2.8.2 Bus Routes and Associated Facilities

Bus stops with seating are located on Hunter Street to the immediate east of Steel Street. The stop on the southern side of Hunter Street benefits from shelter from shop awnings.

Newcastle Buses (State Transit Authority) operate a fare free zone within the Newcastle CBD between 7.30am and 6pm seven days a week. This zone extends from Selma Street in the west; north to the Tree of Knowledge corner (Hannell Street, Wickham) and east to the beaches. The zone loops south into Darby Street, along Bull Street and then back to King Street.

2.8.3 Rail and Bus Service Frequencies

As the hub for most bus services through Newcastle and the region Hunter Street provides access to a wide range of bus services with high frequency reflecting its importance as a major transport interchange.

There is a bus interchange located to the immediate north of the Newcastle Railway Station with the current rail buses connecting to this.

Train services, currently operating from Hamilton, run every hour during the morning and afternoon peak periods to Sydney and return along the Central Coast and Newcastle Line with more frequent services to Wyong and Gosford servicing local stations from Newcastle to Morisset. Similar services operate between Newcastle and Maitland with less frequent services to Scone and Dungog along the Hunter Line.

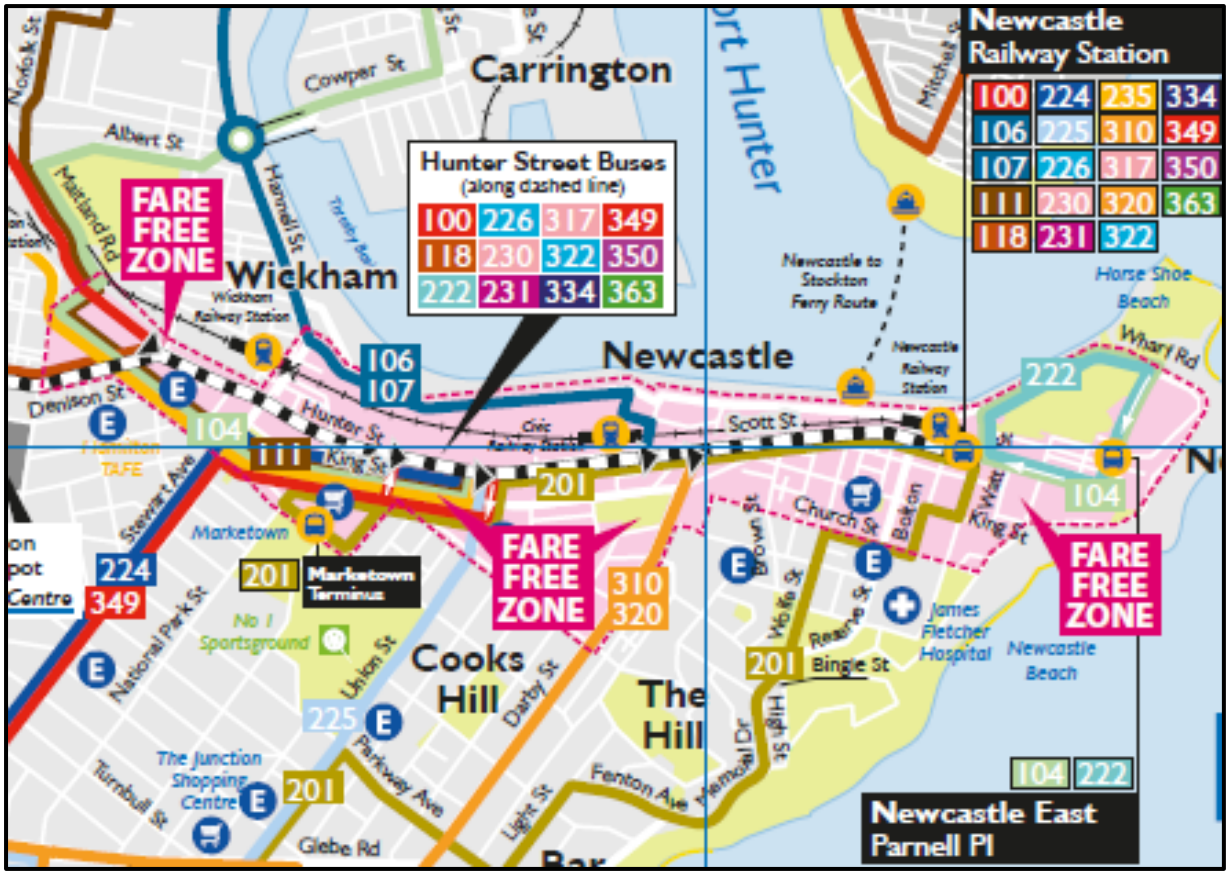


Figure 2-5 Bus services and the Fare Free Zone in the Newcastle CBD (Source: Newcastle Buses)

2.9 Pedestrian Network

There is a well-developed network of footpaths in the locality, allowing for good connectivity to local attractions as well as the Newcastle CBD.

2.10 Other Proposed Developments

There is current construction work occurring on a number of sites in the locality of the subject site, which include residential towers above Marketown, HD18 on Honeysuckle Drive and NeW Space Campus (University of Newcastle). Recent projects completed include the Law Courts to the east of the site in the Civic Precinct.

Plans have been submitted for a new residential development to occur on land to the west of the site, fronting King Street on the opposite side of Cottage Creek from the subject site.

3 Proposed Development

3.1 The Development

The plans for the development allow for a mixed use development comprising of commercial use on the ground floor and residential above it, with car parking provided over 3 levels. All vehicle access is proposed via Steel Street only. The plans allow for:

- 24 x studio units
- 33 x One-bedroom units
- 68 x Two-bedroom units
- 3 x Three-bedroom units
- 702 m^2 commercial

The residential use will include an allowance for affordable housing.

Parking will be provided over 3 levels, with the ground level parking allowing for the commercial parking demands as well as visitor parking demands. The upper 2 levels cater for resident parking demands only, with cycle and motorbike parking provided on all levels.

3.1.1 Phasing and Timing

The development will be constructed in a single phase.

3.1.2 Selection of appropriate design vehicles for access and circulation requirements

The development will accommodate light vehicles only, with no requirement for large delivery vehicles to access the site. This ensures that the height within the car park allows for light vehicles only and does not need to be increased to cater for heavy vehicles.

The circulation through the site for light vehicles has been assessed against AS2890 and an Autoturn simulation has been completed to ensure that vehicles can safely and appropriately travel through the various levels of the car park (Appendix C). The layout of the car park levels allows vehicles to enter and exit the site in a forward direction, as per AS2890 and Council requirements.

3.2 Access

3.2.1 Driveway Location

All vehicle access to the subject site will be via a new access point on Steel Street. As part of the demolition work for the previous buildings on the site, a driveway was provided on the south-east corner of the site, adjacent to the exit driveway from the Travelodge Hotel. The new driveway crossing allows for a two-way ramp heading up the upper two levels of resident parking and a level grade driveway to access the ground level commercial and visitor parking. These driveways have been designed in accordance with Council design requirements.

The driveway location has been determined to minimise the impact upon the street frontage. Whilst an access on Hunter Street was considered, it is considered inappropriate due to the much higher traffic flows in this location as well as the potential impacts created by the light rail, both in terms of activity / interaction with the light rail and the high pedestrian movements in this location.

The access on Steel Street is located between two sets of traffic signals, with less than 100 metres between these traffic signals. This ensures that vehicle speeds on this section of Steel Street are within the posted speed limit of 50 km/h. The design and layout of Steel Street allows for all turning movements, which reduces the impacts at the intersections at both ends of Steel Street in this location and allows drivers to access the site in a convenient manner.

The lower level car park provides for 15 vehicle parking spaces, including loading to the back of house for the commercial element of the project, waste collection as well as cycle storage. The upper level ramp allows for access to the 120 resident parking bays plus motorbike parking and bicycle parking.

3.2.2 Sight Distances

Steel Street in this location provides a good alignment, with kerb side parking to both sides and a single travel lane in both directions. Under AS2890 the required sight distance for the posted speed limit of 50 km/h is 69 metres desirable and 45 metres minimum. Drivers exiting the site are able to see the traffic signals at either end of Steel Street, which are less than 50 metres from the site exit driveway. Drivers can see the minimum required distance of 45 metres, at which point the vehicle speeds are less than 50 km/h, due to the interaction with the traffic signals.

For drivers turning right into the site, the sight line allows them to observe any vehicles travelling north along Steel Street and determine a suitable gap to enter the site.

The traffic signals at both ends of this section of Steel Street create significant gaps in the through traffic movements, allowing for improved entry and exit movements.

3.2.3 Service Vehicle Access

The development will require minimal service vehicle access, with all servicing to be completed by small vans e.g. Toyota HiAce or utility vehicles. Waste collection will be completed by a private contractor with a utility vehicle, as the constraints of the site do not allow for a typical medium rigid truck to enter and exit the site in a forward direction. It is considered that traditional kerb side refuse collection is not desirable in this location, due to the traffic flows and road widths. The size of the refuse vehicle proposed for the development will require frequent servicing of the site, as per normal requirements within a typical CBD development.

The servicing vehicles will only access the ground level of parking. The Autoturn simulation demonstrates that a light vehicle, typical of those that will service the site, can enter and exit the site in a forward direction, with adequate space in accordance with AS2890 to allow this to occur.

3.2.4 Queuing at entrances

Given the traffic flows associated with the development, it is considered that there will be minimal queuing at the entrance to the site. For the commercial / visitor parking, t there is a roller shutter control point located within the property boundary, which will remain open during normal business hours to allow for ease of entry and exit movements. This roller shutter will be closed at night, to ensure safety requirements are met.

For the resident parking access, the roller shutter is located 6 metres within the site boundary and all residents will have an electronic controller to open the roller shutter remotely when turning into the site. This will allow for a smooth and efficient entry into the site, with minimum delays for entering.

For the critical afternoon period, when the entering traffic demands are highest, based upon the RMS rates the residential development could generate 42 traffic movements during the peak hour, of which 36 (85%) would be entering the building. This represents a vehicle approaching the site once every 1.5 minutes, which allows an

entering vehicle to fully enter the site typically before the net entering vehicle arrives. This will ensure that there will typically be no delays at the site entry point which could impact upon Steel Street.

Whilst the morning traffic movements associated with the development are higher, 85% of the flows are outbound and as such do not impact upon the operation of Steel Street.

The commercial element will generate much lower use and as such a much lower frequency of use and is not expected to create any queue at the site access.

3.2.5 Current access compared with proposed access

The previous use on the site has direct vehicle access, with access available via the adjacent land only. During demolition of the previous buildings, a driveway crossing was provided on the south-east corner of the site fronting Steel Street. The proposed driveway is located in the same position as this driveway crossing.

3.2.6 Access to Public Transport

The site is well located for access to public transport, with the light rail to be provided along the site frontage and the site being within an easy walk of the rail interchange at Wickham. There are also currently a large number of buses running along the site frontage and along King Street that provide access to the suburbs across Newcastle. There are high quality footpaths provide along both sides of the roads in the location and pedestrian phases at the traffic signals on Steel Street which allow for good connectivity to the public transport in this location.

3.3 Circulation

3.3.1 Pattern of circulation

The design of the development will allow for vehicles to turn around and exit the site in a forward direction.

3.3.2 Internal Road width (driveway)

The width of the internal driveways and ramps allow for two-way traffic movements in accordance with AS2890. An Autoturn simulation has been completed to demonstrate that safe and appropriate vehicle movements can occur within the car park areas.

3.3.3 Internal Bus Movements

No internal bus movements are required within the development site.

3.3.4 Service Area Layout

No dedicated service area will be provided for the development. An area is available at the back of house, which will allow for small delivery vehicles to park as required, whilst deliveries are made to the commercial area within the ground level. The extent of servicing is considered to be low, and the spaces that a service vehicle may block (9 and 10 on the ground floor) can be marked for tenant parking only i.e. not visitors which would reduce the potential for any conflict with vehicle movements.

3.4 Parking

3.4.1 Proposed Supply

The proposed development allows for parking over three levels with the ground floor providing 15 spaces to cater for the commercial element and 121 spaces provided over levels 1 and 2 for the residential component.

Motorbike parking is provided within the development for 15 motorbikes or scooters.

Bicycle storage is provided across a number of racks as well as secure bike stores across each level.

Four (4) accessible parking spaces are provided in accordance with AS2890-6 on level 2 where there is adequate head space to cater for the specific requirements of accessible parking.

3.4.2 Parking provision per State Government policy

The parking requirements for the site are based on the application of SEPP 65 which provides for either the application of the RMS Guide to Traffic Generating Developments or the Council DCP, whichever is less.

The RMS Guide to Traffic Generating Developments for High Density Residential Flat Buildings in Metropolitan Regional (CBD) Centres allows for parking at the rate of:

Metropolitan Regional (CBD) Centres:

- 0.4 spaces per 1 bedroom unit.
- 0.7 spaces per 2 bedroom unit.
- 1.20 spaces per 3 bedroom unit.
- 1 space per 7 units (visitor parking).

3.4.3 Council code and local parking policies and plans

The Newcastle City Council DCP provides parking in the Newcastle City Centre for residential flat buildings at the rate of:

- Small (<75m2 or 1 bedroom) average 0.6 spaces per dwelling
- Medium (75m2 - 100m2 or 2 bedrooms) average 0.9 spaces per dwelling
- Large (>100m2 or 3 bedrooms) average 1.4 spaces per dwelling
- for the first 3 dwellings plus 1 space for every 5 thereafter or part thereof for visitors

Motorbike parking at the rate of 1 space per 20 car parking spaces.

Bike parking at the rate of 1 space per dwelling plus 1 space per 10 dwellings for visitor parking.

It provides for non-residential elements to be provided at the rate of 1 space per 60m2 gross floor area.

3.4.4 Parking Layout

The site layout will allow for the safe parking of vehicles within the site. The internal parking spaces have been designed in accordance with AS2890 and the internal circulating ramps / aisles allow for two-way movements with a minimum width of 5.8 metres. Three stacked spaces provided on the lower (commercial) level will be managed by the tenants on site which is appropriate given the small area of commercial tenancy on site. Each of the residential levels include 5 stacked parking spaces (10 in total).

3.4.5 Projected demand

The peak parking demands are considered to occur at night, when the resident parking would typically be fully utilised. Demands during the day would be lower. The commercial element of the development would typically be open during the day and potentially into the evening. The visitor demand associated with the residential element will generally by at its highest of a weekend or of an evening when the commercial demand may be less at demand.

Allowing for the application of both the RMS Guide to Traffic Generating Developments and the Council DCP for the residential component of the development the overall parking demand, including the commercial element is:

		RMS Guide		Council DCP	
Studio bedroom residential units	24	0.4 spaces per 1 bedroom unit.	9.6 spaces	0.6 spaces per 1 bedroom unit.	14.4 spaces
1 bedroom residential units	33	0.4 spaces per 1 bedroom unit.	13.2 spaces	0.6 spaces per 1 bedroom unit.	19.8 spaces
2 bedroom residential units	68	0.7 spaces per 2 bedroom unit.	47.6 spaces	0.9 spaces per 2 bedroom unit.	61.2 spaces
3 bedroom residential units	3	1.2 spaces per 3-bedroom unit.	3.6 spaces	1.4 spaces per 3-bedroom unit.	4.2 spaces
Total Residential			74 spaces		99.6 spaces
Visitor parking	128	1 space per 7 units	18.3 spaces	1 space for first 3 dwellings plus 1 space for every 5 thereafter	26 spaces
Commercial Element	702m^2		11.7 spaces	1 space per 60m^2	11.7 spaces
Total			104 spaces		138 spaces

This is a total of 104-138 parking spaces on site.

The proposed supply is 136 spaces. This is two spaces less than the total required under the DCP however 32 more than that required by the application of the RMS Guide rates under the SEPP. This supply is considered appropriate given that there will be some opportunity for the visitor parking and commercial demands to complement each other. There is also a focus on active travel given the location of the site and its proximity to quality transport links and the provision for bike storage. There are also eight parking spaces along the site frontage that may be used by visitors to the site.

The demand for motor bike parking would therefore be to provide 6-7 spaces. The provision of 15 dedicated motor bike spaces caters for the parking on site and allows for both residential demands as well as for visitors and employees to the site.

The bicycle parking demand is for 128 spaces for residents, 12.8 spaces to cater for visitors and 3.5 spaces for the commercial element. A total of 145 bike parking spaces.

Accessible parking for residents is provided within the residents parking. It is proposed that the existing on street disabled parking space adjacent to the access on Steel Street be upgraded to current standards to meet the accessible parking needs of visitors to the site.

3.4.6 Service Vehicle Parking

The largest service vehicle will be a small van, typically a Toyota Hi-Ace associated with deliveries to the commercial element of the project. These can park on the ground level of the parking.

3.4.7 Pedestrian and Bicycle Facilities

The site allows for direct pedestrian to Steel Street for the residential elements, which is then connected to the other roads via the wide footpath on Steel Street. The commercial element has direct pedestrian access to Hunter Street and allows for good connectivity to the other footpaths in this area.

The site allows for extensive on-site bicycle parking on all levels of the parking, for commercial space users, residents and visitors.

4 Transportation Analysis

4.1 Traffic Generation

The development has been assessed against the RMS Guidelines for traffic generating development. The updated guidelines published by the RMS (TDT 2013 04a dated August 2013) indicates that for a residential development such as that proposal the traffic generation rates during the typical morning and afternoon peak periods are:

- 0.53 per unit in the AM peak
- 0.32 per unit in the PM peak
- 4.58 per unit per day

For the proposed development of 128 units this gives 68 vehicles in the AM peak, 41 in the PM peak and 586 vehicles per day. For the morning peak hour, 85% of the traffic would be outbound (58 vehicles), with the reverse pattern occurring in the PM peak (35 inbound) and the daily flows would be typically equally split between 293 inbound and 293 outbound per day.

For the commercial element, it is considered that a large number of visitors to the building will be local and hence passing trade, dependent on the end user. The RMS Guide to Traffic Generating Developments provides a rate of 2 trips per 100 m^2 GFA in the evening peak period and 10 trips per day. The footprint provides 702 m^2 GFA of commercial indicating a potential for 14 trips in the PM peak and 70 trips per day. These are considered to be a worst case scenario, as the location of the site compliments a number of similar users in the area and hence will not be a direct and specific end of trip destination. It can also be seen that with the increasing residential development occurring in the locality, there is a much greater opportunity for people to walk and significantly reduce the traffic demands accordingly.

Whilst no generation rate is provided for the AM peak, it is considered that it would be lower than the PM peak period.

Overall, the site could generate in the order of 82 trips in the AM peak, 55 trips in the PM peak and 656 trips per day, equally split between 328 inbound and 328 outbound per day.

4.1.1 Daily and Seasonal Factors

Minimal seasonal variation is expected, with weekday flows being typically greater than weekend flows.

4.1.2 Pedestrian Movements

The site is expected to create high pedestrian movements, with easy and convenient access to a number of local attractions such as Marketown shops, the Law Courts, NeW Space University, Honeysuckle and the foreshore and the Newcastle CBD. These pedestrian demands will be catered for by the high standard of pedestrian facilities in the locality, with wide footpaths to both sides of the roads in the locality and all the major intersections controlled by traffic signals which incorporate pedestrian phases.

4.2 Traffic Distribution and Assignment

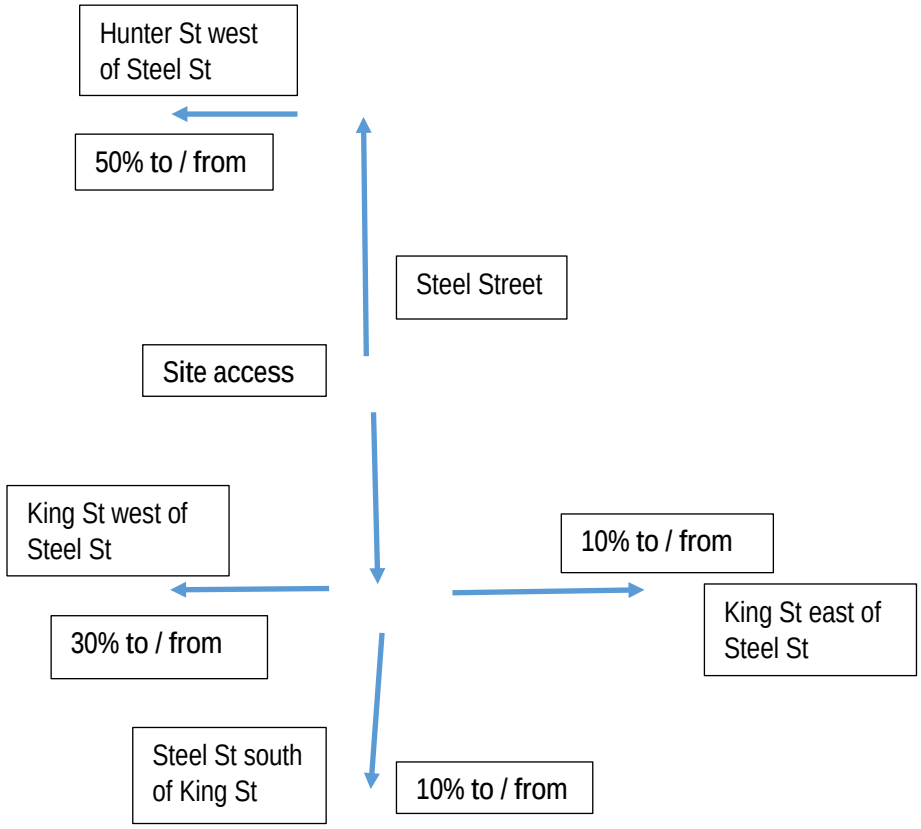
4.2.1 Hourly Distribution of Trips

Traffic to and from the development, due to the provision of traffic signals at both ends of the Steel Street allows for ease of distribution on the greater road network. It is considered that the vast majority of the traffic movements will be to / from the south and west of the site, with minimal demands to the east of the site. The demand for trips to the east of the site can be easily met with walking or bus trips now, and with light rail in the future. These trips to the east can also be easily accommodated by cycle movements.

For the purposes of this assessment, it is considered that the trips would be equally split between the intersection of Steel Street and Hunter Street (with all traffic travelling on the Hunter Street to the west of Steel) and traffic using the intersection of Steel Street and King Street to the south (with the majority then using King Street to the west of Steel Street.

4.2.2 Origin / destinations assignment

The distribution of traffic is considered to be:



4.3 Impact on Road Safety

It is considered that the additional traffic flows associated with the development of the subject site will have a minimal impact upon traffic safety. The key intersections in the vicinity of the site are all controlled by traffic signals, which ensure safety is maximised for both road users and pedestrians, with the control of tuning movements and pedestrian movements at all intersections.

The major impact of the development could be at the site access on Steel Street, however this is located on a reasonably straight section of road and allows for good visibility in both directions that meets the requirements of AS2890 in both directions. Drivers entering and exiting the site are able to observe the traffic movements in both directions as well as the operation of the traffic signals on Steel Street in both directions. These traffic signals both create significant gaps in the traffic movements along Steel Street in both directions and provide suitable gaps for traffic entering and exiting the site.

The traffic data collected as part of this project demonstrates that Steel Street is currently carrying traffic flows well within its capacity, with less than 450 vehicles per hour two-way compared with the capacity of 1,800 vehicles per hour two-way. This ensures that the additional traffic will not have an adverse impact upon the road capacity or safety in this location.

4.4 Impact of Generated Traffic

4.4.1 Impact on daily Traffic Flows

The existing peak hour traffic adjacent to the site are well within acceptable limits for their classifications as local urban roads, as demonstrated in Section 3.5.1 above. The current traffic flows have been compared with the capacity of these roads and all of the road in the vicinity of the subject site currently have significant spare capacity. It is considered that as these roads have spare capacity during the critical peak periods, then there is spare capacity to cater for the additional traffic movements associated with the development for the daily impact.

The Transport for NSW Technical Paper for the light rail has also assessed the road network within the CBD and has stated that the road network has adequate capacity to cate for the current traffic flows as well as the future 2028 traffic flows, with and without the proposed light rail. This is consistent with the observations and findings completed by Seca Solution for this project.

4.4.2 Peak Hour Impacts on Intersections

As part of the assessment for the proposed development, the intersection capacity analysis program Sidra has been used. The Sidra analysis has reviewed the impact of the generated traffic on the road network and specifically at the signal controlled intersections of Steel Street with Hunter Street and King Street.

The results of the Sidra modelling are presented below for the current traffic flows plus the full development flows.

Table 4-1 2016 Existing Traffic Flows plus development flows– Steel Street and King Street

Approach	Level of service	Delay (seconds)	Queue (metres)
Steel St south	C / C	41.8 / 35.7	46.1 / 56.9
King St east	B / C	18.8 / 37.8	67.8 / 203.1
Steel St north	C / D	36.6 / 47.1	48.2 / 94.1
King St west	B / C	25.0 / 34.1	150.4 / 106.3
Overall	B / C	25.7 / 37.1	150.4 / 203.1

N.B results for AM / PM peak

The results above demonstrate that the traffic flows associated with the proposed development will have a minimal impact on the operation of the intersection with minimal increases in delays and congestion.

Table 4-2 2016 Existing Traffic Flows plus development – Steel Street and Hunter Street

Approach	Level of service	Delay (seconds)	Queue (metres)
Steel St south	D / D	43.9 / 45.2	37.7 / 31.5
Hunter St east	A / A	7.4 / 7.4	45.3 / 78.1
Steel St north	C / D	40.1 / 43.7	13.3 / 38.0
Hunter St west	A / A	8.8 / 10.0	78.8 / 85.1
Overall	A / A	13.6 / 13.7	78.8 / 85.1

N.B results for AM / PM peak

The results above demonstrate that the traffic flows associated with the proposed development will have a minimal impact on the operation of the intersection with minimal increases in delays and congestion.

4.4.3 Impact of Construction Traffic

The construction work will require a number of trucks, to deliver materials including concrete to the site. This will occur over a number of weeks and months as the site is developed, thereby reducing the impact of this traffic during the peak periods. The development does not require any significant earthworks thereby reducing any potential impacts associated with the removal of this earth. The site will require a crane to be provided on site and will require a works zone on-street. The appropriate position for a works zone is on the Steel Street frontage.

The impact of the construction traffic and works will need to be considered in association with the construction activities for the proposed light rail along Hunter Street, which will impact upon the length of Hunter Street for a number of months. The details associated the light rail are not known at this stage.

An important factor for the construction will be the impact of construction workers and their vehicles. It is considered that construction staff should be directed to park away from the site, and that public transport is used to access the site or a shuttle bus is provided to link the site and an off-site parking area. This can be determined during the detailed design stage of the project.

All works on site will be governed by the relevant EP&A rules and as stipulated within any development consent granted. This will include hours of work.

4.4.4 Background traffic and other developments

The future impact of the light rail and general background traffic growth allowing for sites such as this has been assessed by Transport for NSW as part of the light rail project. It has been determined that the current road network, with the road upgrades identified by the Transport for NSW Technical Paper provided, will have adequate capacity to cater for the future design year of 2028.

4.5 Public Transport

4.5.1 Options for improving services

It is considered that the development will not require the provision of any upgrade of public transport, over and above that already identified as part of the light rail project. The site is well served by both current and future public transport and will allow for reduced reliance upon the use of private motor vehicles.

4.5.2 Pedestrian Access to Bus Stops

Pedestrian access to bus stops and the future light rail is good and no additional works are required.

4.6 Pedestrian and Cyclists

The site has good connections to existing pedestrian and cyclist facilities and does not generate the requirement for any additional works.

5 Improvement Analysis

5.1 Improvements to Accommodate Existing Traffic

It is considered that the existing road network has adequate capacity, based upon the observations on site, Sidra assessment completed by Seca Solution and the Technical Paper prepared by Transport for NSW.

5.2 Improvements to Accommodate Background Traffic

The Technical Paper prepared by Transport for NSW for the light rail project has identified road upgrades to accommodate the light rail impacts for the future design year of 2028, allowing for background traffic growth over the normal 10 year design horizon. The subject site will not generate the requirement for any additional road network upgrades.

5.3 Additional Improvements to Accommodate Development Traffic

No road upgrades are required to accommodate the development traffic flows.

5.4 Alternative Improvements

No alternatives are put forward for consideration.

6 Summary and Recommendations

6.1 Summary

The following conclusions are drawn from the investigations into the proposed mixed use development, The Empire, on the corner of Steel Street and Hunter Street, Newcastle.

The proposed development is for a mixed use development, providing commercial use with associated parking and visitor parking for the site in the ground floor and two levels of resident parking with residential units above. All access will be provided via Steel Street only.

The site access is located on Steel Street, with traffic signals within 50 metres of the site access. The operation of these traffic signals has been assessed with Sidra, based upon the current traffic numbers surveyed as part of this project and confirm that the current traffic signals operate well with acceptable delays and congestion. The Technical Paper prepared by Transport for NSW for the light rail project confirms this modelling output.

The additional traffic flows generated by the development could be in the order of 82 in the AM peak period and 55 in the PM peak period, based upon the advice provided within the RMS Guide to Traffic Generating Developments and some 656 vehicle movements per day. The impact of these additional traffic flows has been assessed for the peak periods with Sidra and it can be seen that the additional traffic generated by the development will have a minimal impact upon the immediate signal controlled intersections on Steel Street.

The Technical Paper prepared by Transport for NSW has also been reviewed, as this paper reviews the impact of the light rail for the future design year of 2028. This Technical Paper confirms that the overall road network within the vicinity of the site and the Newcastle CBD has adequate capacity to cater for the future design year of 2028, allowing for the background growth in traffic movements. This paper has identified a number of intersections that require increased capacity but does not highlight any capacity issues for the two intersections on Steel Street adjacent to the subject site. The Sidra modelling completed by Seca Solution confirms this outcome.

Allowing for the application of both the RMS Guide to Traffic Generating Developments and the Council DCP for the residential component of the development the overall parking demand, including the commercial element is between 104-138 parking spaces. The project proposes a supply of 136 spaces, which is two spaces less than the total required under the DCP and 32 more than that required by the application of the RMS Guide rates under the SEPP. The provision of two less visitor parking spaces is considered acceptable in this location, with the availability of on-street parking in this area plus the site's location adjacent to the future light rail corridor on Hunter Street. As well visitor parking demands associated with the residents are likely to occur at different times (evenings, weekends) to the peak demands associated with the commercial use. Of the existing eight on street parking spaces along the site frontage, it is proposed to upgrade the disabled space to accommodate accessible parking demands for the commercial element of the project.

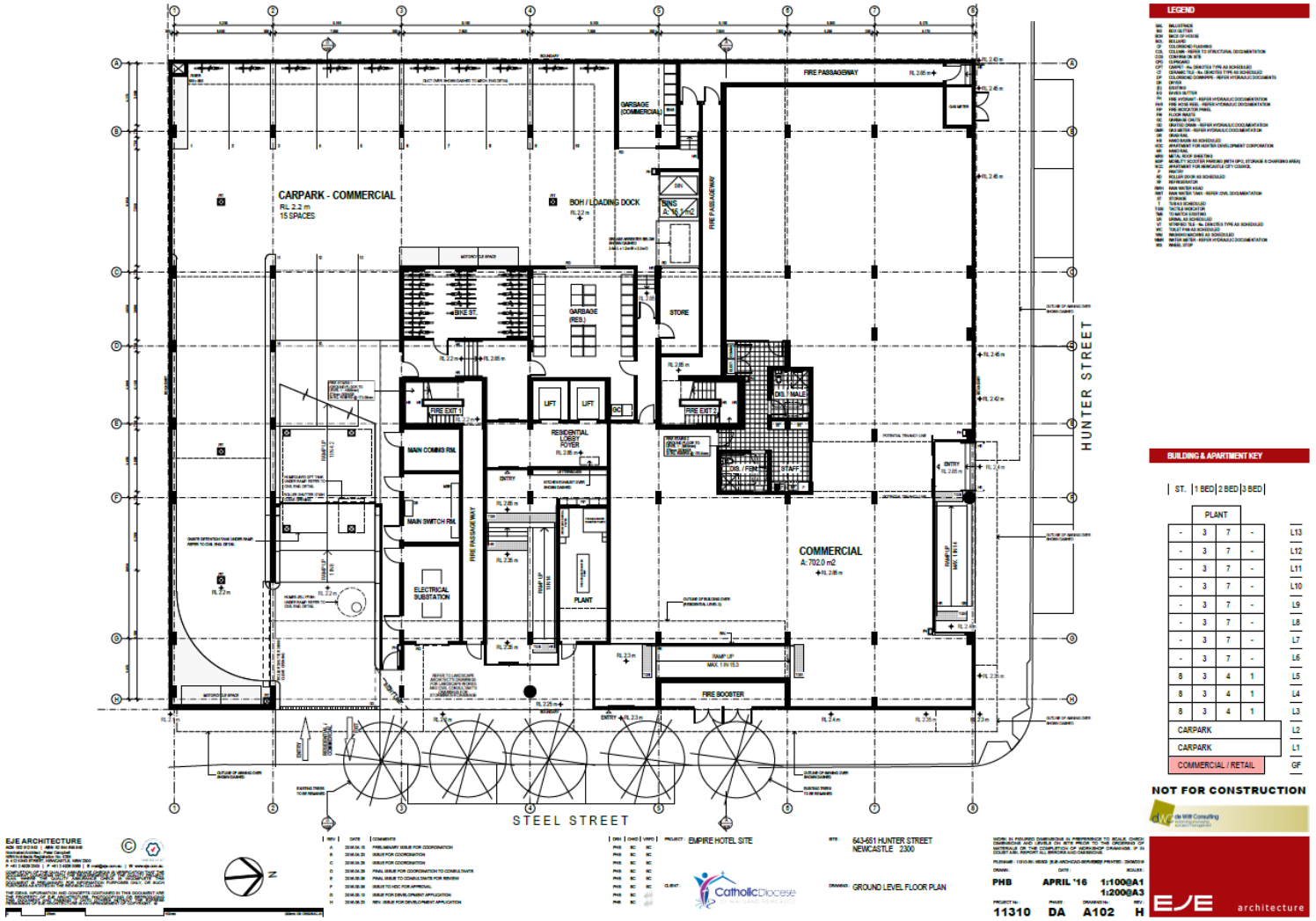
The site access on Steel Street will allow for safe and appropriate access to the subject site, with good visibility available for drivers entering and exiting the subject site. The layout of the driveway and internal ramps allows for two way traffic movements in accordance with AS2890 and the internal layout has been checked with Autoturn to demonstrate that these movements can be achieved. The loading dock on the ground level will allow for light vehicle access only, with the site only requiring servicing by small vans and utility vehicles. There is no requirement for any trucks to access the site, given the type of development and the floor area for the commercial development.

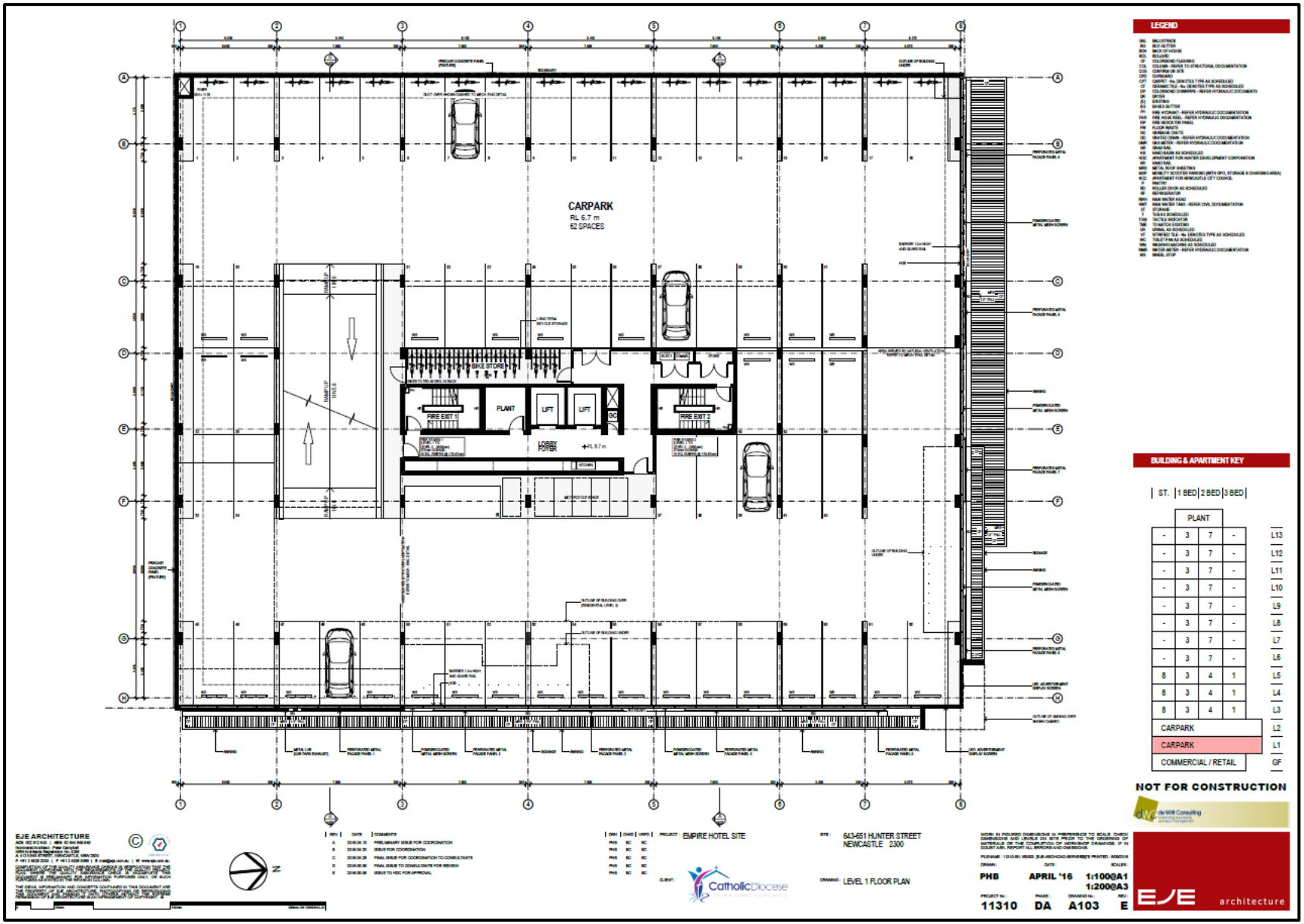
The site provides parking for motorbikes and cyclists within the car park levels to allow for these users and discourages the use of cars. The site is well located for walking and public transport use, with wide footpaths provided to both sides of the roads in the locality allowing for good connectivity to the local facilities as well as access to the Newcastle CBD and Honeysuckle foreshore area. The majority of buses servicing the Newcastle CBD run along Hunter Street and allow for good connects to other suburbs in greater Newcastle as well as ease of connection to the proposed Wickham interchange.

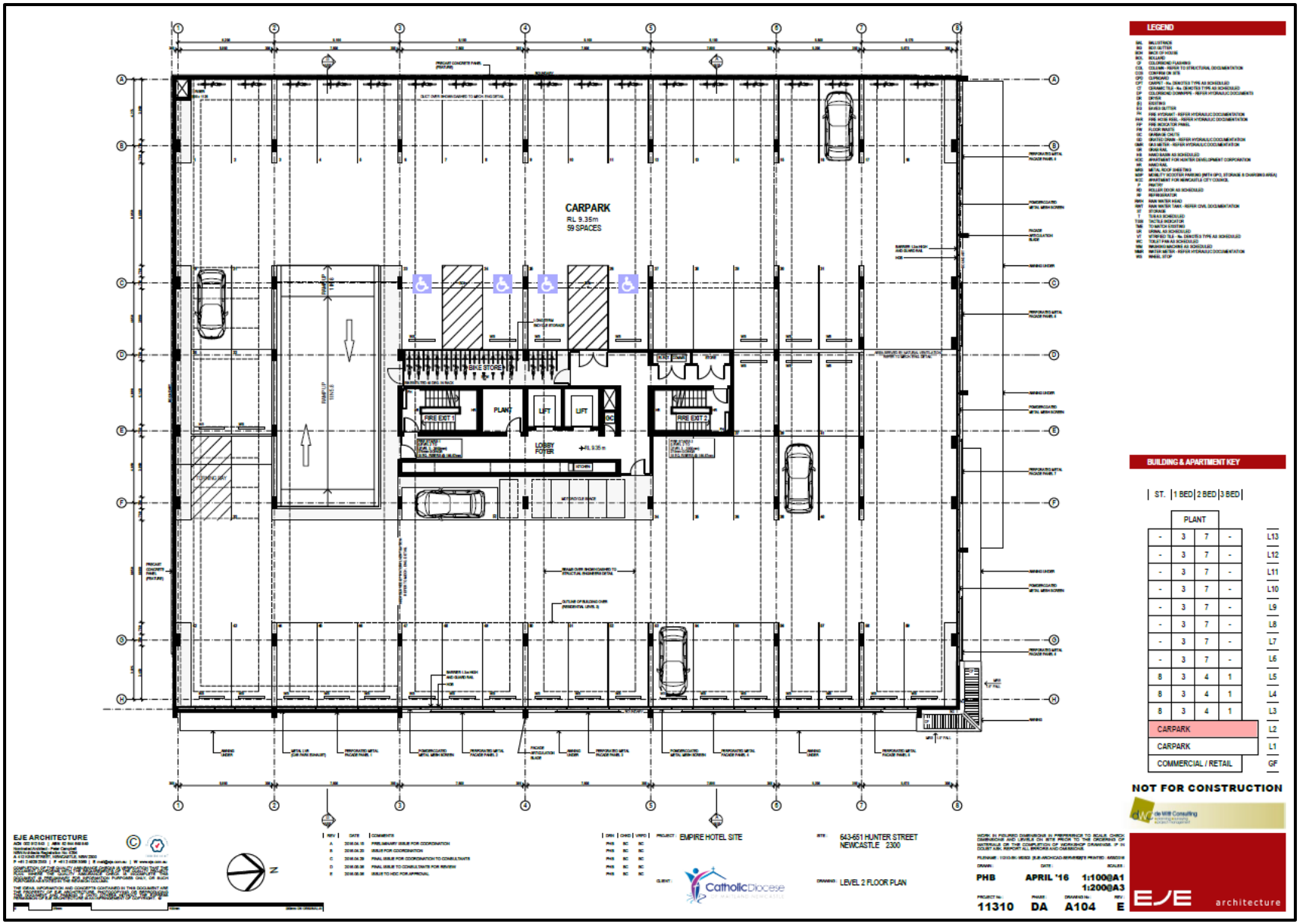
6.2 Recommendations

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

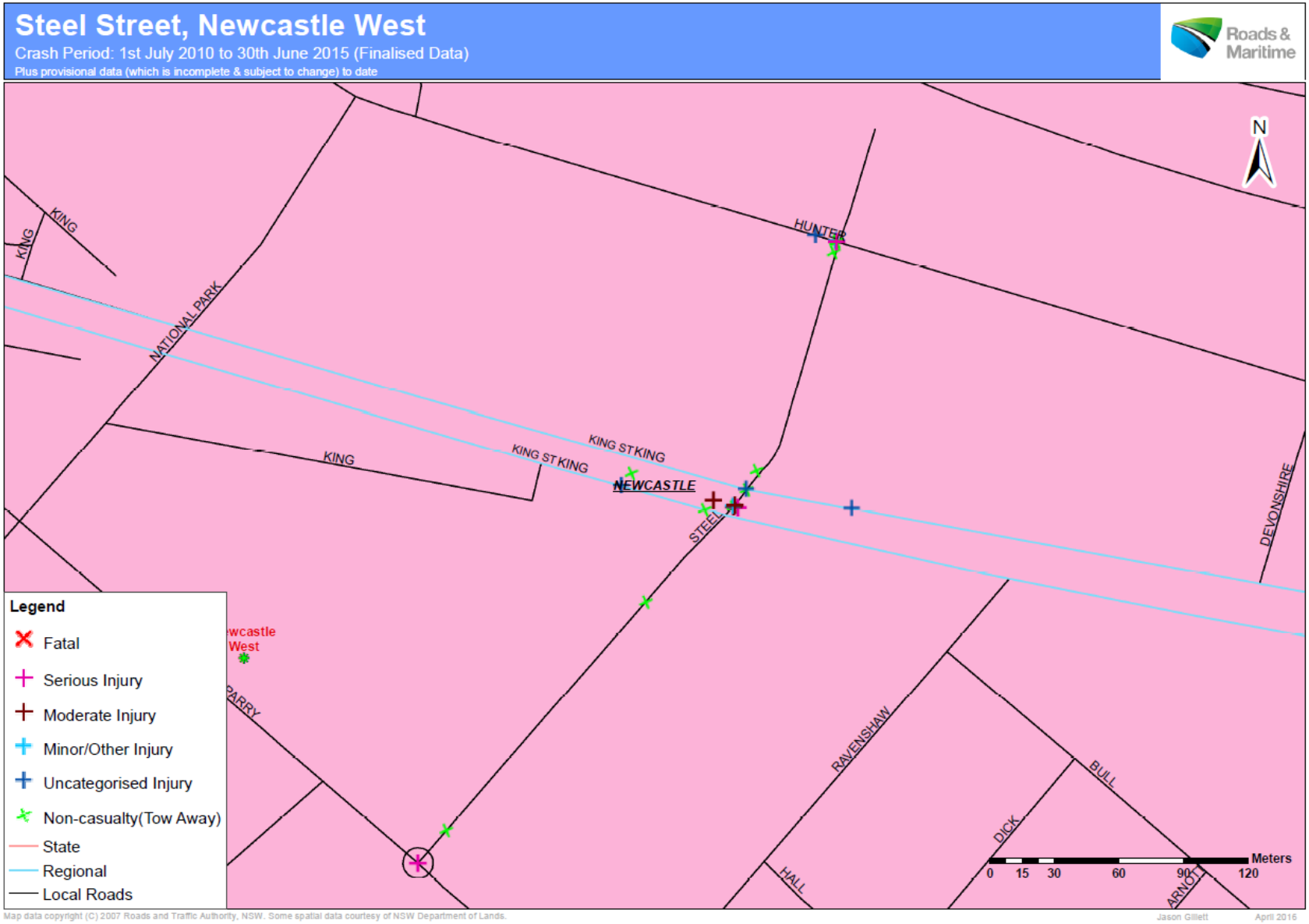
Appendix A – Site Plan

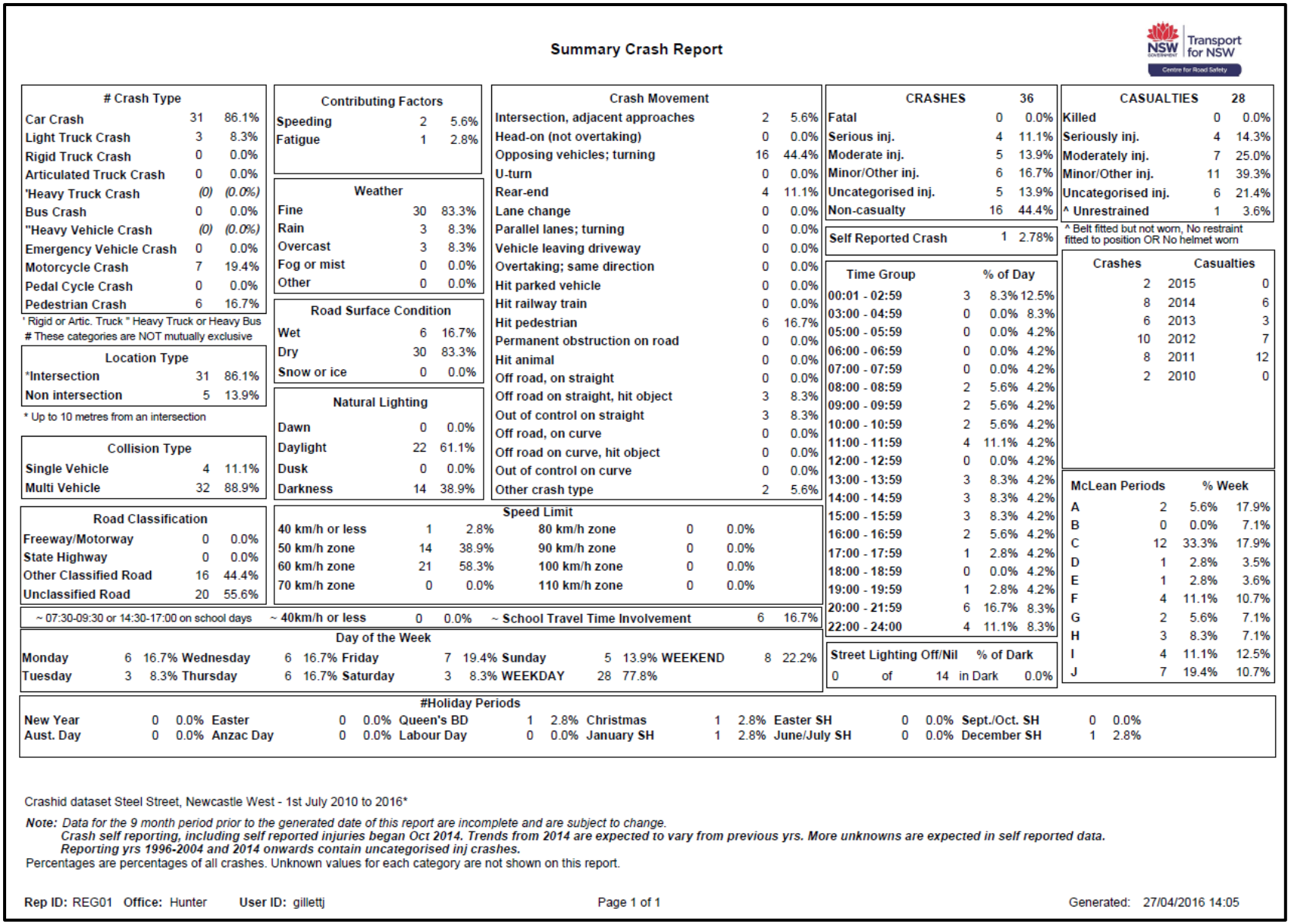



CARPARK
RL 6.7 m
62 SPACES
PLANT
LIFT
LIFT
FIRE EXIT 1
FIRE EXIT 2
LOBBY FOYER
RL 6.7 m
BIKE STORE
LEGEND
BUILDING & APARTMENT KEY
ST.
1 BED
2 BED
3 BED
PLANT
L13
L12
L11
L10
L9
L8
L7
L6
L5
L4
L3
CARPARK
L2
CARPARK
L1
COMMERCIAL / RETAIL
GF
NOT FOR CONSTRUCTION
EJE ARCHITECTURE
EMPIRE HOTEL SITE
643-651 HUNTER STREET
NEWCASTLE 2300
LEVEL 1 FLOOR PLAN
PHB
APRIL '16
1:100@A1
1:200@A3
11310
DA
A103
E
EJE architecture


CARPARK
RL 9.35m
59 SPACES
LEGEND
BUILDING & APARTMENT KEY
ST. | 1 BED | 2 BED | 3 BED
PLANT
L13
L12
L11
L10
L9
L8
L7
L6
L5
L4
L3
CARPARK
L2
CARPARK
L1
COMMERCIAL / RETAIL
GF
NOT FOR CONSTRUCTION
EJE ARCHITECTURE
EMPIRE HOTEL SITE
643-651 HUNTER STREET
NEWCASTLE 2300
LEVEL 2 FLOOR PLAN
PHB
APRIL '16
1:100@A1
1:200@A3
11310
DA
A104
E
EJE architecture

Appendix B – Accident Data





Summary Crash Report

Transport for NSW — Centre for Road Safety

# Crash Type		
Car Crash	31	86.1%
Light Truck Crash	3	8.3%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(0)	(0.0%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(0)	(0.0%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	7	19.4%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	6	16.7%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	31	86.1%
Non intersection	5	13.9%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	4	11.1%
Multi Vehicle	32	88.9%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	16	44.4%
Unclassified Road	20	55.6%

Contributing Factors		
Speeding	2	5.6%
Fatigue	1	2.8%

Weather		
Fine	30	83.3%
Rain	3	8.3%
Overcast	3	8.3%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	6	16.7%
Dry	30	83.3%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	22	61.1%
Dusk	0	0.0%
Darkness	14	38.9%

Crash Movement		
Intersection, adjacent approaches	2	5.6%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	16	44.4%
U-turn	0	0.0%
Rear-end	4	11.1%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	6	16.7%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	3	8.3%
Out of control on straight	3	8.3%
Off road, on curve	0	0.0%
Off road on curve, hit object	0	0.0%
Out of control on curve	0	0.0%
Other crash type	2	5.6%

Speed Limit				
40 km/h or less	1	2.8%	80 km/h zone	0	0.0%
50 km/h zone	14	38.9%	90 km/h zone	0	0.0%
60 km/h zone	21	58.3%	100 km/h zone	0	0.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days		~ 40km/h or less	0	0.0%	~ School Travel Time Involvement	6	16.7%

Day of the Week												
Monday	6	16.7%	Wednesday	6	16.7%	Friday	7	19.4%	Sunday	5	13.9%	WEEKEND	8	22.2%
Tuesday	3	8.3%	Thursday	6	16.7%	Saturday	3	8.3%	WEEKDAY	28	77.8%			

CRASHES	36	
Fatal	0	0.0%
Serious inj.	4	11.1%
Moderate inj.	5	13.9%
Minor/Other inj.	6	16.7%
Uncategorised inj.	5	13.9%
Non-casualty	16	44.4%

Self Reported Crash	1	2.78%

Time Group		% of Day	
00:01 - 02:59	3	8.3%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	2	5.6%	4.2%
09:00 - 09:59	2	5.6%	4.2%
10:00 - 10:59	2	5.6%	4.2%
11:00 - 11:59	4	11.1%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	3	8.3%	4.2%
14:00 - 14:59	3	8.3%	4.2%
15:00 - 15:59	3	8.3%	4.2%
16:00 - 16:59	2	5.6%	4.2%
17:00 - 17:59	1	2.8%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	1	2.8%	4.2%
20:00 - 21:59	6	16.7%	8.3%
22:00 - 24:00	4	11.1%	8.3%

Street Lighting Off/Nil		% of Dark	
0	of 14	in Dark	0.0%

CASUALTIES	28	
Killed	0	0.0%
Seriously inj.	4	14.3%
Moderately inj.	7	25.0%
Minor/Other inj.	11	39.3%
Uncategorised inj.	6	21.4%
^ Unrestrained	1	3.6%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
2	2015	0
8	2014	6
6	2013	3
10	2012	7
8	2011	12
2	2010	0

McLean Periods		% Week	
A	2	5.6%	17.9%
B	0	0.0%	7.1%
C	12	33.3%	17.9%
D	1	2.8%	3.5%
E	1	2.8%	3.6%
F	4	11.1%	10.7%
G	2	5.6%	7.1%
H	3	8.3%	7.1%
I	4	11.1%	12.5%
J	7	19.4%	10.7%

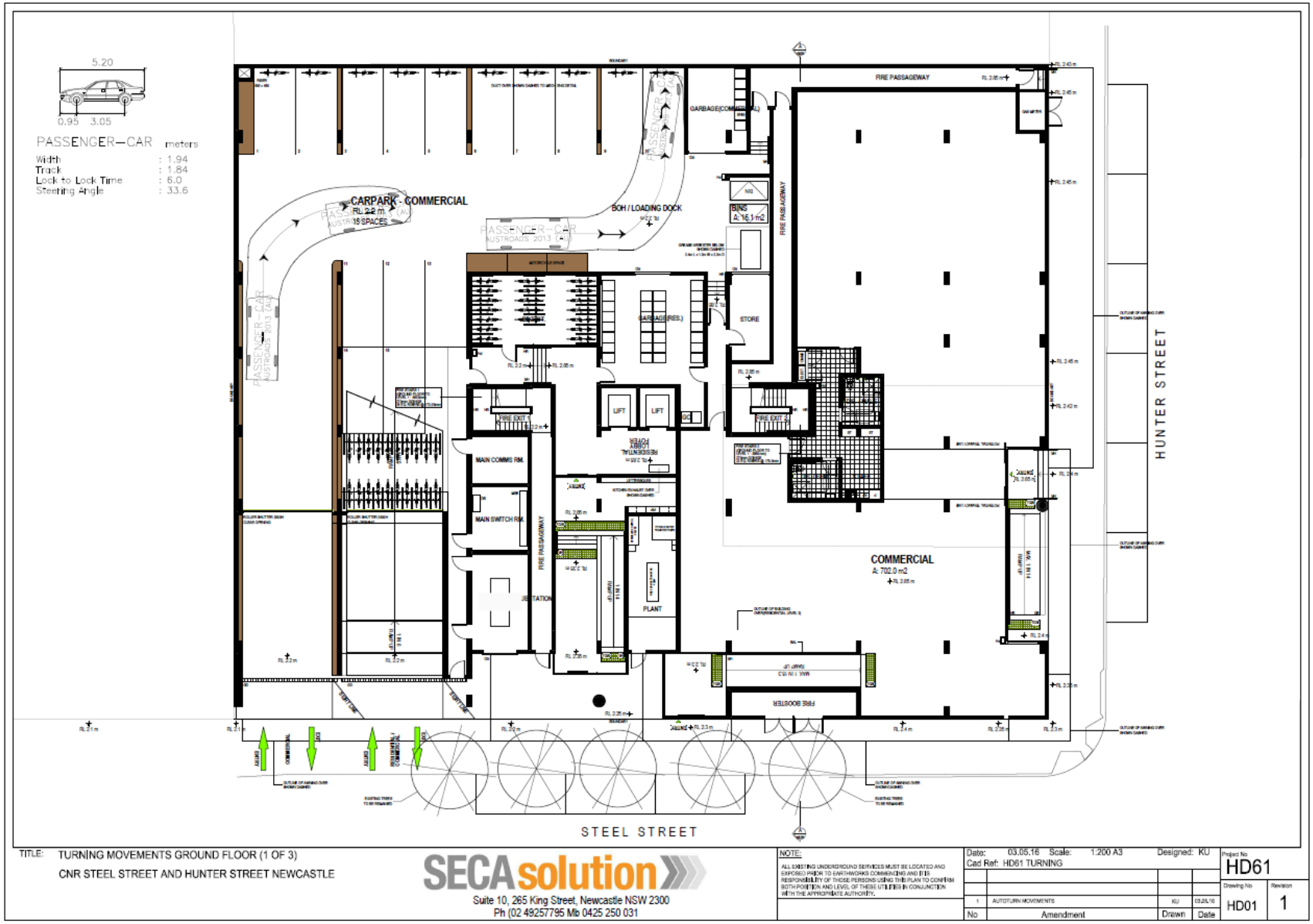
#Holiday Periods																		
New Year	0	0.0%	Easter	0	0.0%	Queen's BD	1	2.8%	Christmas	1	2.8%	Easter SH	0	0.0%	Sept./Oct. SH	0	0.0%	
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	0	0.0%	January SH	1	2.8%	June/July SH	0	0.0%	December SH	1	2.8%	

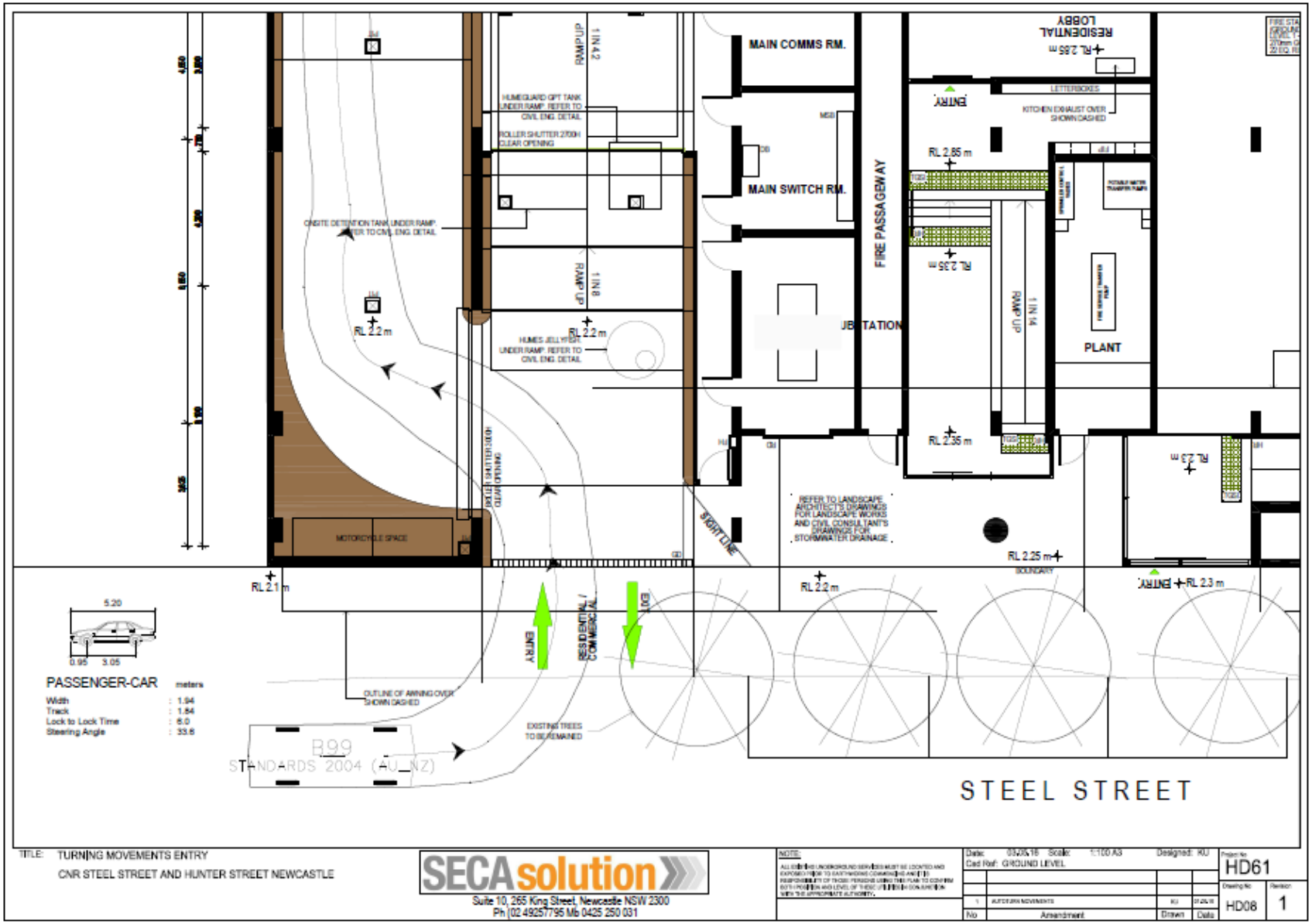
Crashid dataset Steel Street, Newcastle West - 1st July 2010 to 2016*

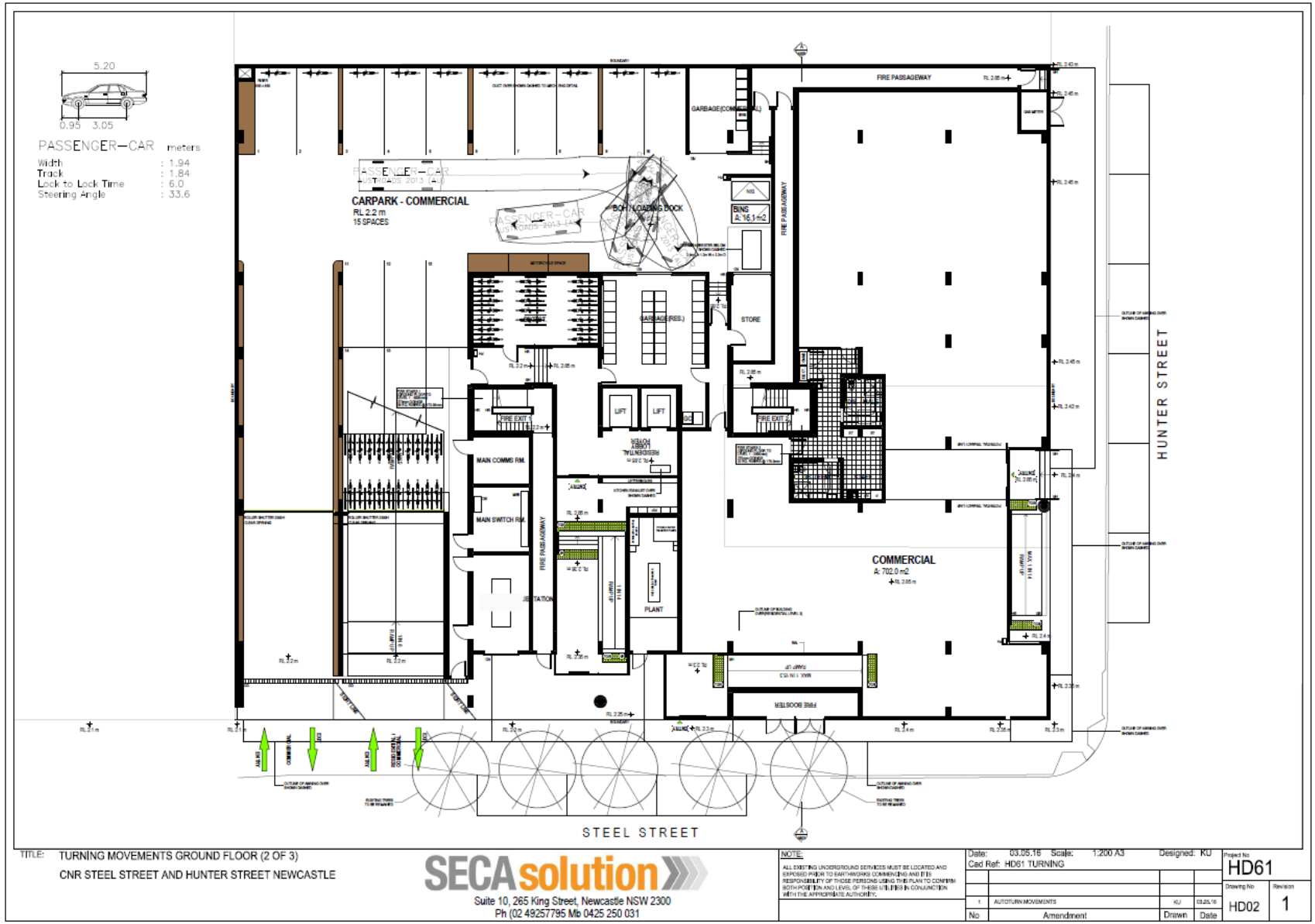
Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.
Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data.
Reporting yrs 1996-2004 and 2014 onwards contain uncategorised inj crashes.
Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

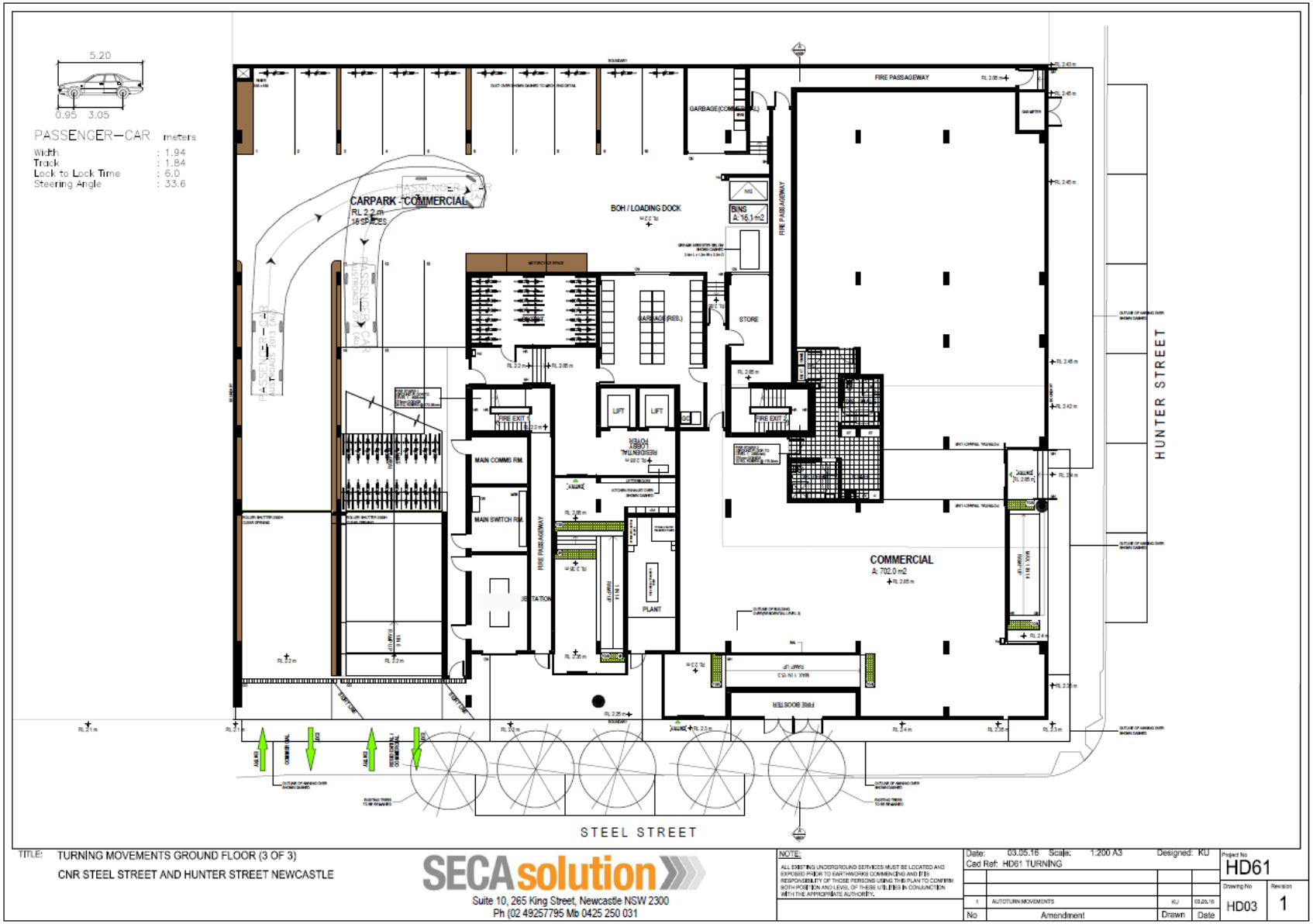
Rep ID: REG01 **Office:** Hunter **User ID:** gillettj Page 1 of 1 Generated: 27/04/2016 14:05

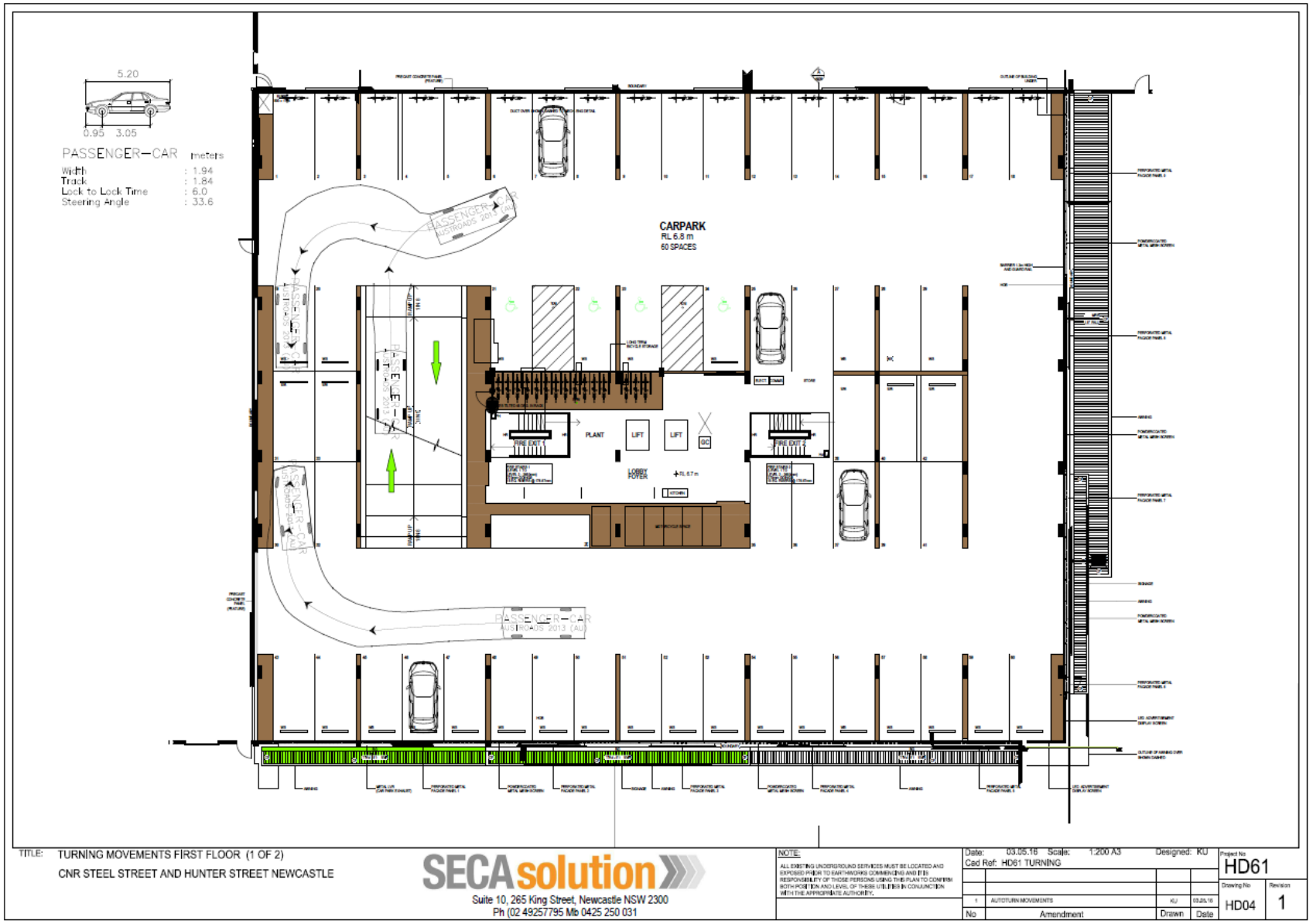
Appendix C – Autoturn Simulation

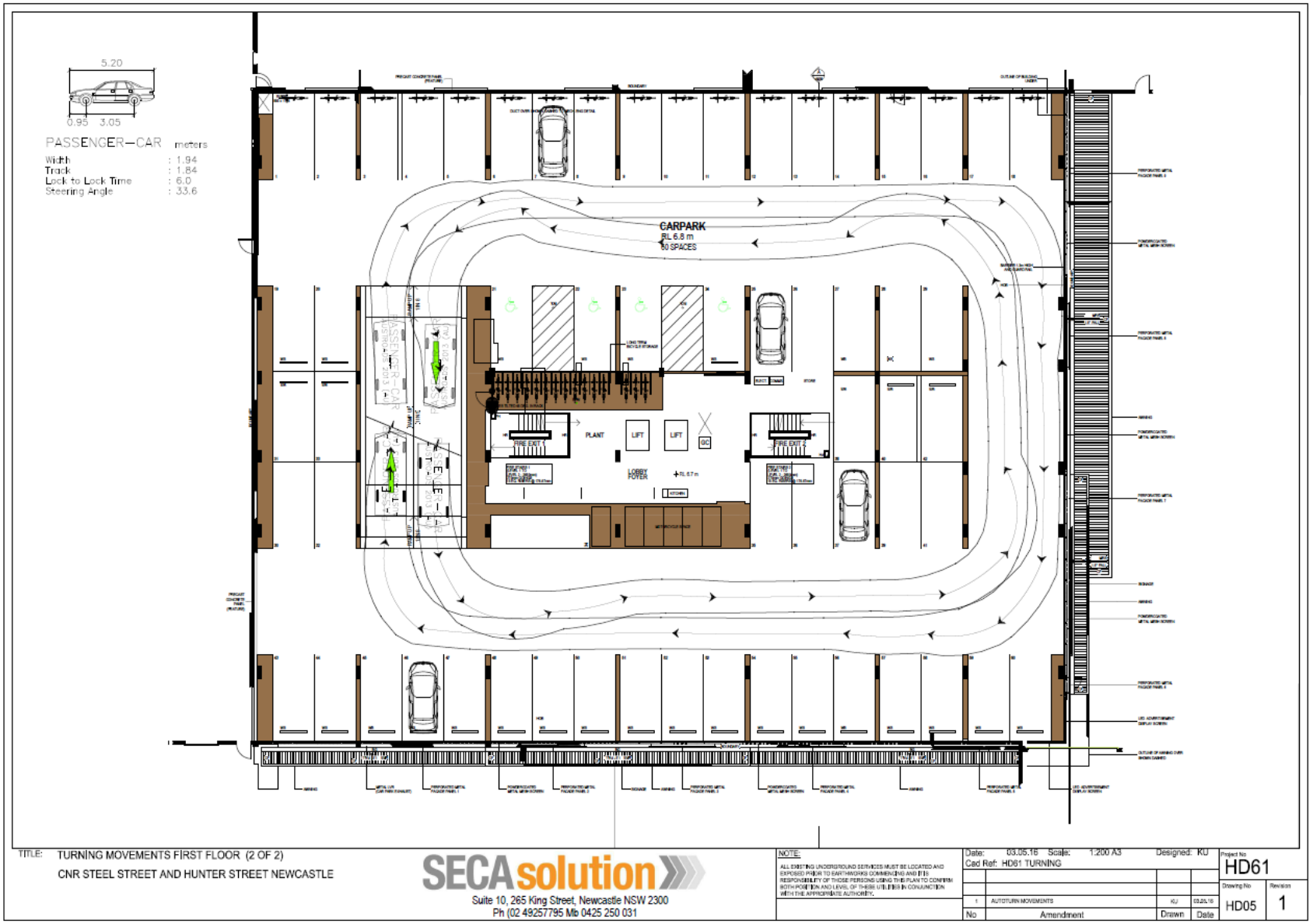


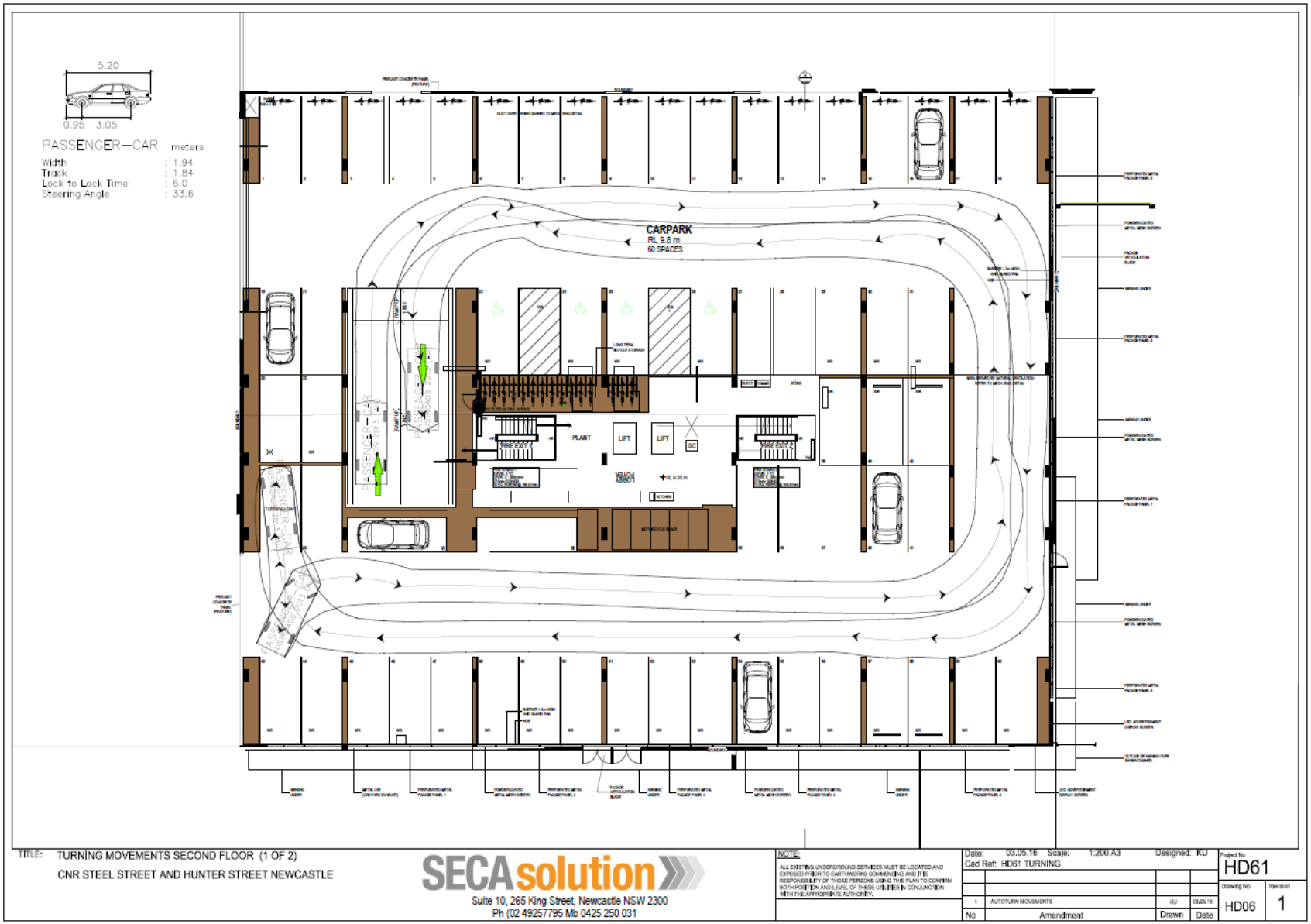

MAIN COMMS RM.
MAIN SWITCH RM.
FIRE PASSAGEWAY
RESIDENTIAL LOBBY
PLANT
RAMP UP 1 IN 4.2
RAMP UP 1 IN 8
RAMP UP 1 IN 14
RL 2.85 m
RL 2.35 m
RL 2.2 m
RL 2.1 m
RL 2.25 m
RL 2.3 m
ENTRY
LETTERBOXES
KITCHEN EXHAUST OVER SHOWN DASHED
ROLLER SHUTTER 2700H CLEAR OPENING
ONSITE DETENTION TANK UNDER RAMP REFER TO CIVIL ENG. DETAIL
HUMES JELLYFISH UNDER RAMP REFER TO CIVIL ENG. DETAIL
HUMEGUARD GPT TANK UNDER RAMP REFER TO CIVIL ENG. DETAIL
MOTORCYCLE SPACE
SIGHT LINE
REFER TO LANDSCAPE ARCHITECTS DRAWINGS FOR LANDSCAPE WORKS AND CIVIL CONSULTANT'S DRAWINGS FOR STORMWATER DRAINAGE
OUTLINE OF AWNING OVER SHOWN DASHED
EXISTING TREES TO BE REMAINED
RESIDENTIAL / COMMERCIAL
EXIT
ENTRY
5.20
0.95
3.05
PASSENGER-CAR
meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
B99
STANDARDS 2004 (AU_NZ)
STEEL STREET
TITLE: TURNING MOVEMENTS ENTRY
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph 02 49257795 Mb 0425 250 031
Date: 07/05/18 Scale: 1:100 A3 Designed: KU
Cad Ref: GROUND LEVEL
Project No HD61
Drawing No HD08
Revision 1
No Amendment Drawn Date
1 AUTOTURN MOVEMENTS KU 07/05/18

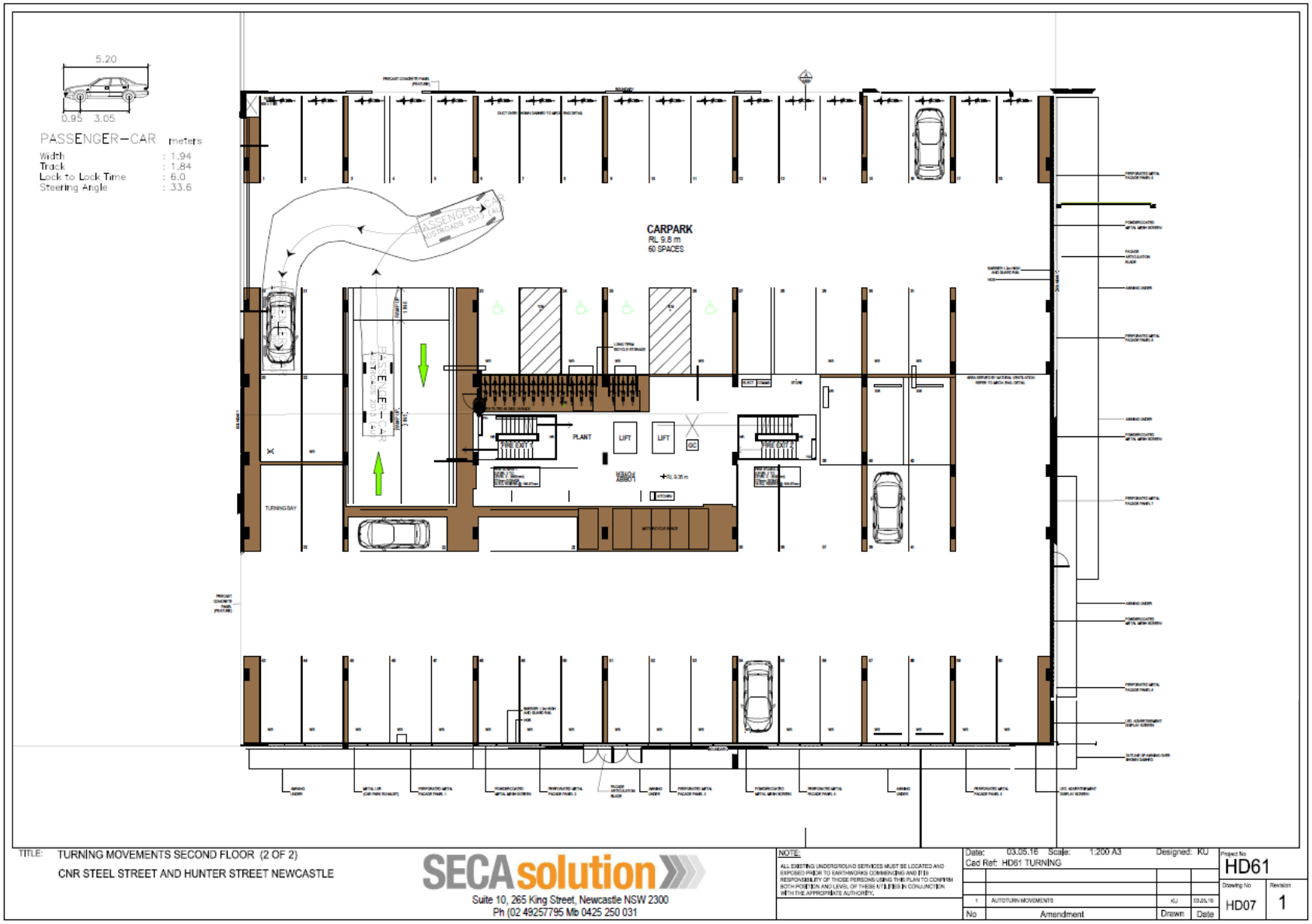

5.20
0.95 3.05
PASSENGER—CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK - COMMERCIAL
RL 2.2 m
15 SPACES
PASSENGER—CAR
AUSTROADS 2013 (A)
BOH LOADING DOCK
BINS
A: 16.1 m2
FIRE PASSAGEWAY
GARBAGE(RESL.)
STORE
LIFT
LIFT
FIRE EXIT
MAIN COMMS RM.
MAIN SWITCH RM.
JET STATION
PLANT
COMMERCIAL
A: 702.0 m2
HUNTER STREET
STEEL STREET
TITLE: TURNING MOVEMENTS GROUND FLOOR (2 OF 3)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
ALL EXISTING UNDERGROUND SERVICES MUST BE LOCATED AND EXPOSED PRIOR TO EARTHWORKS COMMENCING AND IT IS RESPONSIBILITY OF THOSE PERSONS USING THIS PLAN TO CONFIRM BOTH POSITION AND LEVEL OF THESE UTILITIES IN CONJUNCTION WITH THE APPROPRIATE AUTHORITY.
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
Drawing No HD02
Revision 1
No Amendment Drawn Date
1 AUTOTURN MOVEMENTS KU 03.05.16


5.20
0.95 3.05
PASSENGER—CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK - COMMERCIAL
RL 2.2 m
16 SPACES
BOH / LOADING DOCK
BINS
A: 16.1 m2
FIRE PASSAGEWAY
GARBAGE(COMMERCIAL)
STORE
GARBAGE(RES.)
LIFT
LIFT
FIRE EXIT
FIRE EXIT
MAIN COMMS RM.
MAIN SWITCH RM.
RESIDENTIAL LOBBY ABOVE
HYDRANT
PLANT
COMMERCIAL
A: 702.0 m2
HUNTER STREET
STEEL STREET
TITLE: TURNING MOVEMENTS GROUND FLOOR (3 OF 3)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
ALL EXISTING UNDERGROUND SERVICES MUST BE LOCATED AND EXPOSED PRIOR TO EARTHWORKS COMMENCING AND IT IS RESPONSIBILITY OF THOSE PERSONS USING THIS PLAN TO CONFIRM BOTH POSITION AND LEVEL OF THESE UTILITIES IN CONJUNCTION WITH THE APPROPRIATE AUTHORITY.
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
1 AUTOTURN MOVEMENTS KU 03.05.16
No Amendment Drawn Date
Drawing No HD03
Revision 1


5.20
0.95 3.05
PASSENGER–CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK
RL 6.8 m
60 SPACES
PLANT
LIFT
LIFT
FIRE EXIT
FIRE EXIT
LOBBY FOYER
RL 6.7 m
PASSENGER–CAR
AUSTROADS 2013 (AU)
TITLE: TURNING MOVEMENTS FIRST FLOOR (1 OF 2)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
ALL EXISTING UNDERGROUND SERVICES MUST BE LOCATED AND EXPOSED PRIOR TO EARTHWORKS COMMENCING AND IT IS RESPONSIBILITY OF THOSE PERSONS USING THIS PLAN TO CONFIRM BOTH POSITION AND LEVEL OF THESE UTILITIES IN CONJUNCTION WITH THE APPROPRIATE AUTHORITY.
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
Drawing No HD04
Revision 1
1 AUTOTURN MOVEMENTS KU 03.05.16
No Amendment Drawn Date


5.20
0.95 3.05
PASSENGER—CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK
RL 6.8 m
50 SPACES
PLANT
LIFT
LIFT
LOBBY FOYER
RL 6.7 m
FIRE EXIT
FIRE EXIT
TITLE: TURNING MOVEMENTS FIRST FLOOR (2 OF 2)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
ALL EXISTING UNDERGROUND SERVICES MUST BE LOCATED AND EXPOSED PRIOR TO EARTHWORKS COMMENCING AND IT IS RESPONSIBILITY OF THOSE PERSONS USING THIS PLAN TO CONFIRM BOTH POSITION AND LEVEL OF THESE UTILITIES IN CONJUNCTION WITH THE APPROPRIATE AUTHORITY.
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
Drawing No HD05
Revision 1
No. Amendment Drawn Date
1 AUTOTURN MOVEMENTS KU 03.05.16

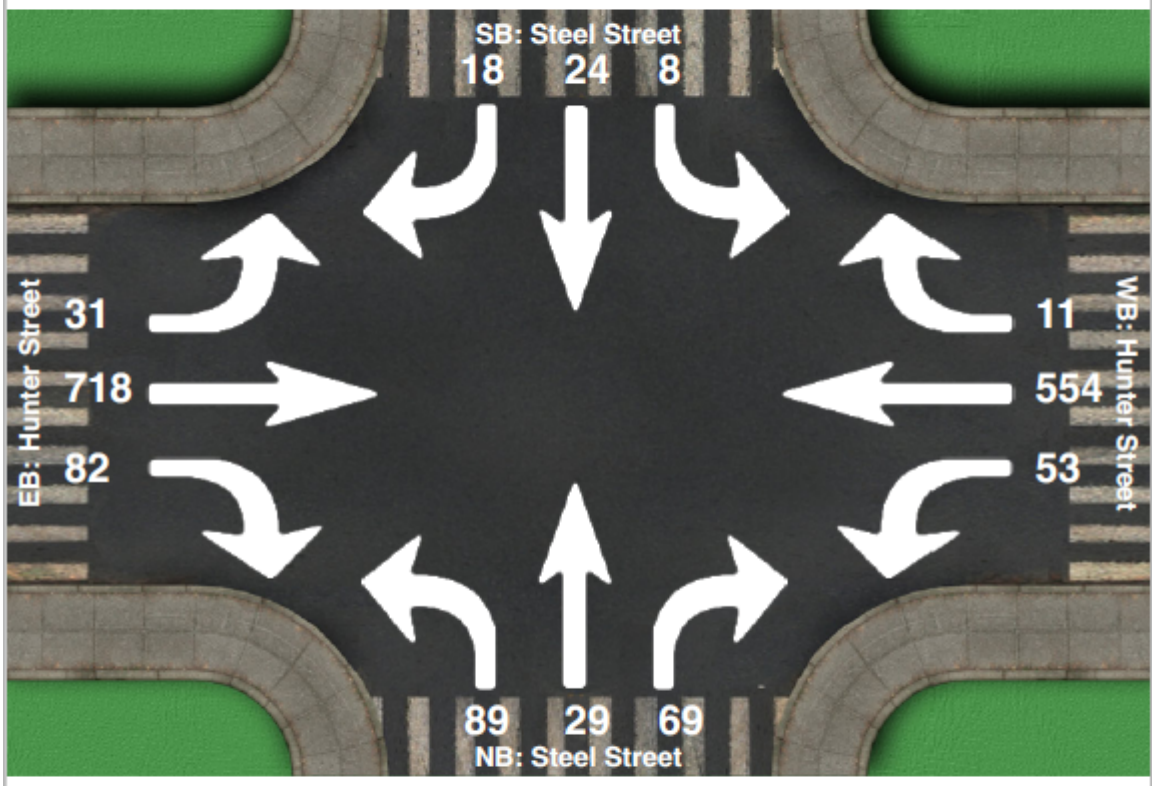

5.20
0.95 3.05
PASSENGER—CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK
RL 9.8 m
60 SPACES
PLANT
LIFT
LIFT
GC
FIRE EXIT
FIRE EXIT
HEAD ASSY
RL 9.35 m
KITCHEN
TURNING BAY
TITLE: TURNING MOVEMENTS SECOND FLOOR (1 OF 2)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
ALL EXISTING UNDERGROUND SERVICES MUST BE LOCATED AND EXPOSED PRIOR TO EARTHWORKS COMMENCING AND IT IS RESPONSIBILITY OF THOSE PERSONS USING THIS PLAN TO CONFIRM BOTH POSITION AND LEVEL OF THESE UTILITIES IN CONJUNCTION WITH THE APPROPRIATE AUTHORITY.
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
Drawing No HD06
Revision 1
No Amendment Drawn Date
1 AUTOTURN MOVEMENTS KU 03.05.16


5.20
0.95 3.05
PASSENGER–CAR meters
Width : 1.94
Track : 1.84
Lock to Lock Time : 6.0
Steering Angle : 33.6
CARPARK
RL 9.8 m
60 SPACES
PLANT
LIFT
LIFT
FIRE EXIT
FIRE EXIT
TURNING BAY
TITLE: TURNING MOVEMENTS SECOND FLOOR (2 OF 2)
CNR STEEL STREET AND HUNTER STREET NEWCASTLE
SECAsolution
Suite 10, 265 King Street, Newcastle NSW 2300
Ph (02 49257795 Mb 0425 250 031
NOTE:
Date: 03.05.16 Scale: 1:200 A3 Designed: KU
Cad Ref: HD61 TURNING
Project No HD61
Drawing No HD07
Revision 1
No Amendment Drawn Date
1 AUTOTURN MOVEMENTS KU 03.05.16

Appendix D – Traffic Data

Intersection Peak Hour

Location: Steel Street at Hunter Street, Newcastle
GPS Coordinates:
Date: 2016-04-28
Day of week: Thursday
Weather:
Analyst: Ct



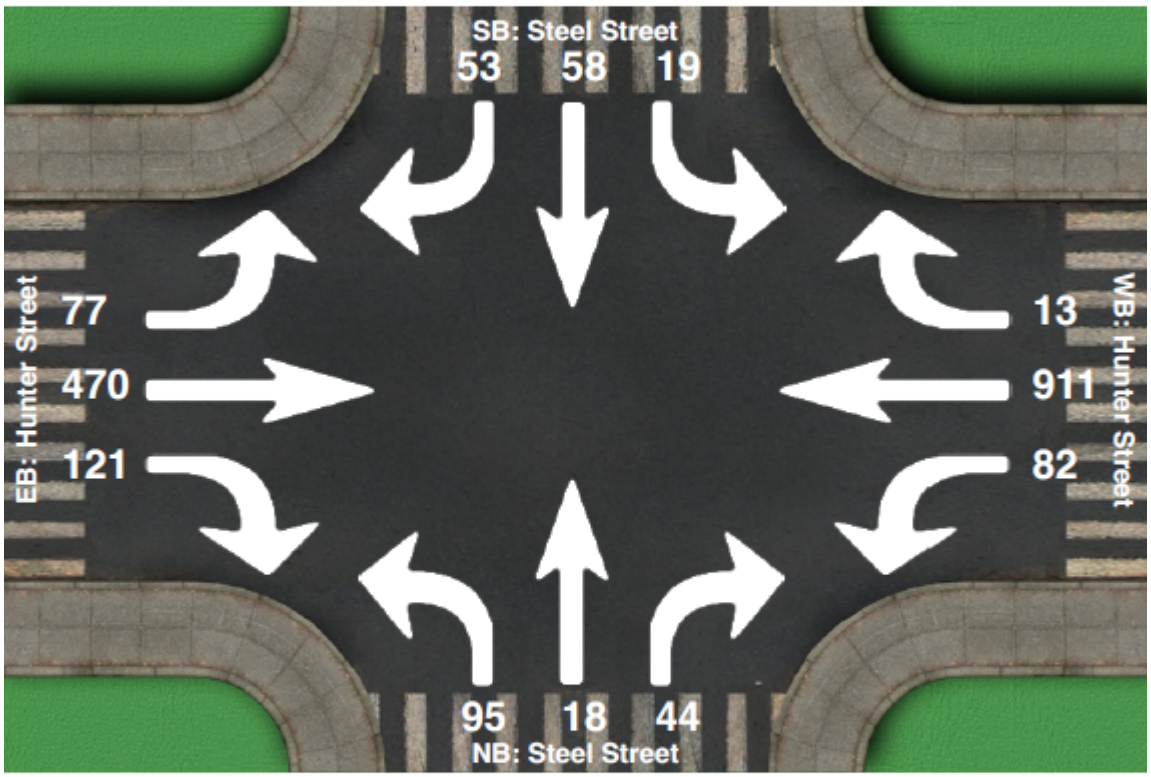
Intersection Peak Hour

08:00 - 09:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	8	24	18	53	554	11	89	29	69	31	718	82	1686
Factor	0.67	0.75	0.75	0.78	0.85	0.69	0.82	0.66	0.78	0.70	0.90	0.73	0.94
Approach Factor	0.78			0.88			0.82			0.88			

Intersection Peak Hour

Location: Steel Street at Hunter Street, Newcastle
GPS Coordinates:
Date: 2016-04-28
Day of week: Thursday
Weather:
Analyst: Ct



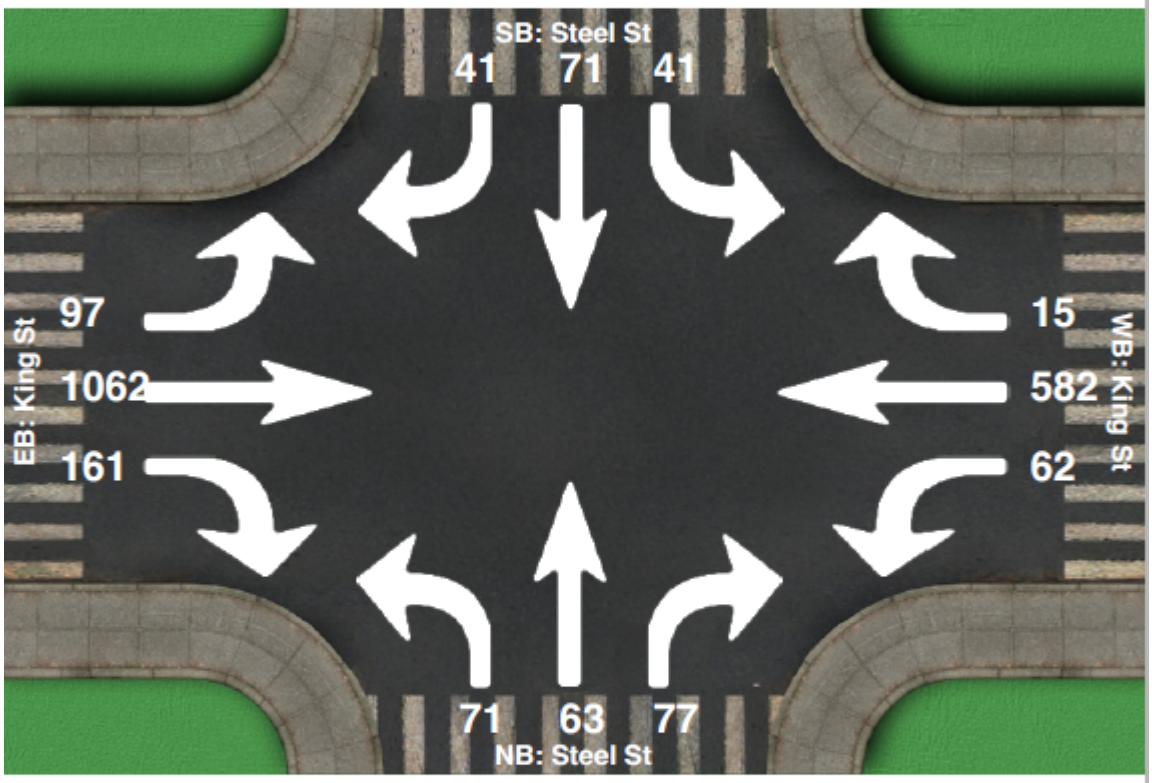
Intersection Peak Hour

16:30 - 17:30

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	19	58	53	82	911	13	95	18	44	77	470	121	1961
Factor	0.68	0.81	0.70	0.54	0.90	0.65	0.85	0.64	0.79	0.92	0.92	0.84	0.90
Approach Factor	0.88			0.86			0.87			0.94			

Intersection Peak Hour

Location: Steel St at King St, Newcastle
GPS Coordinates:
Date: 2016-04-28
Day of week: Thursday
Weather:
Analyst: BM



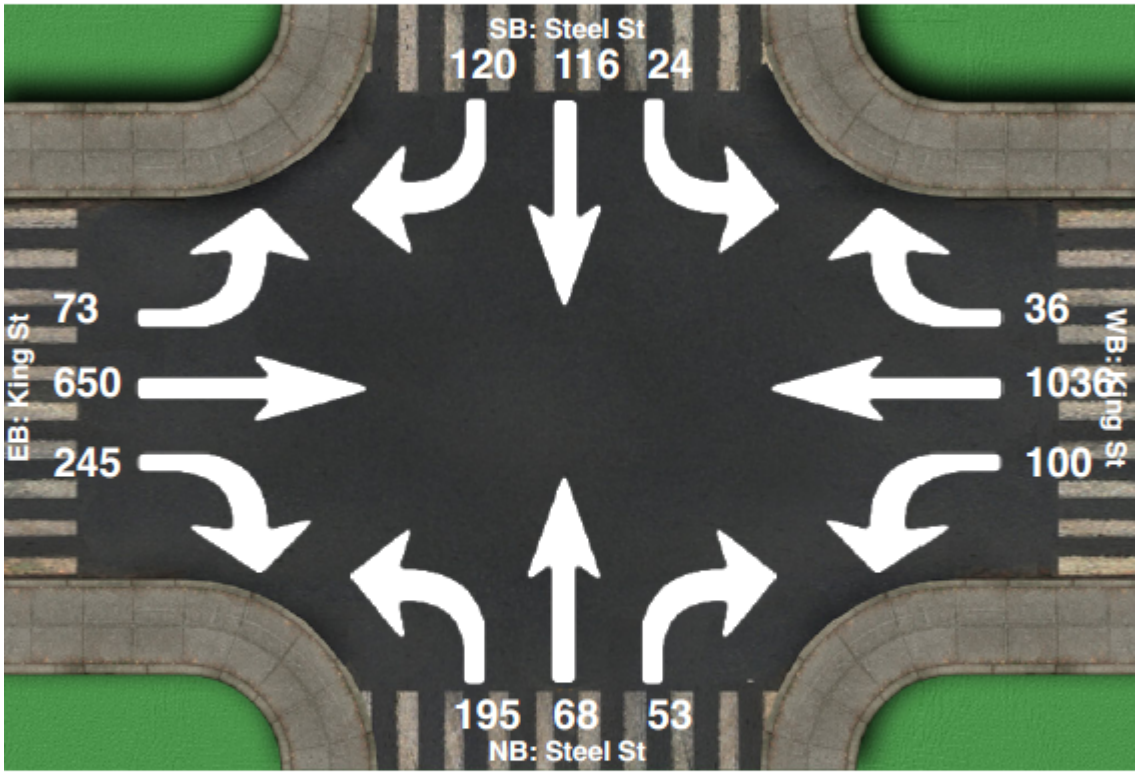
Intersection Peak Hour

08:00 - 09:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	41	71	41	62	582	15	71	63	77	97	1062	161	2343
Factor	0.85	0.85	0.79	0.70	0.95	0.54	0.71	0.68	0.80	0.84	0.93	0.91	0.96
Approach Factor	0.83			0.91			0.79			0.94			

Intersection Peak Hour

Location: Steel St at King St, Newcastle
GPS Coordinates:
Date: 2016-04-28
Day of week: Thursday
Weather:
Analyst: BM



Intersection Peak Hour

16:45 - 17:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	24	116	120	100	1036	36	195	68	53	73	650	245	2716
Factor	0.75	0.88	0.91	0.83	0.89	0.90	0.70	0.81	0.74	0.70	0.90	0.86	0.94
Approach Factor	0.88			0.90			0.76			0.98			

Appendix E – Sidra Analysis

Interpreting Sidra Results:

1-Level of Service (LoS)

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

2-Average Vehicle Delay (AVD)

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

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

3-Degree of Saturation (D/S)

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

INTERSECTION SUMMARY

Site: 101 [Steel and King AM base]

Steel St and King St
AM base flows 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles**	**Pedestrians**	**Persons**
Travel Speed (Average)	35.3 km/h	2.3 km/h	33.1 km/h
Travel Distance (Total)	1414.2 veh-km/h	8.1 ped-km/h	1705.1 pers-km/h
Travel Time (Total)	40.1 veh-h/h	3.5 ped-h/h	51.6 pers-h/h
Demand Flows (Total)	2466 veh/h	211 ped/h	2960 pers/h
Percent Heavy Vehicles (Demand)	3.1 %		
Degree of Saturation	0.656	0.073	
Practical Spare Capacity	37.1 %		
Effective Intersection Capacity	3757 veh/h		
Control Delay (Total)	16.22 veh-h/h	1.75 ped-h/h	21.22 pers-h/h
Control Delay (Average)	23.7 sec	30.0 sec	25.8 sec
Control Delay (Worst Lane)	51.6 sec		
Control Delay (Worst Movement)	51.6 sec	44.3 sec	51.6 sec
Geometric Delay (Average)	1.3 sec		
Stop-Line Delay (Average)	22.3 sec		
Idling Time (Average)	18.9 sec		
Intersection Level of Service (LOS)	LOS B	LOS D	
95% Back of Queue - Vehicles (Worst Lane)	20.8 veh		
95% Back of Queue - Distance (Worst Lane)	150.4 m		
Queue Storage Ratio (Worst Lane)	0.34		
Total Effective Stops	1642 veh/h	158 ped/h	2128 pers/h
Effective Stop Rate	0.67 per veh	0.75 per ped	0.72 per pers
Proportion Queued	0.74	0.75	0.80
Performance Index	134.0	4.4	138.3
Cost (Total)	1305.10 $/h	87.69 $/h	1392.80 $/h
Fuel Consumption (Total)	168.0 L/h		
Carbon Dioxide (Total)	397.8 kg/h		
Hydrocarbons (Total)	0.036 kg/h		
Carbon Monoxide (Total)	0.423 kg/h		
NOx (Total)	0.606 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and King AM base]

Steel St and King St
AM base flows 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel St south											
1	L2	75	1.0	0.238	45.0	LOS D	3.2	22.7	0.90	0.76	23.0
2	T1	66	1.0	0.599	43.8	LOS D	7.0	49.2	0.98	0.81	18.6
3	R2	81	1.0	0.599	49.4	LOS D	7.0	49.2	0.98	0.81	24.6
Approach		222	1.0	0.599	46.3	LOS D	7.0	49.2	0.95	0.79	22.5
East: King St east											
4	L2	65	1.0	0.069	18.7	LOS B	1.6	11.2	0.53	0.69	37.0
5	T1	613	4.0	0.316	15.2	LOS B	8.6	62.5	0.62	0.54	42.6
6	R2	16	1.0	0.061	46.3	LOS D	0.7	4.8	0.90	0.69	22.5
Approach		694	3.6	0.316	16.3	LOS B	8.6	62.5	0.62	0.55	41.4
North: Steel St north											
7	L2	43	1.0	0.059	10.2	LOS A	0.6	4.3	0.40	0.64	43.5
8	T1	75	1.0	0.626	43.3	LOS D	5.5	38.8	0.95	0.80	19.1
9	R2	43	1.0	0.626	48.8	LOS D	5.5	38.8	0.95	0.80	21.1
Approach		161	1.0	0.626	35.9	LOS C	5.5	38.8	0.80	0.75	24.1
West: King St west											
10	L2	102	1.0	0.109	19.0	LOS B	2.5	17.9	0.55	0.70	32.7
11	T1	1118	4.0	0.618	18.2	LOS B	20.8	150.4	0.75	0.67	40.3
12	R2	169	1.0	0.656	51.6	LOS D	8.2	58.0	1.00	0.83	21.2
Approach		1389	3.4	0.656	22.4	LOS B	20.8	150.4	0.76	0.69	36.5
All Vehicles		2466	3.1	0.656	23.7	LOS B	20.8	150.4	0.74	0.67	35.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	16.9	LOS B	0.1	0.1	0.58	0.58
P2	East Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	14.6	LOS B	0.1	0.1	0.54	0.54
P4	West Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		211	30.0	LOS D			0.75	0.75

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

INTERSECTION SUMMARY

Site: 101 [Steel and Hunter AM base]

Steel Street and Hunter Street
AM base 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles**	**Pedestrians**	**Persons**
Travel Speed (Average)	41.1 km/h	2.4 km/h	37.1 km/h
Travel Distance (Total)	867.9 veh-km/h	7.2 ped-km/h	1048.7 pers-km/h
Travel Time (Total)	21.1 veh-h/h	2.9 ped-h/h	28.3 pers-h/h
Demand Flows (Total)	1775 veh/h	211 ped/h	2130 pers/h
Percent Heavy Vehicles (Demand)	2.5 %		
Degree of Saturation	0.389	0.044	
Practical Spare Capacity	131.1 %		
Effective Intersection Capacity	4557 veh/h		
Control Delay (Total)	6.27 veh-h/h	1.40 ped-h/h	8.92 pers-h/h
Control Delay (Average)	12.7 sec	23.9 sec	15.1 sec
Control Delay (Worst Lane)	44.8 sec		
Control Delay (Worst Movement)	46.5 sec	40.6 sec	46.5 sec
Geometric Delay (Average)	1.2 sec		
Stop-Line Delay (Average)	11.6 sec		
Idling Time (Average)	9.3 sec		
Intersection Level of Service (LOS)	LOS A	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	10.4 veh		
95% Back of Queue - Distance (Worst Lane)	74.8 m		
Queue Storage Ratio (Worst Lane)	0.22		
Total Effective Stops	847 veh/h	135 ped/h	1151 pers/h
Effective Stop Rate	0.48 per veh	0.64 per ped	0.54 per pers
Proportion Queued	0.51	0.64	0.57
Performance Index	102.9	3.7	106.5
Cost (Total)	647.32 $/h	73.84 $/h	721.16 $/h
Fuel Consumption (Total)	90.1 L/h		
Carbon Dioxide (Total)	213.1 kg/h		
Hydrocarbons (Total)	0.019 kg/h		
Carbon Monoxide (Total)	0.234 kg/h		
NOx (Total)	0.272 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and Hunter AM base]

Steel Street and Hunter Street
AM base 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel Steet											
1	L2	94	1.0	0.267	43.4	LOS D	4.0	28.0	0.89	0.77	19.2
2	T1	31	1.0	0.383	41.0	LOS C	4.6	32.6	0.93	0.77	12.0
3	R2	73	1.0	0.383	46.5	LOS D	4.6	32.6	0.93	0.77	22.1
Approach		197	1.0	0.383	44.2	LOS D	4.6	32.6	0.91	0.77	19.4
East: Hunter Street east											
4	L2	56	1.0	0.258	11.7	LOS A	6.1	43.8	0.40	0.41	45.3
5	T1	583	3.0	0.258	6.4	LOS A	6.1	43.8	0.41	0.39	49.3
6	R2	12	1.0	0.258	12.1	LOS A	5.8	41.7	0.42	0.37	42.5
Approach		651	2.8	0.258	6.9	LOS A	6.1	43.8	0.41	0.39	48.9
North: Steel St north											
7	L2	8	1.0	0.024	39.0	LOS C	0.3	2.4	0.84	0.66	21.1
8	T1	25	1.0	0.161	39.0	LOS C	1.9	13.3	0.89	0.70	13.0
9	R2	19	1.0	0.161	42.5	LOS C	1.9	13.3	0.89	0.70	16.4
Approach		53	1.0	0.161	40.3	LOS C	1.9	13.3	0.88	0.69	15.7
West: Hunter Street west											
10	L2	33	1.0	0.389	12.5	LOS A	10.4	74.8	0.46	0.43	21.7
11	T1	756	3.0	0.389	7.4	LOS A	10.4	74.8	0.47	0.46	47.8
12	R2	86	1.0	0.389	13.9	LOS A	8.0	57.4	0.49	0.51	39.0
Approach		875	2.7	0.389	8.3	LOS A	10.4	74.8	0.47	0.46	46.0
All Vehicles		1775	2.5	0.389	12.7	LOS A	10.4	74.8	0.51	0.48	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	6.9	LOS A	0.1	0.1	0.37	0.37
P2	East Full Crossing	53	40.6	LOS E	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	7.6	LOS A	0.1	0.1	0.39	0.39
P4	West Full Crossing	53	40.6	LOS E	0.1	0.1	0.90	0.90
All Pedestrians		211	23.9	LOS C			0.64	0.64

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: SECA SOLUTION | Processed: Friday, 29 April 2016 7:35:05 AM

INTERSECTION SUMMARY

Site: 101 [Steel and King PM base]

Steel St and King St
PM base flows 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	28.3 km/h	2.3 km/h	27.0 km/h
Travel Distance (Total)	1600.8 veh-km/h	8.1 ped-km/h	1929.1 pers-km/h
Travel Time (Total)	56.5 veh-h/h	3.6 ped-h/h	71.4 pers-h/h
Demand Flows (Total)	2859 veh/h	211 ped/h	3431 pers/h
Percent Heavy Vehicles (Demand)	2.9 %		
Degree of Saturation	0.852	0.034	
Practical Spare Capacity	5.6 %		
Effective Intersection Capacity	3355 veh/h		
Control Delay (Total)	29.41 veh-h/h	1.85 ped-h/h	37.14 pers-h/h
Control Delay (Average)	37.0 sec	31.6 sec	39.0 sec
Control Delay (Worst Lane)	55.1 sec		
Control Delay (Worst Movement)	55.1 sec	37.9 sec	55.1 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	35.3 sec		
Idling Time (Average)	30.5 sec		
Intersection Level of Service (LOS)	LOS C	LOS D	
95% Back of Queue - Vehicles (Worst Lane)	28.1 veh		
95% Back of Queue - Distance (Worst Lane)	203.1 m		
Queue Storage Ratio (Worst Lane)	0.43		
Total Effective Stops	2461 veh/h	167 ped/h	3120 pers/h
Effective Stop Rate	0.86 per veh	0.79 per ped	0.91 per pers
Proportion Queued	0.90	0.79	0.95
Performance Index	199.3	4.5	203.8
Cost (Total)	1935.16 $/h	90.05 $/h	2025.21 $/h
Fuel Consumption (Total)	219.8 L/h		
Carbon Dioxide (Total)	519.8 kg/h		
Hydrocarbons (Total)	0.050 kg/h		
Carbon Monoxide (Total)	0.537 kg/h		
NOx (Total)	0.780 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and King PM base]

Steel St and King St
PM base flows 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel St south											
1	L2	205	1.0	0.384	36.3	LOS C	8.1	56.9	0.85	0.79	26.0
2	T1	72	1.0	0.293	32.3	LOS C	5.0	35.6	0.84	0.72	22.7
3	R2	56	1.0	0.293	37.9	LOS C	5.0	35.6	0.84	0.72	29.0
Approach		333	1.0	0.384	35.7	LOS C	8.1	56.9	0.85	0.77	25.9
East: King St east											
4	L2	105	1.0	0.159	28.8	LOS C	3.5	24.5	0.71	0.74	31.2
5	T1	1091	4.0	0.852	38.5	LOS C	28.1	203.1	0.96	0.97	29.5
6	R2	38	1.0	0.121	44.0	LOS D	1.6	11.2	0.88	0.72	23.2
Approach		1234	3.7	0.852	37.8	LOS C	28.1	203.1	0.94	0.94	29.5
North: Steel St north											
7	L2	25	1.0	0.025	8.5	LOS A	0.3	1.9	0.31	0.61	45.4
8	T1	122	1.0	0.823	46.7	LOS D	12.9	91.2	0.99	0.97	17.9
9	R2	126	1.0	0.823	52.3	LOS D	12.9	91.2	0.99	0.97	19.9
Approach		274	1.0	0.823	45.8	LOS D	12.9	91.2	0.92	0.94	20.3
West: King St west											
10	L2	77	1.0	0.116	28.4	LOS B	2.5	17.5	0.70	0.72	27.2
11	T1	684	4.0	0.541	27.0	LOS B	14.4	104.0	0.83	0.72	34.8
12	R2	258	1.0	0.823	55.1	LOS D	13.5	95.4	1.00	0.92	20.3
Approach		1019	3.0	0.823	34.2	LOS C	14.4	104.0	0.87	0.77	29.8
All Vehicles		2859	2.9	0.852	37.0	LOS C	28.1	203.1	0.90	0.86	28.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	26.7	LOS C	0.1	0.1	0.73	0.73
P2	East Full Crossing	53	37.9	LOS D	0.1	0.1	0.87	0.87
P3	North Full Crossing	53	23.9	LOS C	0.1	0.1	0.69	0.69
P4	West Full Crossing	53	37.9	LOS D	0.1	0.1	0.87	0.87
All Pedestrians		211	31.6	LOS D			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

INTERSECTION SUMMARY

Site: 101 [Steel and Hunter PM base]

Steel Street and Hunter Street
PM base 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	**Vehicles**	**Pedestrians**	**Persons**
Travel Speed (Average)	39.0 km/h	2.5 km/h	35.8 km/h
Travel Distance (Total)	980.3 veh-km/h	7.2 ped-km/h	1183.5 pers-km/h
Travel Time (Total)	25.2 veh-h/h	2.9 ped-h/h	33.1 pers-h/h
Demand Flows (Total)	2064 veh/h	211 ped/h	2477 pers/h
Percent Heavy Vehicles (Demand)	2.4 %		
Degree of Saturation	0.456	0.040	
Practical Spare Capacity	97.5 %		
Effective Intersection Capacity	4529 veh/h		
Control Delay (Total)	8.11 veh-h/h	1.38 ped-h/h	11.11 pers-h/h
Control Delay (Average)	14.1 sec	23.7 sec	16.1 sec
Control Delay (Worst Lane)	43.9 sec		
Control Delay (Worst Movement)	45.5 sec	39.7 sec	45.5 sec
Geometric Delay (Average)	1.4 sec		
Stop-Line Delay (Average)	12.8 sec		
Idling Time (Average)	10.4 sec		
Intersection Level of Service (LOS)	LOS A	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	12.7 veh		
95% Back of Queue - Distance (Worst Lane)	90.9 m		
Queue Storage Ratio (Worst Lane)	0.54		
Total Effective Stops	1100 veh/h	135 ped/h	1455 pers/h
Effective Stop Rate	0.53 per veh	0.64 per ped	0.59 per pers
Proportion Queued	0.56	0.64	0.62
Performance Index	134.7	3.7	138.3
Cost (Total)	806.88 $/h	73.47 $/h	880.34 $/h
Fuel Consumption (Total)	107.0 L/h		
Carbon Dioxide (Total)	253.0 kg/h		
Hydrocarbons (Total)	0.023 kg/h		
Carbon Monoxide (Total)	0.275 kg/h		
NOx (Total)	0.320 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and Hunter PM base]

Steel Street and Hunter Street
PM base 2016
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel Steet											
1	L2	100	1.0	0.271	42.5	LOS D	4.2	29.6	0.89	0.77	19.5
2	T1	19	1.0	0.255	40.0	LOS C	2.8	20.1	0.91	0.74	12.2
3	R2	46	1.0	0.255	45.5	LOS D	2.8	20.1	0.91	0.74	22.3
Approach		165	1.0	0.271	43.1	LOS D	4.2	29.6	0.90	0.76	19.7
East: Hunter Street east											
4	L2	86	1.0	0.419	13.1	LOS A	11.7	83.5	0.48	0.48	43.6
5	T1	959	3.0	0.419	7.8	LOS A	11.7	83.5	0.49	0.47	47.6
6	R2	14	1.0	0.419	13.6	LOS A	11.4	81.8	0.49	0.45	40.7
Approach		1059	2.8	0.419	8.3	LOS A	11.7	83.5	0.49	0.47	47.2
North: Steel St north											
7	L2	20	1.0	0.054	38.5	LOS C	0.8	5.6	0.84	0.69	21.2
8	T1	61	1.0	0.430	40.3	LOS C	5.2	36.8	0.93	0.77	12.6
9	R2	56	1.0	0.430	43.8	LOS D	5.2	36.8	0.93	0.77	16.0
Approach		137	1.0	0.430	41.5	LOS C	5.2	36.8	0.92	0.75	15.4
West: Hunter Street west											
10	L2	81	1.0	0.445	13.3	LOS A	12.7	90.9	0.50	0.49	21.1
11	T1	495	3.0	0.445	7.8	LOS A	12.7	90.9	0.50	0.49	47.3
12	R2	127	1.0	0.456	20.8	LOS B	3.9	27.5	0.64	0.76	29.2
Approach		703	2.4	0.456	10.8	LOS A	12.7	90.9	0.52	0.54	40.6
All Vehicles		2064	2.4	0.456	14.1	LOS A	12.7	90.9	0.56	0.53	39.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	7.2	LOS A	0.1	0.1	0.38	0.38
P2	East Full Crossing	53	39.7	LOS D	0.1	0.1	0.89	0.89
P3	North Full Crossing	53	8.0	LOS A	0.1	0.1	0.40	0.40
P4	West Full Crossing	53	39.7	LOS D	0.1	0.1	0.89	0.89
All Pedestrians		211	23.7	LOS C			0.64	0.64

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: SECA SOLUTION | Processed: Friday, 29 April 2016 7:35:08 AM

INTERSECTION SUMMARY

Site: 101 [Steel and King AM base+dev]

Steel St and King St
AM base flows 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	34.1 km/h	2.3 km/h	32.0 km/h
Travel Distance (Total)	1429.2 veh-km/h	8.1 ped-km/h	1723.1 pers-km/h
Travel Time (Total)	41.9 veh-h/h	3.5 ped-h/h	53.9 pers-h/h
Demand Flows (Total)	2502 veh/h	211 ped/h	3003 pers/h
Percent Heavy Vehicles (Demand)	3.1 %		
Degree of Saturation	0.720	0.073	
Practical Spare Capacity	25.0 %		
Effective Intersection Capacity	3475 veh/h		
Control Delay (Total)	17.84 veh-h/h	1.82 ped-h/h	23.23 pers-h/h
Control Delay (Average)	25.7 sec	31.2 sec	27.8 sec
Control Delay (Worst Lane)	51.6 sec		
Control Delay (Worst Movement)	51.6 sec	44.3 sec	51.6 sec
Geometric Delay (Average)	1.4 sec		
Stop-Line Delay (Average)	24.3 sec		
Idling Time (Average)	20.6 sec		
Intersection Level of Service (LOS)	LOS B	LOS D	
95% Back of Queue - Vehicles (Worst Lane)	20.8 veh		
95% Back of Queue - Distance (Worst Lane)	150.4 m		
Queue Storage Ratio (Worst Lane)	0.34		
Total Effective Stops	1752 veh/h	162 ped/h	2265 pers/h
Effective Stop Rate	0.70 per veh	0.77 per ped	0.75 per pers
Proportion Queued	0.78	0.77	0.84
Performance Index	141.7	4.5	146.2
Cost (Total)	1380.92 $/h	89.41 $/h	1470.32 $/h
Fuel Consumption (Total)	174.8 L/h		
Carbon Dioxide (Total)	413.8 kg/h		
Hydrocarbons (Total)	0.038 kg/h		
Carbon Monoxide (Total)	0.438 kg/h		
NOx (Total)	0.634 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and King AM base+dev]

Steel St and King St
AM base flows 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel St south											
1	L2	75	1.0	0.193	41.0	LOS C	3.0	21.4	0.86	0.75	24.3
2	T1	66	1.0	0.473	39.1	LOS C	6.5	46.1	0.93	0.78	20.0
3	R2	81	1.0	0.473	44.7	LOS D	6.5	46.1	0.93	0.78	26.1
Approach		222	1.0	0.473	41.8	LOS C	6.5	46.1	0.91	0.77	23.9
East: King St east											
4	L2	65	1.0	0.075	21.0	LOS B	1.7	12.1	0.58	0.70	35.5
5	T1	613	4.0	0.343	17.9	LOS B	9.4	67.8	0.67	0.58	40.6
6	R2	16	1.0	0.061	46.3	LOS D	0.7	4.8	0.90	0.69	22.5
Approach		694	3.6	0.343	18.8	LOS B	9.4	67.8	0.67	0.59	39.5
North: Steel St north											
7	L2	43	1.0	0.057	10.9	LOS A	0.7	4.7	0.42	0.65	42.8
8	T1	75	1.0	0.661	41.3	LOS C	6.8	48.2	0.94	0.82	19.4
9	R2	74	1.0	0.661	46.9	LOS D	6.8	48.2	0.94	0.82	21.4
Approach		192	1.0	0.661	36.6	LOS C	6.8	48.2	0.83	0.78	23.8
West: King St west											
10	L2	107	1.0	0.124	21.4	LOS B	2.9	20.5	0.59	0.71	31.1
11	T1	1118	4.0	0.720	21.3	LOS B	20.8	150.4	0.81	0.72	38.2
12	R2	169	1.0	0.656	51.6	LOS D	8.2	58.0	1.00	0.83	21.2
Approach		1395	3.4	0.720	25.0	LOS B	20.8	150.4	0.81	0.73	34.9
All Vehicles		2502	3.1	0.720	25.7	LOS B	20.8	150.4	0.78	0.70	34.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	19.3	LOS B	0.1	0.1	0.62	0.62
P2	East Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	16.9	LOS B	0.1	0.1	0.58	0.58
P4	West Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		211	31.2	LOS D			0.77	0.77

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: SECA SOLUTION | Processed: Friday, 29 April 2016 7:35:00 AM

INTERSECTION SUMMARY

Site: 101 [Steel and Hunter AM base+dev]

Steel Street and Hunter Street
AM base 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	40.2 km/h	2.5 km/h	36.4 km/h
Travel Distance (Total)	881.0 veh-km/h	7.2 ped-km/h	1064.4 pers-km/h
Travel Time (Total)	21.9 veh-h/h	2.9 ped-h/h	29.2 pers-h/h
Demand Flows (Total)	1812 veh/h	211 ped/h	2174 pers/h
Percent Heavy Vehicles (Demand)	2.5 %		
Degree of Saturation	0.401	0.040	
Practical Spare Capacity	124.4 %		
Effective Intersection Capacity	4516 veh/h		
Control Delay (Total)	6.86 veh-h/h	1.38 ped-h/h	9.61 pers-h/h
Control Delay (Average)	13.6 sec	23.7 sec	15.9 sec
Control Delay (Worst Lane)	44.8 sec		
Control Delay (Worst Movement)	46.4 sec	39.7 sec	46.4 sec
Geometric Delay (Average)	1.2 sec		
Stop-Line Delay (Average)	12.4 sec		
Idling Time (Average)	10.1 sec		
Intersection Level of Service (LOS)	LOS A	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	11.0 veh		
95% Back of Queue - Distance (Worst Lane)	78.8 m		
Queue Storage Ratio (Worst Lane)	0.23		
Total Effective Stops	896 veh/h	135 ped/h	1210 pers/h
Effective Stop Rate	0.49 per veh	0.64 per ped	0.56 per pers
Proportion Queued	0.53	0.64	0.59
Performance Index	107.9	3.7	111.5
Cost (Total)	678.47 $/h	73.47 $/h	751.94 $/h
Fuel Consumption (Total)	93.2 L/h		
Carbon Dioxide (Total)	220.3 kg/h		
Hydrocarbons (Total)	0.019 kg/h		
Carbon Monoxide (Total)	0.241 kg/h		
NOx (Total)	0.280 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and Hunter AM base+dev]

Steel Street and Hunter Street
AM base 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel Steet											
1	L2	125	1.0	0.359	43.2	LOS D	5.3	37.7	0.90	0.78	19.3
2	T1	31	1.0	0.382	40.9	LOS C	4.6	32.6	0.93	0.77	12.0
3	R2	73	1.0	0.382	46.4	LOS D	4.6	32.6	0.93	0.77	22.1
Approach		228	1.0	0.382	43.9	LOS D	5.3	37.7	0.92	0.77	19.5
East: Hunter Street east											
4	L2	56	1.0	0.262	12.1	LOS A	6.3	45.3	0.42	0.42	44.7
5	T1	583	3.0	0.262	6.8	LOS A	6.3	45.3	0.42	0.40	48.8
6	R2	12	1.0	0.262	12.5	LOS A	6.0	42.9	0.43	0.39	42.0
Approach		651	2.8	0.262	7.4	LOS A	6.3	45.3	0.42	0.40	48.4
North: Steel St north											
7	L2	8	1.0	0.023	38.1	LOS C	0.3	2.3	0.83	0.66	21.4
8	T1	25	1.0	0.162	39.0	LOS C	1.9	13.3	0.89	0.70	13.0
9	R2	19	1.0	0.162	42.5	LOS D	1.9	13.3	0.89	0.70	16.4
Approach		53	1.0	0.162	40.1	LOS C	1.9	13.3	0.88	0.69	15.8
West: Hunter Street west											
10	L2	33	1.0	0.401	13.0	LOS A	11.0	78.8	0.47	0.44	21.4
11	T1	756	3.0	0.401	8.0	LOS A	11.0	78.8	0.49	0.47	47.2
12	R2	92	1.0	0.401	14.4	LOS A	8.3	59.0	0.51	0.52	38.2
Approach		880	2.7	0.401	8.8	LOS A	11.0	78.8	0.49	0.48	45.4
All Vehicles		1812	2.5	0.401	13.6	LOS A	11.0	78.8	0.53	0.49	40.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	7.2	LOS A	0.1	0.1	0.38	0.38
P2	East Full Crossing	53	39.7	LOS D	0.1	0.1	0.89	0.89
P3	North Full Crossing	53	8.0	LOS A	0.1	0.1	0.40	0.40
P4	West Full Crossing	53	39.7	LOS D	0.1	0.1	0.89	0.89
All Pedestrians		211	23.7	LOS C			0.64	0.64

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 101 [Steel and King PM base+dev]

Steel St and King St
PM base flows 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	28.3 km/h	2.3 km/h	27.0 km/h
Travel Distance (Total)	1610.0 veh-km/h	8.1 ped-km/h	1940.1 pers-km/h
Travel Time (Total)	57.0 veh-h/h	3.6 ped-h/h	71.9 pers-h/h
Demand Flows (Total)	2881 veh/h	211 ped/h	3457 pers/h
Percent Heavy Vehicles (Demand)	2.8 %		
Degree of Saturation	0.852	0.034	
Practical Spare Capacity	5.6 %		
Effective Intersection Capacity	3381 veh/h		
Control Delay (Total)	29.72 veh-h/h	1.85 ped-h/h	37.51 pers-h/h
Control Delay (Average)	37.1 sec	31.6 sec	39.1 sec
Control Delay (Worst Lane)	55.1 sec		
Control Delay (Worst Movement)	55.1 sec	37.9 sec	55.1 sec
Geometric Delay (Average)	1.8 sec		
Stop-Line Delay (Average)	35.4 sec		
Idling Time (Average)	30.5 sec		
Intersection Level of Service (LOS)	LOS C	LOS D	
95% Back of Queue - Vehicles (Worst Lane)	28.1 veh		
95% Back of Queue - Distance (Worst Lane)	203.1 m		
Queue Storage Ratio (Worst Lane)	0.44		
Total Effective Stops	2484 veh/h	167 ped/h	3147 pers/h
Effective Stop Rate	0.86 per veh	0.79 per ped	0.91 per pers
Proportion Queued	0.90	0.79	0.95
Performance Index	201.8	4.5	206.3
Cost (Total)	1951.91 $/h	90.05 $/h	2041.96 $/h
Fuel Consumption (Total)	221.3 L/h		
Carbon Dioxide (Total)	523.4 kg/h		
Hydrocarbons (Total)	0.050 kg/h		
Carbon Monoxide (Total)	0.541 kg/h		
NOx (Total)	0.783 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and King PM base+dev]

Steel St and King St
PM base flows 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel St south											
1	L2	205	1.0	0.384	36.3	LOS C	8.1	56.9	0.85	0.79	26.0
2	T1	72	1.0	0.294	32.3	LOS C	5.0	35.6	0.84	0.72	22.7
3	R2	56	1.0	0.294	37.9	LOS C	5.0	35.6	0.84	0.72	29.0
Approach		333	1.0	0.384	35.7	LOS C	8.1	56.9	0.85	0.77	25.9
East: King St east											
4	L2	105	1.0	0.159	28.8	LOS C	3.5	24.5	0.71	0.74	31.2
5	T1	1091	4.0	0.852	38.5	LOS C	28.1	203.1	0.96	0.97	29.5
6	R2	38	1.0	0.121	44.0	LOS D	1.6	11.2	0.88	0.72	23.2
Approach		1234	3.7	0.852	37.8	LOS C	28.1	203.1	0.94	0.94	29.5
North: Steel St north											
7	L2	25	1.0	0.025	8.5	LOS A	0.3	1.9	0.31	0.61	45.4
8	T1	122	1.0	0.837	48.1	LOS D	13.3	94.1	0.99	0.99	17.6
9	R2	129	1.0	0.837	53.7	LOS D	13.3	94.1	0.99	0.99	19.5
Approach		277	1.0	0.837	47.1	LOS D	13.3	94.1	0.93	0.96	19.9
West: King St west											
10	L2	96	1.0	0.144	28.7	LOS C	3.1	22.1	0.71	0.73	27.0
11	T1	684	4.0	0.550	27.0	LOS B	14.7	106.3	0.83	0.72	34.8
12	R2	258	1.0	0.823	55.1	LOS D	13.5	95.4	1.00	0.92	20.3
Approach		1038	3.0	0.823	34.1	LOS C	14.7	106.3	0.86	0.77	29.7
All Vehicles		2881	2.8	0.852	37.1	LOS C	28.1	203.1	0.90	0.86	28.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	26.7	LOS C	0.1	0.1	0.73	0.73
P2	East Full Crossing	53	37.9	LOS D	0.1	0.1	0.87	0.87
P3	North Full Crossing	53	23.9	LOS C	0.1	0.1	0.69	0.69
P4	West Full Crossing	53	37.9	LOS D	0.1	0.1	0.87	0.87
All Pedestrians		211	31.6	LOS D			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

INTERSECTION SUMMARY

Site: 101 [Steel and Hunter PM base+dev]

Steel Street and Hunter Street
PM base 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	39.3 km/h	2.4 km/h	36.0 km/h
Travel Distance (Total)	988.1 veh-km/h	7.2 ped-km/h	1192.9 pers-km/h
Travel Time (Total)	25.2 veh-h/h	2.9 ped-h/h	33.1 pers-h/h
Demand Flows (Total)	2086 veh/h	211 ped/h	2504 pers/h
Percent Heavy Vehicles (Demand)	2.4 %		
Degree of Saturation	0.505	0.049	
Practical Spare Capacity	78.4 %		
Effective Intersection Capacity	4135 veh/h		
Control Delay (Total)	7.96 veh-h/h	1.41 ped-h/h	10.97 pers-h/h
Control Delay (Average)	13.7 sec	24.2 sec	15.8 sec
Control Delay (Worst Lane)	46.1 sec		
Control Delay (Worst Movement)	47.7 sec	41.5 sec	47.7 sec
Geometric Delay (Average)	1.4 sec		
Stop-Line Delay (Average)	12.3 sec		
Idling Time (Average)	10.1 sec		
Intersection Level of Service (LOS)	LOS A	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	11.9 veh		
95% Back of Queue - Distance (Worst Lane)	85.1 m		
Queue Storage Ratio (Worst Lane)	0.55		
Total Effective Stops	1079 veh/h	135 ped/h	1430 pers/h
Effective Stop Rate	0.52 per veh	0.64 per ped	0.57 per pers
Proportion Queued	0.54	0.64	0.59
Performance Index	131.5	3.7	135.2
Cost (Total)	801.28 $/h	74.23 $/h	875.51 $/h
Fuel Consumption (Total)	106.5 L/h		
Carbon Dioxide (Total)	251.8 kg/h		
Hydrocarbons (Total)	0.022 kg/h		
Carbon Monoxide (Total)	0.274 kg/h		
NOx (Total)	0.314 kg/h		

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 101 [Steel and Hunter PM base+dev]

Steel Street and Hunter Street
PM base 2016
Plus development flows
Signals - Fixed Time Isolated Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Steel Steet											
1	L2	103	1.0	0.311	44.7	LOS D	4.5	31.5	0.91	0.77	18.9
2	T1	19	1.0	0.288	42.1	LOS C	2.9	20.7	0.93	0.75	11.7
3	R2	46	1.0	0.288	47.7	LOS D	2.9	20.7	0.93	0.75	21.7
Approach		168	1.0	0.311	45.2	LOS D	4.5	31.5	0.92	0.76	19.1
East: Hunter Street east											
4	L2	86	1.0	0.407	12.2	LOS A	10.9	78.1	0.45	0.46	44.7
5	T1	959	3.0	0.407	6.9	LOS A	10.9	78.1	0.46	0.44	48.8
6	R2	14	1.0	0.407	12.6	LOS A	10.7	76.8	0.46	0.42	41.9
Approach		1059	2.8	0.407	7.4	LOS A	10.9	78.1	0.46	0.44	48.4
North: Steel St north											
7	L2	20	1.0	0.060	40.4	LOS C	0.8	5.8	0.86	0.69	20.6
8	T1	61	1.0	0.489	42.6	LOS D	5.4	38.0	0.95	0.78	12.1
9	R2	56	1.0	0.489	46.1	LOS D	5.4	38.0	0.95	0.78	15.4
Approach		137	1.0	0.489	43.7	LOS D	5.4	38.0	0.94	0.76	14.9
West: Hunter Street west											
10	L2	81	1.0	0.432	12.4	LOS A	11.9	85.1	0.46	0.46	21.5
11	T1	495	3.0	0.432	6.8	LOS A	11.9	85.1	0.46	0.46	48.5
12	R2	146	1.0	0.505	19.6	LOS B	4.4	31.3	0.63	0.76	30.0
Approach		722	2.4	0.505	10.0	LOS A	11.9	85.1	0.50	0.52	41.3
All Vehicles		2086	2.4	0.505	13.7	LOS A	11.9	85.1	0.54	0.52	39.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	6.5	LOS A	0.1	0.1	0.36	0.36
P2	East Full Crossing	53	41.5	LOS E	0.1	0.1	0.91	0.91
P3	North Full Crossing	53	7.2	LOS A	0.1	0.1	0.38	0.38
P4	West Full Crossing	53	41.5	LOS E	0.1	0.1	0.91	0.91
All Pedestrians		211	24.2	LOS C			0.64	0.64

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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