Transport for NSW

Transport Access Program - Hazelbrook Station
Traffic Transport and Access Impact Assessment (TT&IA)

November 2018

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1. Introduction

1.1 Overview

The NSW Government is committed to facilitating and encouraging the use of public transport, such as trains, by upgrading stations to make them more accessible, and improving interchanges around stations with other modes of transport such as bicycles, buses and cars.

The Transport Access Program is a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure where it is needed most.

Hazelbrook Station does not currently meet key requirements of the *Disability Standards for Accessible Public Transport* (DSAPT) or the Commonwealth *Disability Discrimination Act 1992* (DDA).

The non-compliant access points and stairs to the Hazelbrook Station concourse and platforms do not facilitate access for people with reduced mobility, parents/carers with prams or customers with luggage. There are no lift facilities and inadequate amenities and tactile surfacing to stairs, platforms and interchange facilities.

The Proposal would involve upgrade works to Hazelbrook Station, the commuter carpark and surrounding footpaths. The station is located 93 kilometres west of the Sydney Central Business District (CBD) in the suburb of Hazelbrook and is serviced by the Blue Mountains line. Platform 1 provides train services east towards the CBD and Platform 2 provides train services west towards Katoomba, Mount Victoria and Lithgow. The Proposal is located within the Blue Mountains local government area between Railway Parade and the Great Western Highway, Hazelbrook.

The key features of the proposed Hazelbrook Station Upgrade are summarised as follows:

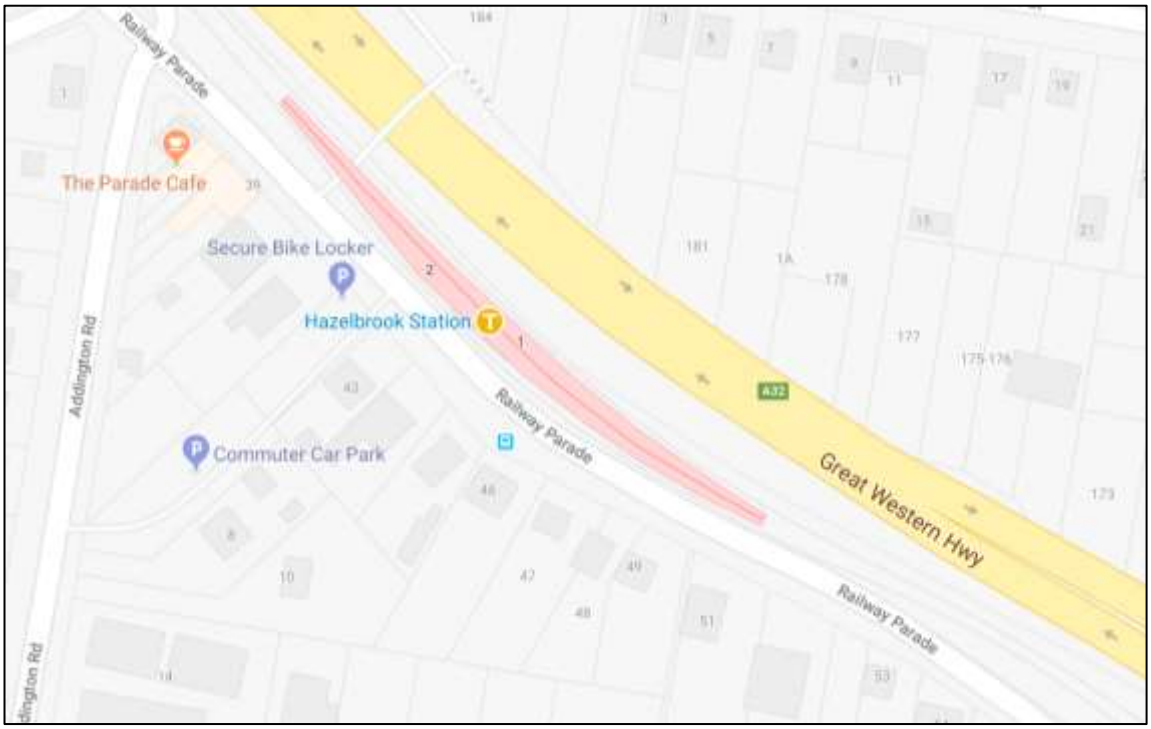
- installation of a new lift, glazed awnings and a new lift landing from the existing footbridge to the platforms
- modification to the existing commuter carpark, Railway Parade Pedestrian Crossing (including new road humps) and a footbridge to provide a DDA compliant path between the new lift, station building, toilets and the boarding zone on the platform
- regrade existing platform/concourse surfaces to provide DDA compliant path between new lift, station building, toilets and the boarding zone on the platform
- relocation of existing bike storage within the existing commuter car park
- installation of new corridor fencing 50 metres past either end of the station platforms
- removal of some existing plants and gardens within and surrounding the station to allow for works
- modification of the existing station building layout to allow for a new family accessible toilet, ambulant toilet and storage room
- ancillary works including adjustments to lighting and opal card readers, new anti-throw screens, handrails, minor drainage works, landscaping, electrical upgrades, improvements to station communications systems including CCTV cameras, hearing loops, PA system, wayfinding signage, emergency help points, and installation of tactile ground surface indicators (TGSIs).

Subject to planning approval, construction works are expected to commence in early 2019 and take approximately 18 months to complete.

Site location

Hazelbrook Station is located 93 kilometres west of the Sydney Central Business District (CBD) in the suburb of Hazelbrook and is serviced by the Blue Mountains Line. Platform one provides train services east to the Sydney CBD and platform two provides train services west to Katoomba, Mount Victoria and Lithgow. The station is located within the Blue Mountains Local Government Area, between Railway Parade and the Great Western Highway as shown in Figure 1.

Figure 1-1 Hazelbrook Station Subject Site



Source: Google Maps (2018)

1.2 Purpose of this report

This Traffic, Transport and Access Impact Assessment (TT&AI) report provides an assessment of the traffic and transport impacts associated with the construction and operation of the proposed station upgrade.

This report also:

- details the pedestrian modelling analysis undertaken for Hazelbrook Station
- provides input to the design of the proposed station accessibility upgrade as part of the Transport Access Program (TAP) project
- provides an assessment of the proposed upgrade arrangements on pedestrian flows at pinch points within and in proximity to the station
- outlines the preliminary requirements for a Construction Traffic and Pedestrian Management Plan (CTMP) to guide contractors when they develop a detailed CTMP prior to construction.

1.3 Scope and limitations

This Study has been limited by the following:

- the assessment has been undertaken based on a desktop review of the proposed station upgrade arrangement and forecast pedestrian demands. No site inspection was undertaken as part of this study. On site observations of existing pedestrian demands at the station were identified by weekday AM and PM peak pedestrian surveys
- no microsimulation modelling was undertaken for the pedestrian modelling analysis.
- No traffic modelling has been undertaken as part of this study. The scope of this study is to provide a review of pedestrian accessibility for the proposed station upgrade and provide a high level Preliminary CTMP
- the Preliminary CTMP does not include the Traffic Control Plans which are to be provided by the approved Contractor as part of the detailed CTMP prior to construction
- no intersection or mid-block assessment of construction traffic impacts was undertaken
- forecast station patronage for Hazelbrook Station was provided by Transport for NSW
- the scope of the pedestrian analysis undertaken for this Study includes an assessment of the proposed upgrade arrangements on pedestrian flows at pinch points in the pedestrian network, with reference to the Fruin Level of Service (LoS) criteria
- the limitations of this “static” Fruin LoS spreadsheet model include the inability to model evacuation scenarios. Microsimulation modelling would be required to assess this type of dynamic scenario.

1.3.1 Scope of pedestrian modelling analysis

Pedestrian modelling was undertaken to assess the forecast 2036 peak (plus 15 percent contingency) pedestrian demand design requirements during the future operation of the Hazelbrook Station.

For pedestrian modelling analysis of train stations, Transport for NSW typically require an additional 15 percent pedestrian demand contingency to be included in the assessment. This has therefore been applied to forecast 2036 peak demand for Hazelbrook Station.

This pedestrian modelling assessment has been undertaken at “pinch points” in the pedestrian network at the station, including the following locations:

1. Stairs between the bridge and platform
2. Bridge, south of the platform stairs
3. Bridge, north of the platform stairs
4. Walkway to the proposed (bridge level).

The pedestrian pinch point locations of the proposed station upgrade that have been assessed are identified in Figure 1-2.

The pedestrian modelling was undertaken using a “static” Fruin LoS spreadsheet model, under the following pedestrian demand scenarios:

- Weekday AM peak forecast 2036 passenger demand, with an additional 15 percent contingency
- Weekday PM peak forecast 2036 passenger demand, with an additional 15 percent contingency.

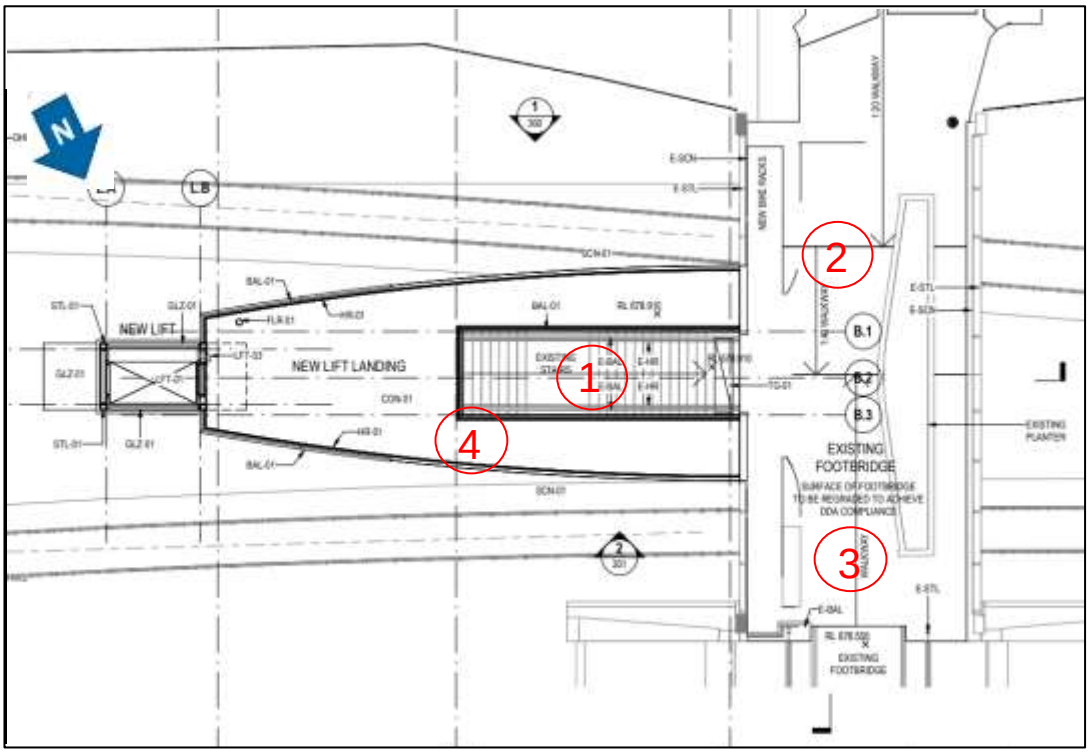


Figure 1-2 Pedestrian pinch point locations – bridge level

1.4 Assumptions

The following assumptions have been made in determining the future pedestrian demands at Hazelbrook Station, accounting for potential variability in daily fluctuations of pedestrian activity:

- growth rates based on forecast station patronage provided by Transport for NSW has been applied to the observed 2018 pedestrian counts to determine the future 2036 (+ 15 percent) contingency pedestrian demands
- for a conservative assessment, it has been assumed that:
  - 100 percent of pedestrians travelling between the platform and bridge would use the stairs
  - For the walkway to the proposed to the lift (at the bridge level), 30 percent of the pedestrians travelling between the platform and bridge would use the lifts
- the following conservative assumptions have been applied in order to calculate the peak five minute and peak one minute pedestrian demands:
  - 15 minute peak flow factor (33 percent of peak hour flow) factor = 33 percent for entries and exits
  - five minute peak flow factor (50 percent of 15 minute peak flow) = 50 percent for entries and exits
  - one minute peak flow factor (five minute peak flow) = 20 percent for entries and 85 percent for exits.

2. Existing conditions

2.1 Existing road network characteristics

Roads within NSW are categorised in the following two ways:

- by Classification (ownership)
- by the function that they perform.

Road classification

Roads are classified (as defined by the *Roads Act 1993*) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows Roads and Maritime Services (Roads and Maritime) to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, Roads and Maritime has three administrative classes of roads. These are:

- **State Roads –** Major arterial links through NSW and within major urban areas. They are the principle traffic carrying roads and fully controlled by Roads and Maritime with maintenance fully funded by Roads and Maritime. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though Roads and Maritime funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from Roads and Maritime. Regional Roads may be all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by Roads and Maritime
- **Local Roads** – The remainder of the council controlled roads. Local Roads are the responsibility of councils for maintenance funding. Roads and Maritime may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegations to local government from Roads and Maritime.

Functional hierarchy

Functional road classification involves the relative balance of the mobility and access functions. Roads and Maritime define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by Roads and Maritime, typically no limit in flow and designed to carry vehicles long distance between regional centres
- **Sub-Arterial Roads** – can be managed by either Roads and Maritime or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links)
- **Collector Roads** – provide connectivity between local roads and the-arterial road network and typically carry between 2,000 and 10,000 vehicles per day

- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

A summary of the key roads in the vicinity of the site is provided below.

Great Western Highway (A32)

The Great Western Highway (A32) is an arterial road, located north of Hazelbrook Station. It has two traffic lanes in each direction, separated predominately by a raised median strip and by a steel barrier within vicinity to the station.

Approximately 450 metres to the west of Hazelbrook Station, the Great Western Highway forms a signal controlled intersection with Oaklands Road. Signal controlled pedestrian crossings are provided at each approach at this intersection.

On the northern side of the Great Western Highway, bus stops are provided approximately 450 metres to the east of Hazelbrook Station (at the front of Hazelbrook Public School) and 250 m to the west of the station.

Railway Parade

Railway Parade functions as a collector road providing access to Hazelbrook Station in the south and has connectivity to the local roads in Hazelbrook (south of the Great Western Highway) and the Great Western Highway. Running parallel to the railway line, Railway Parade has one traffic lane in each direction.

A pedestrian (zebra) crossing is located adjacent to the station to provide a safe crossing for pedestrians.

No Parking and No Stopping zones are the primary parking restriction implemented either side of Railway Parade in the vicinity of Hazelbrook Station. However, out the front of the several local businesses located on the south of Railway Parade a 1/2P parking (8:30 AM to 6:00 PM between Monday to Friday and 8:30 AM to 12:30 PM on Saturday) is available.

Access to the off-street commuter car park located to the south of Hazelbrook Station is provided from Railway Parade.

Railway Parade has a sign posted speed limit of 50 km/h in both directions.

Oaklands Road

Oaklands Road functions as a collector road providing indirect access to Hazelbrook Station via the Great Western Highway. It runs in a north-south direction providing, connections to local roads and residential properties.

Oaklands Road has one traffic lane in each direction separated by a solid double line (BB line). Bus stops are located off each carriageway approximately 84 metres north of Oaklands Road signalised intersection with the Great Western Highway.

Falcon Street

Falcon Street is located northeast of Hazelbrook Station. It functions as a local road and provides indirect access to Hazelbrook Station primarily for pedestrians. Falcon Street has one traffic lane in each direction.

Unrestricted parallel parking is provided on either side of Falcon Street. A bus stop is located in the westbound direction of Falcon Street.

Falcon Street does not have a sign posted speed limit, so a default urban speed limit of 50 km/h applies.

2.2 Public transport

2.2.1 Trains

Hazelbrook Station is served by Blue Mountains Line service. This line provides connections between Lithgow and Sydney Central Station.

Train services in the Blue Mountains are operated by NSW TrainsLink who are a service delivery agency of Transport for NSW. The majority of the population centres in the Blue Mountains are served by the Blue Mountains Line which operates between Lithgow Station and Central Station, however some services terminate at Mount Victoria, Katoomba and Springwood.

Hazelbrook Station is included in the peak hour express services, which do not stop at the minor stations on the Blue Mountains Line.

Train services typically operate with 15 - 30 minute frequencies during peak morning and evening periods and 60 minute frequencies in off-peak periods.

The journey times between Hazelbrook Station and Central Station are approximately 98 minutes for normal services and 91 minutes for express services.

2.2.2 Buses

A bus stop servicing Hazelbrook Station are located on the south side of Railway Parade, the following bus services operate from this stop are:

- Bus route 685H – Springwood to North Hazelbrook
- Bus route 690K – Springwood to Katoomba Blue Mountains

Bus stops servicing areas within a 500 metre radius of Hazelbrook Station are located on each side of the Great Western Highway, the following bus services operate from these stops:

- Bus route 685H (northern side of Great Western Highway) – Springwood to North Hazelbrook
- Bus route 690K (northern side of Great Western Highway) – Springwood to Katoomba Blue Mountains
- Bus route 690K (southern side of Great Western Highway) –Katoomba Blue Mountains to Springwood.

2.3 Walking network

Walking access to Hazelbrook Station from the north is provided via the footbridge overpass (Campbell Bridge) over the Great Western Highway. In the south, access to the station is provided via Railway Parade.

Footpaths are provided along the southern side of Railway Parade in the vicinity of the station. A pedestrian (zebra) crossing provides a crossing opportunity from the footpath to the station entrance. A shared path is provided along the northern side of the Great Western Highway which has linkages to Falcon Street and other local streets in the area.

Signal controlled pedestrian crossings are provided at each approach at the Great Western Highway / Oakland Road intersection.

2.4 Bicycle network

Bicycle locker hire boxes and bike racks are located to the south of Hazelbrook Station. As shown at Figure 2-1, the bicycle locker hire is located near the entrance to the commuter car park. Bike racks are located at the southern access to the concourse adjacent to the pedestrian crossing.

Figure 2-1 Existing bicycle locker

Source: TfNSW

The bicycle network around the vicinity of Hazelbrook Station is shown in Figure 2-2. The figure shows that there are limited bicycle networks in the vicinity to the station. Two on road paths of high difficulty are provided within the road shoulder along the westbound and eastbound carriageways of the Great Western Highway.

Figure 2-2 Existing bicycle routes

Source: www.rms.nsw.gov.au/maps/cycleway_finder - Modified by GHD

2.5 Car parking

Off-street commuter car parks are provided on the southern side of Hazelbrook Station off Railway Parade. On street parking on Railway Parade approximately 45 metres southwest of the station has 1/2P restriction, with the following time limits.

- Monday to Friday: 8:30 AM to 6:00 PM
- Saturday: 8:30 AM to 12:30 PM.

Further west (approximately 15 metres) of the station on Railway Parade, unrestricted on street parking is available on both sides of the road. East of the station, unrestricted on street parking is available on the southern side of the road.

Additional on street parking is available on Terrace Falls Road and Addington Road.

On the northern side of Hazelbrook Station, on street parking is available on Falcon Street, Burford Street and Albert Road.

2.6 Taxi / kiss and ride facilities

2.6.1 Taxi

No formal taxi zones are provided within the vicinity of Hazelbrook Station.

2.6.2 Kiss and ride

A formal “No Parking” zone kiss and ride facility is available at Hazelbrook Station, which can accommodate one vehicle. This “No Parking” zone is also signed as a “Pick Up and Set Down area” and is located on the southern side of the station on Railway Parade northwest of the pedestrian overbridge. A “No Stopping” zone is located on the opposite side of the road.

3. Pedestrian Modelling

This section details the pedestrian modelling analysis for the proposed Hazelbrook Station upgrade.

3.1 Model design standards and requirement

The following sections outline the design requirements and standards adopted for the pedestrian modelling.

3.1.1 Design standards

The design standards utilised in the pedestrian movement analysis includes the following:

- Austroads Guide to Traffic Management Part 3 Traffic Studies – Section 3.4
- Sydney Trains 'Engineering Standard Stations and Buildings Station Design Standard Requirements' Sydney Trains (formally RailCorp) 2010.
- Transit Capacity and Quality of Service Manual Third Edition, TRB 2017.
- Roads and Maritime's Guide to Traffic Generating Developments (2002)

3.1.2 Design requirements

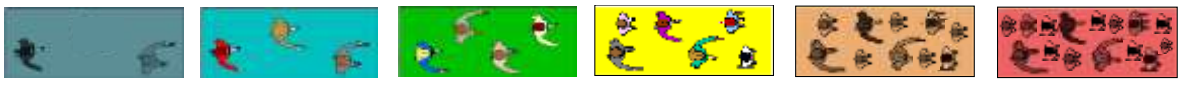
The design requirements used in this appraisal include:

- Austroads Guide to Traffic Management Part 3 Traffic Studies – Section 3.4, which states that for the purposes of pedestrian traffic assessments, 15 minute peak is generally an accepted standard and for facilities sensitive to peak arrivals and crowding a shorter period may be selected. A rail station is deemed to fit this criteria and an average minute in a peak five minute period is deemed to be a conservative appraisal for determining design requirements
- the pedestrian movement assessment has been performed by determining the average minute passenger flow rate within the peak five minute period
- Sydney Train's 'Engineering Standard Stations and Buildings Station Design Standard Requirements' specifies that a Fruin LoS C is a desirable design criteria to achieve for station quality objectives for managing spatial queuing and passenger conflict. There are different LoS criteria for stairs and walkways, as shown in Table 3-1.

Table 3-1 Fruin Levels of Service (LoS)

Level of Service	Pax/m/min for stairs	Pax/m/min for a walkway
A	< 16	< 23
B	16 – 23	23 – 33
C	23 – 33	33 – 49
D	33 – 43	49 – 66
E	43 – 56	66 - 82

Source: Fruin 1971



Level of service A: < 23 pax/m/min | Level of service B: 33 pax/m/min | Level of service C: 49 pax/m/min | Level of service D: 66 pax/m/min | Level of service E: 83 pax/m/min | Level of service F: > 83 pax/m/min

3.2 Opal data

Opal data for Hazelbrook Station was provided by Transport for NSW, which identified the number of station entries and exists during the month of May 2017. The average weekday passenger profile, based on the Opal data, is shown in Figure 3-1.

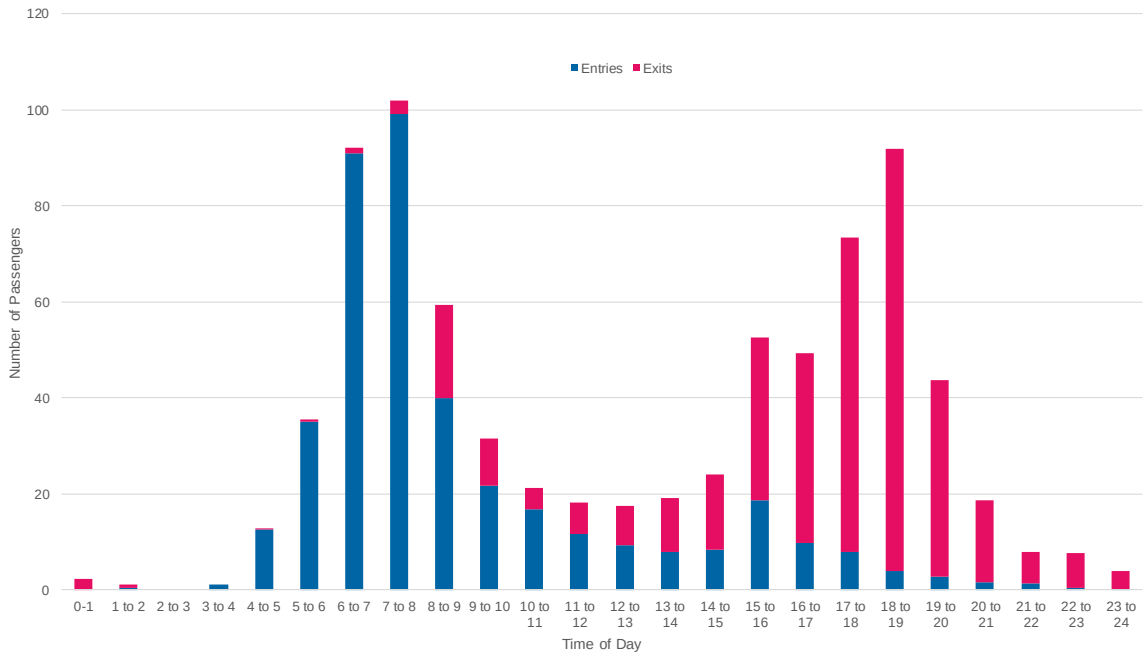


Figure 3-1 Hazelbrook Station Opal data – average weekday station entries and exits

A summary of the observed weekday peak hourly station entries and exists, based on the opal data is provided in Table 3-2.

Table 3-2 Opal Data – average weekday peak station entries and exits (2017)

Peak Period	Entries	Exits	2-way
AM Peak (7-8 AM)	99	3	102
PM Peak (6-7 PM)	4	88	92
Saturday Peak (6-7 PM)	11	25	36
Sunday Peak (10-11 AM)	20	6	26

**Source: TfNSW Opal data, May 2017*

3.3 Pedestrian counts

For the purpose of this study, GHD commissioned Matrix Traffic and Transport Data Solutions Pty. Ltd. to undertake pedestrian counts at key locations with the Hazelbrook Station precinct. The pedestrian counts were undertaken on Thursday 16 August 2018 during the following time periods:

- weekday morning peak, between 6.00 AM – 9.00 AM
- weekday evening peak, between 3.00 PM – 6.00 PM.

The pedestrian count data is provided in Appendix A.

Analysis of the pedestrian count data identified the following peak hour periods:

- weekday morning peak hour, between 7.05 AM – 8.05 AM

- weekday evening peak hour, between 3.25 PM – 4.25 PM.

The morning and evening peak five minute periods, in terms of overall pedestrian demand, were observed to be as follows:

- weekday morning peak five minute period, between 6.10 AM – 6.15 AM
- weekday evening peak five minute period, between 3.50 PM – 3.55 PM.

A summary of the surveyed peak hour pedestrian movements is shown in Figure 3-2 and Figure 3-3 for the weekday AM and PM peak hours respectively.

Analysis of the pedestrian surveys indicated that:

- in the AM peak hour, the peak five minute period pedestrian volumes accounted for 15 percent of the peak hour pedestrian movements (total recorded movements).
- i the PM peak hour, the peak five minute period pedestrian volumes accounted for 15 percent of the peak hour pedestrian movements (total recorded movements).

Figure 3-2 2018 Pedestrian counts – AM peak hour (7.05 AM– 8.05 AM)

Figure 3-3 2018 Pedestrian counts – PM peak hour (3.50 PM– 4.50 PM)

3.4 Forecast pedestrian volumes

Transport for NSW has provided existing and forecast patronage for Hazelbrook Station, which is summarised in Table 3-3. The resulting growth rate is also shown.

Table 3-3 Forecast station patronage – Hazelbrook Station

Peak Period	2017	2036	Annual Growth Rate
Average weekday AM peak (6 AM– 10 AM)	285	267	0.69%
Average weekday PM peak (3 PM - 7 PM)	325	305	0.69%

Source: Transport for NSW (2018)

The annual growth rates shown in Table 3-3 have been applied to the observed 2018 AM and PM peak hour pedestrian volumes to calculate the 2036 pedestrian movements. An additional 15 percent contingency has also been applied to the pedestrian volumes for the pedestrian analysis. The resulting 2036 (+ 15 percent) pedestrian demands, based on the existing station configuration are shown in Figure 3-4 and Figure 3-5 for the weekday AM and PM peak hours respectively.

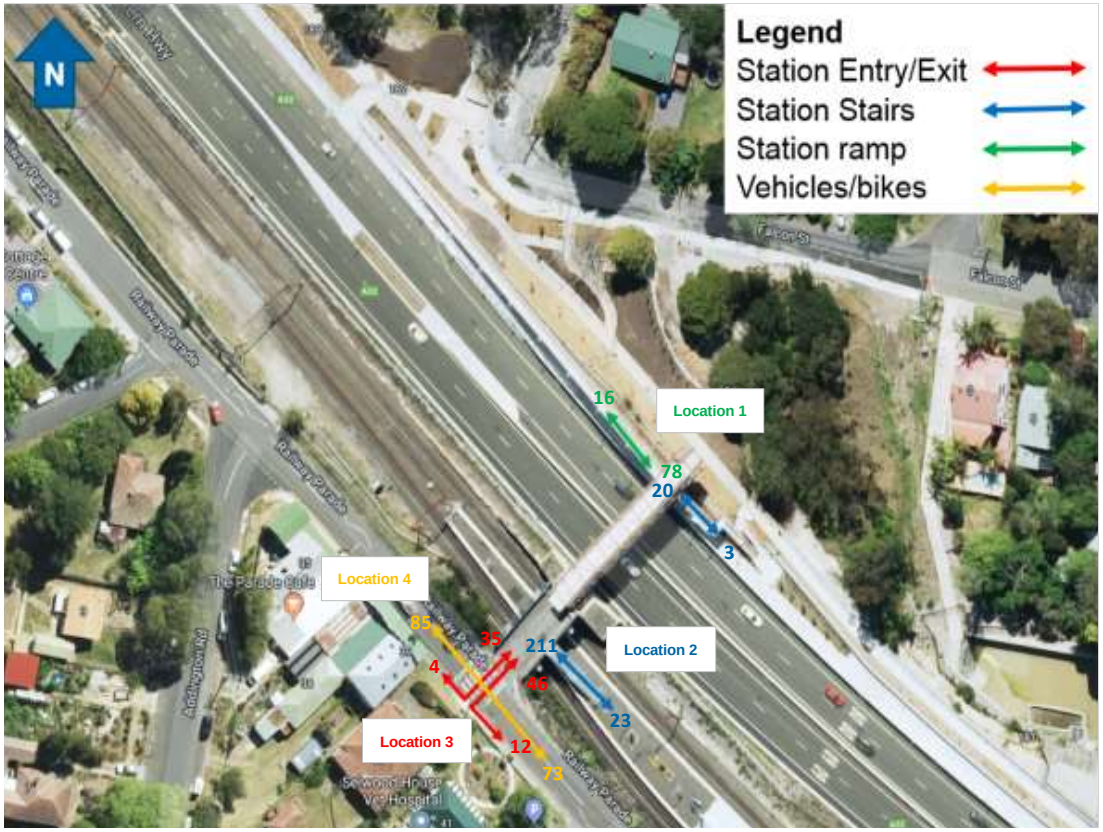


Figure 3-4 Forecast 2036 + 15% contingency pedestrian volumes – AM peak hour

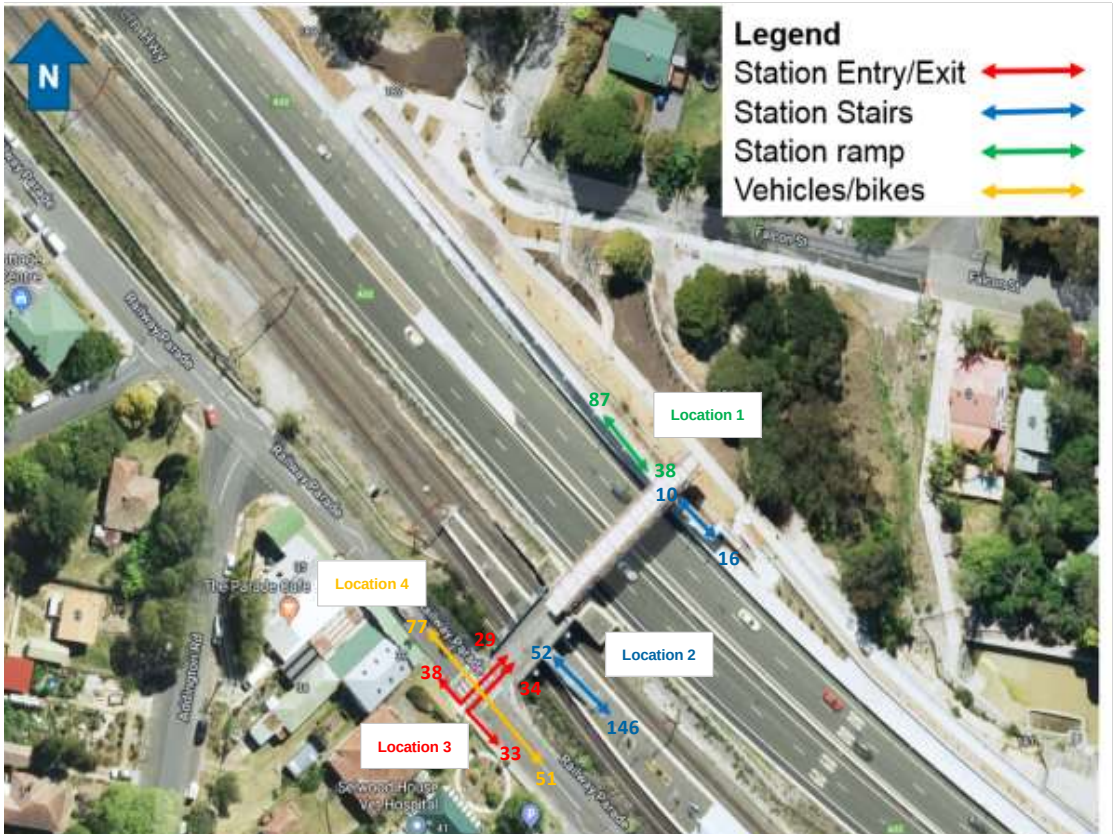


Figure 3-5 Forecast 2036 + 15% contingency pedestrian volumes – PM peak hour

3.5 Model Parameters

The pinch point widths shown in Table 3-4 have been adopted for the assessment, based on the proposed station upgrade design.

Table 3-4 Pinch point widths

Location	1	2	3	4
Pinch point locations	Southern stairs (proposed)	Northern stairs (proposed)	Concourse	Southern Entry
Width (m)	2.70	3.20	3.10	1.40
Handrail width (m)	0.15	0.00	0.00	0.00
Edge effect (m)	0.00	0.00	0.20	0.20
Shoulder overhang (m)	0.08	0.08	0.00	0.00
Width of a person waiting in area	0.00	0.30	0.30	0.30
Effective Width (m)	**2.55**	**2.98**	**3.00**	**1.30**

**Note – refer to* Figure 1-2 *for a plan showing the pinch point reference number locations.*

3.5.1 Results

The results of the pedestrian modelling for the pedestrian bridge and the stairs are summarised in Table 3-5 and Table 3-6. The full pedestrian model data is provided in Appendix B.

As shown, based on the design year of 2036 (plus a 15 percent contingency factor), all of the pinch points are expected to operate at a satisfactory LoS A during both the AM peak and PM peak periods.

Table 3-5 Pedestrian LoS Results – 2036 + 15 % contingency pedestrian demands (AM peak hour)

Location	Average minute pedestrian demand during the five Minute Peak (per metre)			Average Minute LoS During the five Minute Peak
	Entries	Exits	Combined	
1 - Stairs between the bridge and platform	0	3	3	A
2 - Bridge, south of the platform stairs	1	0	1	A
3 - Bridge, north of the platform stairs	1	0	1	A
4 - Walkway to the proposed (bridge level)	0	2	2	A

Table 3-6 Pedestrian LoS Results – 2036 + 15 % contingency pedestrian demands (AM peak hour)

Location	Average minute pedestrian demand during the five Minute Peak (per metre)			Average Minute LoS During the five Minute Peak
	Entries	Exits	Combined	
1 - Stairs between the bridge and platform	2	1	3	A
2 - Bridge, south of the platform stairs	1	1	1	A
3 - Bridge, north of the platform stairs	1	1	2	A
4 - Walkway to the proposed (bridge level)	1	0	2	A

3.6 Summary

Conservative parameters and assumptions were used in the pedestrian model, using 2036 design volumes with a 15 percent contingency factor. The pedestrian modelling analysis indicates that all of the pinch points are expected to operate at a satisfactory LoS A during the AM and PM peak periods.

4. Construction Impacts

This section of the report considers the traffic and transport impacts associated with construction activities for the Hazelbrook Station upgrade.

4.1 Construction traffic generation

The number of construction vehicles to access the site will need to be confirmed by the contractor at the detailed construction planning stage.

Traffic generated by construction activities for the project would include heavy vehicles associated with the construction plant, deliveries and removal of materials along with light vehicles from construction workers.

The duration of the construction activities for Hazelbrook Station is expected to be approximately 18 months.

Heavy vehicles

The types of heavy vehicle to be used during the construction period are expected to include medium and large rigid vehicles. Oversize vehicle may also be required for transporting lifts and pre-cast structures.

All construction storage containment will be within the proposed construction compound. However, this will be confirmed in the detailed construction planning stage.

For the purposes of this assessment, the number of heavy vehicles accessing the site has been assumed to be up to 10 heavy vehicles per day. The majority of heavy vehicles activity is expected to occur at the site outside of the AM and PM road network peak hours. As a conservative approach, however, it has been assumed that 20 percent of construction heavy vehicle traffic would access the site during the weekday AM and PM peak hours (i.e. 2 vehicles).

This increase in heavy vehicle traffic is expected to result in minimal impacts to the operation of the surrounding road network and fall within typical daily traffic fluctuations. Should the assumed construction movements vary, the potential impacts would need to be reviewed as part of the detailed construction planning stage.

Light vehicles

For the purposes of this assessment, it has been assumed that there are expected to be up to 30 construction workers at the site during peak periods, with approximately 20 workers at the site on a typical day.

It has been assumed for a worst case scenario that there would be a typical car driver rate of 100 percent (i.e. each individual worker driving a car), however it is expected that a significant proportion of workers would arrive by train or carpool. Application of this car driver rate to the assumed workforce yields a traffic generation in the order of up to 60 light vehicles per day (30 inbound and 30 outbound).

In conjunction with the proposed hours of construction (assumed to be 7:30 AM to 5:00 PM), it is expected that workers would arrive at the site before and during the observed road network AM peak hour (7:00 AM - 8:00 PM) while an assumed 50 percent of workers would depart during the PM peak hour (5:00 PM - 6:00 PM).

These peak hours were observed based on traffic data provided from the NSW Roads and Maritime Traffic Volume Viewer website for the Great Western Highway. This small increase in

light vehicle traffic is expected to result in minimal impacts to the operation of the surrounding road network and fall within typical daily traffic fluctuations.

Construction light vehicles are expected to park on-street if required, with limited offsite parking available and would be required during day work to park outside a designated exclusion zone of approximately 400 metres. This would need to be addressed in greater detail in a CTMP for the proposed works.

Light vehicle construction vehicles are expected to park on the road network in proximity to Hazelbrook Station during the construction period. It is recommended that workers are encouraged to use alternate transport options such as public transport to access the site.

A detailed CTMP should include the following:

- construction arrangements
- heavy vehicles and light construction vehicles
- pedestrian and bicycle access and safety
- public transport access
- parking and traffic impacts
- recommended mitigation measures during construction.

4.1.1 Construction vehicle access routes

Access options to the site are limited due to the restricted access roads off the Great Western Highway. It is anticipated that the major route access for the delivery of equipment and materials will be from the east along the Great Western Highway.

To reduce the potential impacts on the performance of the intersections in the vicinity of the site (and to minimise right turn manoeuvres at unsignalised intersections), it is recommended that construction vehicles access the site from the east along the Great Western Highway and utilise the left turn into Park Road before travelling along Railway Parade.

Egress is likely to be to the west, along Railway Parade to Oaklands Road where the existing signal controlled intersection allows for all turn manoeuvres onto the Great Western Highway. This recommended route is shown in Figure 4-1. Should access be required from the west, this route could be reversed to access to the site via Oakland's Road and egress via Park Road.

Temporary road closures could occur on Railway Parade at various times during the construction period. Vehicles may need to take alternate road routes during this time. A detailed CTMP would address how traffic would be redirected if required.

Access to the construction compound located in the rail corridor and the construction site is available through the rail corridor access point north-west of Hazelbrook Station off Railway Parade.

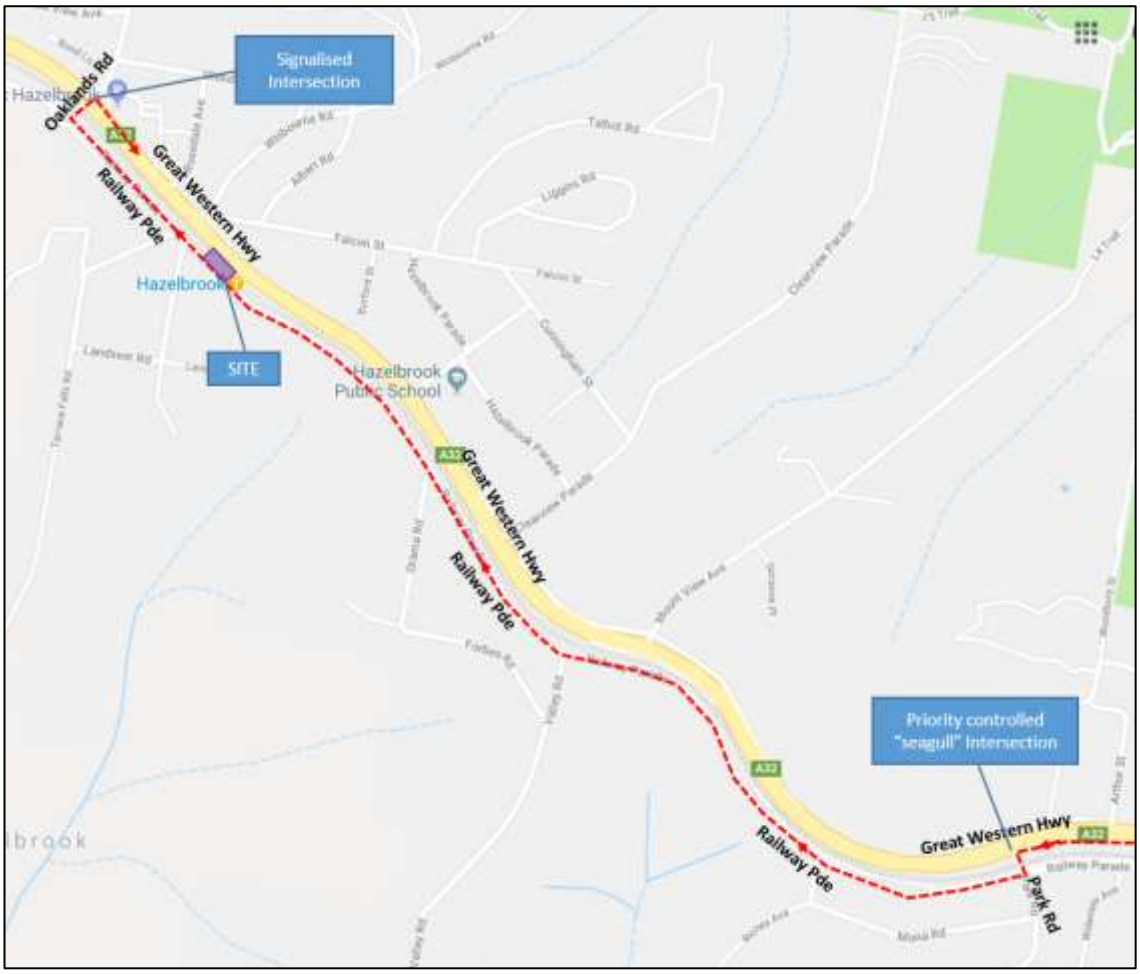


Figure 4-1 Construction vehicle access routes (to / from the east)

Source: Google maps – modified by GHD

4.2 Pedestrian and bicycle rider impacts

Access to the station is expected to be maintained at all times during the construction period except during scheduled rail track possessions. However, pedestrians and bicycle riders on Railway Parade are anticipated to be affected by the proposed construction activities.

Potential interactions between construction traffic and pedestrians and bicycle riders include:

- impact to pedestrian and bicycle rider movements due to the movement of material, traffic diversions and the location of crane/s during construction.
- pedestrian access is likely to be impacted due to the construction of the new Station accesses, pedestrian crossing and footpath at Railway Parade.
- increased vehicle movements may reduce safety.

Mitigation measures for ensuring that pedestrian and bicycle rider access and safety are not compromised would include traffic control near the pedestrian and bicycle access points on the northern and southern side of Hazelbrook Station.

4.3 Public transport impacts

Bus services are proposed to continue to operate along the Great Western Highway and Railway Parade the vicinity of the station during construction activities. As such, impacts to bus services operating in the vicinity of the site are expected to be minimal.

However, it is recommended that consideration be given to possible traffic control requirements near the bus stop at Railway Parade when large vehicles need to access the site during construction.

4.4 Car parking impacts

The construction compound would be located to the north-west of Hazelbrook Station in the cleared area directly beside the railway lines within the rail corridor. The number of off-street parking spaces that would be required by the compound and potential construction worker parking is currently unknown. This will need to be identified and addressed as part of the detailed CTMP and further analysis of the project impacts as part of the detailed design stage.

It is expected some workers would also park in on-street parking locations in the vicinity of the construction compound. This may reduce the available on-street parking, currently used by commuters and visitors in the vicinity of Hazelbrook Station. A parking exclusion zone for workers would be detailed in the TMP to reduce impact to commuters in the area immediately surrounding the train station.

On-street parking in the vicinity of the works is anticipated to be sufficient to cater for temporary parking losses during construction. However, this will need to be assessed as part of the detail CTMP and further analysis of the project impacts as part of the detailed construction design stage.

It is recommended that workers be encouraged to use alternate transport options such as public transport to access the site to reduce impacts on the parking demand. Construction workers would not park in the commuter car park.

4.5 Taxi / kiss and ride impacts

A Kiss and ride facility is located on the south-western side of Railway Parade to the north of the pedestrian crossing. Details of the construction compound and staging of works has not been identified at this stage of the project, however, where possible the construction compound and staging should avoid impacts on the kiss and ride facility.

Should alteration to the kiss and ride facility be required as part of the constructions works, this will need to be managed through the development of a detailed CTMP and traffic control measures.

There is currently no taxi parking at Hazelbrook Station. As such, the impacts to taxis will be negligible.

4.6 Construction Traffic and Pedestrian Management Plan

The following sections provide a guide for the requirements for developing a CTMP for the proposed construction works for the Hazelbrook Station upgrade.

It should be noted that details of the CTMP are not available at this stage of the project, however, the following sections provide guidance for consideration when developing a detailed CTMP for the project.

4.6.1 Construction traffic and pedestrian management objectives

A CTMP should be prepared prior to the commencement of works, with site induction for construction personnel being undertaken to outline the requirements of the CTMP. The aim of the CTMP is to maintain the safety of workers and road users within the vicinity site. The primary objectives of the CTMP are:

- to minimise the impact of the construction vehicle traffic on the overall operation of the road network
- to provide continuous, safe and efficient movement of traffic for both the general public and construction workers
- to install appropriate advance warning signs to inform users of the changed traffic condition
- to provide a description of the construction vehicles and the volume of these construction vehicles accessing/egressing the construction site
- to identify measures to mitigate the impacts of these vehicles (if required)
- to provide information regarding the changed access arrangement and also a description of the proposed external routes for vehicles including the construction vehicles accessing the site
- to establish a safe pedestrian and bicycle riding environment in the vicinity of the site.

4.6.2 Construction traffic routes

Where possible, heavy vehicle traffic movements should be minimised during the road network peak periods. This includes during the weekday AM and PM peak periods and during the middle of the day on weekends when higher traffic volumes occur.

Construction vehicles, particularly heavy vehicles, should avoid driving on local roads, as far as practicable. In particular, heavy vehicle activity should be avoided during school pick-up and drop-off periods (8:00 AM to 9:30 AM and 2:30 PM to 4:00 PM school days) in the vicinity of schools, when pedestrian and vehicle activity is generally greater.

Proposed construction vehicle access routes are shown in Figure 3-1.

4.6.3 Oversize vehicles

Railway Parade is a narrow collector road and due to the road alignment and width, the size of the heavy vehicle is likely to be restricted to Medium Rigid Vehicle (8.8 m in length).

A review of the suitability of the use of Railway Parade for larger vehicles should be undertaken independently by the contractor and may require specific traffic control (i.e. vehicle escort) if such larger vehicles are required.

At this stage of the project, details of the whether oversized vehicles are required to transport equipment or plant to the site are not available. However, should oversize vehicles be required (i.e. lift and pre-cast structures), the contractor will be required to apply for permits from Roads and Maritime, with the submission of suitable traffic management and transportation routes to be agreed, subject to the required size of the vehicle.

Oversize vehicle routes are to be carried out where possible on designated heavy vehicle routes or routes approved by Roads and Maritime. Additionally, oversized traffic movements should be carried out, where possible, outside peak road network periods thereby minimising the impacts on the road network.

4.6.4 Traffic management

Public access to the site is expected to be maintained on the surrounding road network. Vehicles will be permitted to travel past the work site with traffic signage in accordance with a Traffic Control Plan (TCP) to be developed in accordance with Roads and Maritime Services (Roads and Maritime) *Traffic Control at Works Sites* manual (2018) and AS1742.3 – T*raffic*

Control for Works on Roads. This will advise motorists of changes in road network or vehicle movements to/from the site including any “truck turning” activity.

It is not anticipated to implement full road closures within the public road network as part of the construction activity.

Roadworks speed zones are not anticipated to be used as part of the construction of the project. Work areas are to provide safe clearances from through traffic lanes in line with Roads and Maritime Services *Traffic Control at Works Sites* manual.

Traffic Control Plans will need to be developed as part of the detailed CTMP prior to commencing of construction activity on the site.

4.6.5 Parking for construction workers

There is a limited parking opportunity within the immediate vicinity of the site and therefore alternate transport options should be considered to support the workers required to complete the works. Construction contractors are encourage to find parking away from the commuter parking area to avoid utilising these spaces.

Encouraging carpooling between workers will decrease traffic activity and parking demand. The site is located directly at Hazelbrook Station. Promoting the use of such public transport options will greatly assist in reducing traffic movements associated with staff arrival and departure and parking demands to be accommodated within the worksite.

It is anticipated that access for site personnel may occur during the AM and PM peak hour periods of the surrounding road network.

4.6.6 Pedestrian management

Construction site access is to be restricted to authorised personnel only and employees on site. Pedestrian access to and around the site/station should be maintained at all times. This will be particularly evident during the AM and PM peak periods as a result of pedestrians demands associated with the local shopping precinct and workers travelling to and from key employment areas such as Sydney CBD and Parramatta CBD.

A designated path of travel for pedestrians should be maintained near all worksites that are free from trip hazards.

Within the site, pedestrian travel paths should be maintained to key areas such as site building entrances and be free from trip hazards.

A TCP will be required to be developed to be in accordance with Roads and Maritime *Traffic Control at Works Sites* manual and AS1742.3 – *Traffic Control for Works on Roads* is to consider the pedestrian activity adjacent to the construction site.

4.6.7 Bicycle rider management

There are no designated bicycle routes within immediate proximity of the site, however, bicycle riders may utilise the adjoining road network. Bicycle lockers are located on the southern side of Hazelbrook Station within the car park. Ideally, access to these lockers should be maintained throughout the works.

Appropriate traffic management is to be in place to direct bicycle riders past the work site(s), which may include, but not limited to creating a mixed vehicle/bicycle environment on local low volume and speed roads and providing advanced warning of changed conditions for bicycle riders. Worksite traffic control plans in accordance with Roads and Maritime’s *Traffic Control at Works Sites* manual and AS1742.3 – *Traffic Control for Works on Roads* must include how to manage bicycle riding routes.

4.6.8 Road hazards

The proposed works within the road network and rail corridor brings hazards to workers, the public and impacts the surrounding facilities. The CTMP should identify specific road hazards associated with the works area including but not limited to:

- environmental:
  - fog
  - wet weather
  - frost
  - snow.
- transport infrastructure:
  - bus infrastructure
  - railway line and train services
  - bicycle facilities
  - general traffic
  - pedestrian activity.
- public facilities:
  - Hazelbrook local shopping precinct (south) – accessed via Railway Parade
  - Hazelbrook local shopping precinct (north) – accessed via the Great Western Highway.

4.6.9 Method of communicating traffic changes

Advance notification of upcoming works is paramount to safety and efficient delivery of the project. The following outlines communication measure to be considered in the detailed CTMP.

On road communication

TCPs are to be developed in accordance with Australian Standards (AS 1742.3 – Traffic Control Devices for Works on Roads) and Roads and Maritime Traffic Control at Worksites manual to identify appropriate signage (and location) to advise motorists of upcoming changes in the road network.

Sign size should be a minimum size “A” on roads with traffic speeds up to 90 km/h (sign location up to 8 m offset from the traffic lane) or 110 km/h (sign location up to 4.5 m offset from the traffic lane). In other locations where the above is exceeded, signs are to be a minimum size “B”.

The use of Variable Message Signs (VMS) provides benefit to the local community and visitors to convey messages of upcoming impacts to the road network as the result of construction activity. VMS (if required) should be installed in locations and used in accordance with relevant guidelines with the necessary approvals from governing authorities.

Advance notification of works

Prior to commencement of works on site, the contractor is to inform neighbouring properties of proposed works, impacts and site contact information as per the Community Liaison Plan (to be developed prior construction). Notification can be provided by various mean including, but not limited to:

- letterbox distribution
- local paper
- Transport for NSW and the Blue Mountains City Council website.

4.6.10 Emergency services

Blue Mountains Hospital and Springwood Hospital are located approximately 15 km to the west and east of the site respectively. Although the hospitals are not directly impacted by the proposed works, ambulance services and other emergency services (i.e. fire and police) should be considered in developing the CTMP. The road network within the site area should facilitate the access of emergency service vehicles by providing minimum lanes width of 3.5 m (where possible). Emergency services are required to be notified by the contractor of ongoing works and changes to the road network.

5. Operational Impacts

This section provides an assessment of the potential traffic and transport impacts following the proposed Hazelbrook Station upgrade.

5.1 Traffic impacts

As no additional car parking is proposed, the proposed Hazelbrook Station upgrade is expected to result in negligible traffic impacts in the vicinity of the station.

5.2 Parking

The existing two disabled parking spaces within the commuter car park at Railway Parade are proposed to be modified to provide DDA compliant spaces. In addition, the footpath along the south-western side of Railway Parade is proposed to be upgraded to improve accessibility between the DDA compliant parking spaces within the commuter car park and the station entrance, via the pedestrian crossing which is also proposed to be upgraded.

No other changes to off-street and on-street car parking is proposed.

The proposed upgrade would improve the existing DDA compliant parking spaces within the commuter car park at Railway Parade.

5.3 Pedestrian and bicycle rider impacts

Pedestrian access to Hazelbrook Station would be improved by providing an upgrade to the footpath and pedestrian crossing (zebra crossing) at Railway Parade, allowing for improved access to the existing commuter car park.

A new lift to the station platform and an upgrade to the existing stairs between the platform and overbridge would also be provided to improve accessibility to the station.

No changes to the bicycle network or bicycle parking are proposed.

The proposed improvements to will provide better accessibility to the station for pedestrians.

5.4 Bus impacts

No changes are proposed to the existing bus stop facilities or bus services at Hazelbrook Station. However, the proposed pedestrian access improvements will provide better accessibility to the station, improve interchange between different modes of transport and encourage public transport use.

5.5 Taxi / kiss and ride impact

The “No Parking” zone kiss and ride facility at Railway Parade would be maintained and no taxi parking is proposed.

However, the proposed pedestrian access improvements to will provide better accessibility to the station, including between the kiss and ride parking and station entry at Railway Parade.

6. Conclusions and Recommendations

This Traffic, Transport and Access Impact Assessment (TT&AI) report provides an assessment of the traffic and transport impacts associated with the construction and operation of the proposed station upgrade.

This report also:

- details the pedestrian modelling analysis undertaken for Hazelbrook Station
- provides input to the design of the proposed station accessibility upgrade as part of the Transport Access Program (TAP) project
- provides an assessment of the proposed upgrade arrangements on pedestrian flows at pinch points within and in proximity to the station
- outlines the preliminary requirements for a Construction Traffic and Pedestrian Management Plan (CTMP) to guide contractors when they develop a detailed CTMP prior to construction.

6.1 Pedestrian modelling analysis

Pedestrian modelling was undertaken to assess the forecast 2036 peak (plus 15 percent contingency) pedestrian demand design requirements during the future operation of the Hazelbrook Station transport access program upgrade project. This pedestrian modelling assesses has been undertaken at “pinch points” in the pedestrian network at the station, including at the following locations:

1. Stairs between the bridge and platform
2. Bridge, south of the platform stairs
3. Bridge, north of the platform stairs
4. Walkway to the proposed (bridge level).

The pedestrian modelling was undertaken using a “static” Fruin Level of Service (LoS) spreadsheet model.

Conservative parameters and assumptions were used in the pedestrian model, using 2036 design volumes with a 15 percent contingency factor. The pedestrian modelling analysis indicates that all of the pinch points are expected to operate at a satisfactory LoS A during the AM and PM peak periods.

6.2 Construction impacts

A review of the expected construction impacts identified the following:

- Access to the station would be maintained at all times during rail operation. However, pedestrians and bicycle riders on the Railway Parade side of the station are anticipated to be affected by the proposed construction activities. Potential interactions between construction traffic and pedestrians and bicycle riders include:
  - impact to pedestrian and bicycle rider movements due to the movement of material, traffic diversions and the location of crane/s during construction
  - pedestrian access is likely to be impacted due to the construction of the new Station accesses, pedestrian crossing and footpath at Railway Parade
  - increased vehicle movements may reduce safety.

- impacts to bus services operating in the vicinity of the site are expected to be minimal. However, it is recommended that consideration be given to possible traffic control requirements near the bus stop at Railway Parade when large vehicles need to access the site during construction
- there may be some minor impacts to off-street parking at the commuter car park located at Railway Parade associated with the construction compound
- construction workers are expected to park at on-street car parking locations, which could result in an increase in demand for on-street car parking. Workers should be encourage to utilise alternate transport options such public transport to reduce parking demands
- construction of the Hazelbrook Station upgrade may impact the kiss and ride facility at railway Parade. Although this should be avoided, this may need to be temporarily relocated during construction, should construction compound or staging impact the facility
- there is currently no taxi parking at Hazelbrook Station. As such, there is no anticipated the impacts to taxis.

6.3 Operational impacts

The operational impacts include the following:

- pedestrian access to Hazelbrook Station would be improved by providing an upgrade to the footpath and pedestrian crossing (zebra crossing) at Railway Parade, allowing for improved access to the existing commuter car park
- the proposed lift to the station platform and upgrade to the existing stairs between the platform and overbridge would improve accessibility to the station
- no changes to the bicycle network or bicycle parking are proposed
- The upgrade would improve car parking at the station, by modifying the two disabled parking spaces within the commuter car park to provide DDA compliant spaces. This would not result in any loss of car parking spaces
- the pedestrian crossing at Railway Parade and footpath along the south-western side of Railway Parade is proposed to be upgraded to improve accessibility between the commuter car park and the station entrance
- the proposed upgrade is expected to result in negligible traffic impacts at roads in the vicinity of the station
- impacts on bus, kiss and ride and taxi operations would be minimal. However, the proposed pedestrian access improvements will provide better accessibility to the station, improve interchange between different modes of transport and encourage public transport use.

6.4 Construction traffic and pedestrian management

A detailed CTMP is required to be prepared prior to the commencement of works with site induction for construction personnel being undertaken to outline the requirements of the CTMP. The aim of the CTMP is to maintain the safety of all workers and road users within the vicinity site and outline mitigation measures of construction traffic impacts. The plan is to include such items as:

- vehicle approach routes
- Traffic management and TCP
- workers transportation and on-site parking provisions

- pedestrian and bicycle rider management
- oversize vehicle permit requirements
- road hazards (including environmental, transportation infrastructure, emergency services and public facilities)
- methods of communicating traffic changes to the local community and visitors to the area.

The CTMP will be developed in consultation with Blue Mountains City Council, Transport for NSW and Roads and Maritime Services.

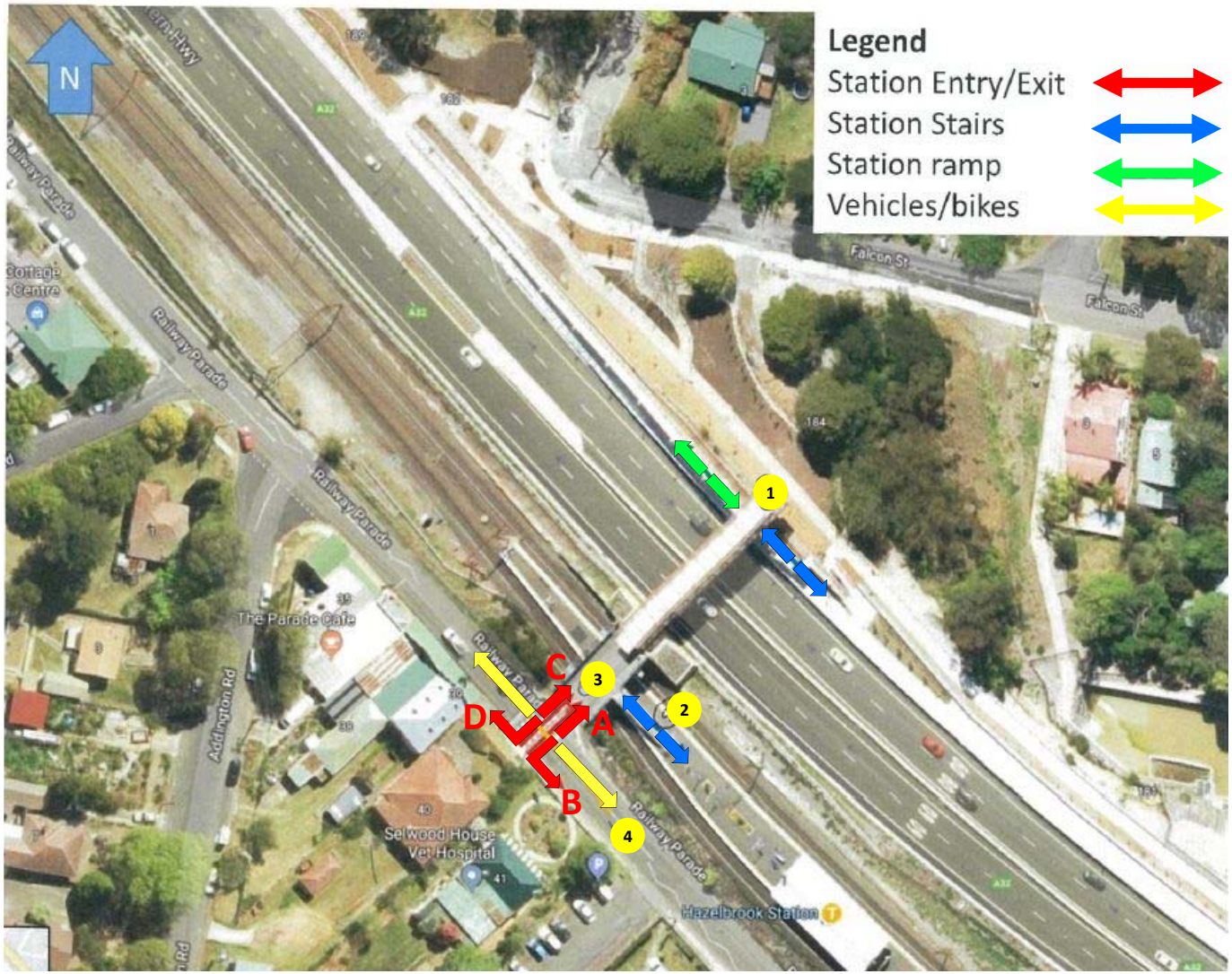
6.5 Conclusion

Based on the assumptions and investigations undertaken by GHD and the conclusions drawn in this report, it is considered that the proposed works provide satisfactory amenity and level of service for pedestrians once operational and minimises adverse impact on the road system and pedestrian access during construction, subject to the implementation of a detailed CTMP prior to construction by the contractor.

Appendices

Appendix A – Pedestrian Surveys

Client	GHD
Date	Thu, 16th Aug 2018
Survey Time	6:00-9:00 & 15:00-18:00 (6hrs)
Description	Pedestrian Count



[Location]

1. Hazelbrook Station Stairs & Ramp
2. Hazelbrook Station Stairs
3. Hazelbrook Station Entry / Exit
4. Hazelbrook Station Vehicels & Bikes

[Survey date]

Thu, 16th Aug 2018

Client	GHD
Location	1. Hazelbrook Station Stairs & Ramp
Date	Thu, 16th Aug 2018
Survey Time	6:00-9:00 & 15:00-18:00 (6hrs)
Description	Pedestrian Count

AM	Ramp IN	Ramp OUT	Stair IN	Stair OUT
6:00 to 6:05	1	4	0	0
6:05 to 6:10	3	0	0	0
6:10 to 6:15	9	1	2	0
6:15 to 6:20	2	1	0	0
6:20 to 6:25	1	0	1	0
6:25 to 6:30	2	1	0	0
6:30 to 6:35	2	0	0	0
6:35 to 6:40	3	0	1	0
6:40 to 6:45	5	0	1	0
6:45 to 6:50	3	2	0	0
6:50 to 6:55	5	2	1	1
6:55 to 7:00	4	0	0	0
7:00 to 7:05	2	0	0	1
7:05 to 7:10	7	2	1	1
7:10 to 7:15	6	0	4	0
7:15 to 7:20	3	2	2	0
7:20 to 7:25	12	2	2	1
7:25 to 7:30	3	1	0	0
7:30 to 7:35	5	0	0	0
7:35 to 7:40	4	0	2	0
7:40 to 7:45	4	1	0	0
7:45 to 7:50	2	0	1	0
7:50 to 7:55	4	0	1	0
7:55 to 8:00	8	3	1	0
8:00 to 8:05	2	1	1	0
8:05 to 8:10	1	2	0	0
8:10 to 8:15	1	0	0	0
8:15 to 8:20	1	0	0	0
8:20 to 8:25	1	2	0	0
8:25 to 8:30	1	0	1	0
8:30 to 8:35	6	6	1	1
8:35 to 8:40	0	22	1	0
8:40 to 8:45	0	0	0	0
8:45 to 8:50	1	0	0	1
8:50 to 8:55	2	0	0	0
8:55 to 9:00	2	14	0	0

PM	Ramp IN	Ramp OUT	Stair IN	Stair OUT
15:00 to 15:05	0	9	0	2
15:05 to 15:10	1	4	1	1
15:10 to 15:15	4	8	2	1
15:15 to 15:20	1	0	1	0
15:20 to 15:25	0	1	0	0
15:25 to 15:30	0	2	2	0
15:30 to 15:35	2	0	0	2
15:35 to 15:40	4	2	1	0
15:40 to 15:45	3	12	0	2
15:45 to 15:50	4	0	0	0
15:50 to 15:55	4	0	2	0
15:55 to 16:00	4	18	0	4
16:00 to 16:05	1	1	3	0
16:05 to 16:10	2	11	0	1
16:10 to 16:15	0	2	0	0
16:15 to 16:20	3	7	0	0
16:20 to 16:25	2	12	0	3
16:25 to 16:30	0	0	3	0
16:30 to 16:35	5	0	0	1
16:35 to 16:40	5	0	0	1
16:40 to 16:45	2	0	0	0
16:45 to 16:50	1	0	0	0
16:50 to 16:55	2	0	0	0
16:55 to 17:00	3	3	0	0
17:00 to 17:05	1	0	0	0
17:05 to 17:10	2	0	0	0
17:10 to 17:15	1	0	0	1
17:15 to 17:20	0	1	1	0
17:20 to 17:25	1	2	0	0
17:25 to 17:30	2	1	0	0
17:30 to 17:35	3	0	0	0
17:35 to 17:40	0	2	0	0
17:40 to 17:45	0	10	0	1
17:45 to 17:50	1	0	0	0
17:50 to 17:55	0	7	0	2
17:55 to 18:00	2	0	0	0

Client	GHD
Location	2. Hazelbrook Station Stairs
Date	Thu, 16th Aug 2018
Survey Time	6:00-9:00 & 15:00-18:00 (6hrs)
Description	Pedestrian Count

AM	IN	OUT
6:00 to 6:05	6	5
6:05 to 6:10	6	0
6:10 to 6:15	32	1
6:15 to 6:20	3	2
6:20 to 6:25	3	0
6:25 to 6:30	3	2
6:30 to 6:35	3	0
6:35 to 6:40	15	0
6:40 to 6:45	19	1
6:45 to 6:50	8	2
6:50 to 6:55	13	0
6:55 to 7:00	5	0
7:00 to 7:05	3	1
7:05 to 7:10	6	0
7:10 to 7:15	30	1
7:15 to 7:20	16	3
7:20 to 7:25	25	0
7:25 to 7:30	4	0
7:30 to 7:35	10	0
7:35 to 7:40	9	1
7:40 to 7:45	25	1
7:45 to 7:50	7	0
7:50 to 7:55	9	1
7:55 to 8:00	15	5
8:00 to 8:05	6	6
8:05 to 8:10	2	0
8:10 to 8:15	1	0
8:15 to 8:20	1	1
8:20 to 8:25	2	0
8:25 to 8:30	2	0
8:30 to 8:35	11	6
8:35 to 8:40	8	23
8:40 to 8:45	0	0
8:45 to 8:50	0	0
8:50 to 8:55	2	0
8:55 to 9:00	3	16

PM	IN	OUT
15:00 to 15:05	0	12
15:05 to 15:10	8	9
15:10 to 15:15	3	8
15:15 to 15:20	2	1
15:20 to 15:25	18	0
15:25 to 15:30	1	0
15:30 to 15:35	7	1
15:35 to 15:40	2	0
15:40 to 15:45	1	25
15:45 to 15:50	8	0
15:50 to 15:55	5	37
15:55 to 16:00	3	0
16:00 to 16:05	2	3
16:05 to 16:10	2	3
16:10 to 16:15	4	28
16:15 to 16:20	1	0
16:20 to 16:25	4	15
16:25 to 16:30	4	1
16:30 to 16:35	5	1
16:35 to 16:40	7	0
16:40 to 16:45	3	0
16:45 to 16:50	6	0
16:50 to 16:55	2	5
16:55 to 17:00	4	4
17:00 to 17:05	0	0
17:05 to 17:10	1	0
17:10 to 17:15	2	0
17:15 to 17:20	1	1
17:20 to 17:25	0	0
17:25 to 17:30	1	0
17:30 to 17:35	3	1
17:35 to 17:40	4	3
17:40 to 17:45	3	26
17:45 to 17:50	2	0
17:50 to 17:55	0	10
17:55 to 18:00	2	0

Client	GHD
Location	3. Hazelbrook Station Entry / Exit
Date	Thu, 16th Aug 2018
Survey Time	6:00-9:00 & 15:00-18:00 (6hrs)
Description	Pedestrian Count

AM	A	B	C	D
6:00 to 6:05	4	1	1	0
6:05 to 6:10	3	0	0	0
6:10 to 6:15	10	0	11	0
6:15 to 6:20	1	1	0	0
6:20 to 6:25	1	0	0	0
6:25 to 6:30	0	0	1	1
6:30 to 6:35	1	0	0	0
6:35 to 6:40	11	0	0	0
6:40 to 6:45	9	1	4	0
6:45 to 6:50	4	0	1	0
6:50 to 6:55	2	0	5	0
6:55 to 7:00	1	0	0	0
7:00 to 7:05	1	0	0	0
7:05 to 7:10	7	1	2	1
7:10 to 7:15	5	1	8	0
7:15 to 7:20	4	0	2	0
7:20 to 7:25	4	0	3	0
7:25 to 7:30	5	0	2	0
7:30 to 7:35	0	0	0	0
7:35 to 7:40	2	0	1	0
7:40 to 7:45	0	0	0	0
7:45 to 7:50	3	0	1	0
7:50 to 7:55	2	1	2	0
7:55 to 8:00	2	4	4	0
8:00 to 8:05	1	2	2	2
8:05 to 8:10	1	0	0	0
8:10 to 8:15	0	0	0	0
8:15 to 8:20	0	1	0	0
8:20 to 8:25	1	0	2	0
8:25 to 8:30	0	0	0	0
8:30 to 8:35	2	0	2	0
8:35 to 8:40	4	1	3	0
8:40 to 8:45	0	0	0	1
8:45 to 8:50	0	0	0	1
8:50 to 8:55	0	0	0	0
8:55 to 9:00	0	2	1	0

PM	A	B	C	D
15:00 to 15:05	6	0	0	1
15:05 to 15:10	6	0	2	0
15:10 to 15:15	3	3	0	4
15:15 to 15:20	0	0	1	0
15:20 to 15:25	0	0	0	0
15:25 to 15:30	0	0	18	2
15:30 to 15:35	5	0	0	1
15:35 to 15:40	0	0	0	0
15:40 to 15:45	2	4	2	6
15:45 to 15:50	1	1	0	2
15:50 to 15:55	0	6	0	11
15:55 to 16:00	1	1	0	0
16:00 to 16:05	0	3	0	0
16:05 to 16:10	12	0	0	0
16:10 to 16:15	5	0	0	1
16:15 to 16:20	0	0	2	0
16:20 to 16:25	0	10	0	6
16:25 to 16:30	0	0	1	1
16:30 to 16:35	0	0	0	0
16:35 to 16:40	1	0	2	1
16:40 to 16:45	0	0	0	0
16:45 to 16:50	2	0	3	1
16:50 to 16:55	0	4	0	1
16:55 to 17:00	1	6	0	5
17:00 to 17:05	0	0	0	0
17:05 to 17:10	0	0	0	0
17:10 to 17:15	0	0	1	1
17:15 to 17:20	0	0	0	0
17:20 to 17:25	1	0	3	0
17:25 to 17:30	0	0	1	0
17:30 to 17:35	1	1	0	0
17:35 to 17:40	0	9	1	4
17:40 to 17:45	0	0	0	0
17:45 to 17:50	1	8	0	5
17:50 to 17:55	0	1	0	0
17:55 to 18:00	0	0	0	0

Client	GHD
Location	4. Hazelbrook Station Vehicels & Bikes
Date	Thu, 16th Aug 2018
Survey Time	6:00-9:00 & 15:00-18:00 (6hrs)
Description	Pedestrian Count

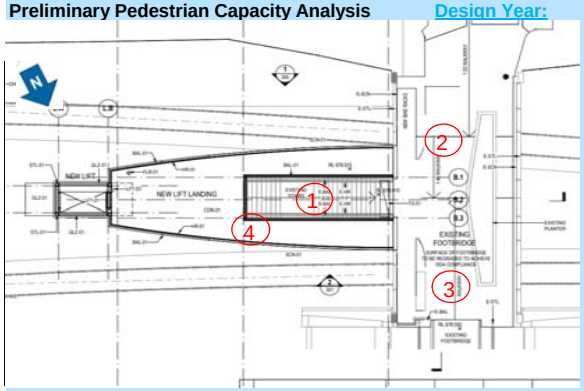
AM	North					South				
	Car	Truck	Bus	Motor Bikes	Cycles	Car	Truck	Bus	Motor Bikes	Cycles
6:00 to 6:05	7	0	0	0	0	3	0	0	0	0
6:05 to 6:10	5	0	0	0	0	2	0	0	0	0
6:10 to 6:15	0	0	0	0	0	3	0	0	0	0
6:15 to 6:20	8	0	0	0	1	2	0	0	0	1
6:20 to 6:25	2	0	0	0	0	1	0	0	0	0
6:25 to 6:30	0	0	0	0	0	1	0	0	0	0
6:30 to 6:35	4	0	0	0	0	1	0	0	0	0
6:35 to 6:40	7	0	0	0	0	3	0	0	0	0
6:40 to 6:45	9	0	0	0	0	0	0	0	0	0
6:45 to 6:50	6	0	0	0	0	1	0	0	0	0
6:50 to 6:55	13	0	0	0	0	1	0	0	0	0
6:55 to 7:00	4	0	0	0	1	2	0	0	0	0
7:00 to 7:05	2	0	0	0	1	0	0	0	0	0
7:05 to 7:10	3	0	0	0	0	2	0	0	0	0
7:10 to 7:15	7	0	0	0	0	8	0	0	0	0
7:15 to 7:20	6	0	1	0	0	5	0	0	0	0
7:20 to 7:25	5	0	0	0	0	3	0	0	0	1
7:25 to 7:30	3	0	0	0	0	2	0	0	0	0
7:30 to 7:35	5	0	0	0	0	6	0	0	0	0
7:35 to 7:40	4	0	0	0	0	3	0	0	0	0
7:40 to 7:45	7	0	0	0	0	6	0	1	0	0
7:45 to 7:50	5	0	0	0	0	5	0	0	0	0
7:50 to 7:55	4	0	0	0	0	3	0	0	0	0
7:55 to 8:00	5	0	1	0	1	4	0	0	0	0
8:00 to 8:05	8	0	0	0	0	7	0	0	0	0
8:05 to 8:10	9	0	1	0	0	7	0	0	0	0
8:10 to 8:15	8	0	1	0	0	6	0	0	0	0
8:15 to 8:20	5	0	2	0	0	3	0	0	0	0
8:20 to 8:25	6	0	1	0	0	4	0	0	0	0
8:25 to 8:30	7	0	0	0	0	4	0	0	0	0
8:30 to 8:35	3	0	0	0	0	4	0	0	0	0
8:35 to 8:40	2	0	0	0	0	2	0	0	0	0
8:40 to 8:45	4	0	0	0	0	3	0	0	0	0
8:45 to 8:50	3	0	1	0	0	2	0	0	0	1
8:50 to 8:55	3	0	0	0	1	3	0	0	0	0
8:55 to 9:00	5	0	0	0	0	3	0	0	0	0

PM	North					South				
	Car	Truck	Bus	Motor Bikes	Cycles	Car	Truck	Bus	Motor Bikes	Cycles
15:00 to 15:05	9	0	2	0	0	7	0	0	0	0
15:05 to 15:10	4	0	0	0	0	1	0	0	0	0
15:10 to 15:15	2	0	0	0	0	0	0	0	0	0
15:15 to 15:20	3	0	0	0	1	1	0	0	0	0
15:20 to 15:25	6	0	0	0	0	9	0	0	0	0
15:25 to 15:30	4	0	0	0	0	3	0	0	0	0
15:30 to 15:35	5	0	2	0	0	2	0	0	1	0
15:35 to 15:40	6	0	0	0	0	3	0	0	0	0
15:40 to 15:45	6	0	1	0	0	8	0	0	0	0
15:45 to 15:50	9	0	0	0	0	7	0	0	0	0
15:50 to 15:55	4	0	0	0	0	3	0	0	0	0
15:55 to 16:00	3	0	0	0	0	0	0	0	0	0
16:00 to 16:05	0	0	0	0	0	1	0	0	0	1
16:05 to 16:10	2	0	0	0	0	0	0	0	0	0
16:10 to 16:15	4	1	0	0	0	0	0	0	0	2
16:15 to 16:20	5	0	2	0	0	3	0	0	0	0
16:20 to 16:25	4	0	0	0	1	5	0	0	0	0
16:25 to 16:30	3	0	0	0	0	2	0	0	0	0
16:30 to 16:35	4	0	0	0	0	4	0	0	0	0
16:35 to 16:40	3	0	1	0	0	4	0	0	0	0
16:40 to 16:45	2	0	0	0	0	3	0	0	0	0
16:45 to 16:50	3	0	0	0	0	5	0	0	0	0
16:50 to 16:55	0	0	0	0	0	2	0	0	0	0
16:55 to 17:00	0	0	0	0	0	4	0	0	0	0
17:00 to 17:05	2	0	0	0	0	3	0	0	0	6
17:05 to 17:10	4	0	0	0	0	5	0	0	0	0
17:10 to 17:15	5	0	0	0	1	7	0	0	0	0
17:15 to 17:20	3	0	0	0	0	6	0	0	0	0
17:20 to 17:25	5	0	0	0	0	6	0	0	0	0
17:25 to 17:30	6	0	0	0	0	7	0	0	0	0
17:30 to 17:35	4	0	0	0	0	5	0	0	0	0
17:35 to 17:40	5	0	0	0	0	7	0	0	0	0
17:40 to 17:45	7	0	0	0	0	9	0	0	0	0
17:45 to 17:50	5	1	0	0	0	7	0	0	0	0
17:50 to 17:55	6	0	0	0	0	5	6	0	0	0
17:55 to 18:00	5	0	0	0	0	7	0	0	0	0

Appendix B – Pedestrian Modelling Outputs

Preliminary Pedestrian Capacity Analysis **Design Year:** *2056+15%*

Assessment Location
Hazelbrook Station - Bridge Level



Outputs

PEAK Minute Flows per metre

Location		Entries	Exits	Combined
1	AM	0	12	12
	PM	2	3	5
2	AM	1	1	2
	PM	1	3	4
3	AM	1	1	2
	PM	1	5	5
4	AM	0	7	7
	PM	1	2	3

AVERAGE Minute Flows per metre

	Entries	Exits	Combined
AM	0	3	3
PM	2	1	3
AM	1	0	1
PM	1	1	1
AM	1	0	1
PM	1	1	2
AM	0	2	2
PM	1	0	2

PEAK Minute Level of Service

Location		Entries	Exits	Combined
1	AM	A	A	A
	PM	A	A	A
2	AM	A	A	A
	PM	A	A	A
3	AM	A	A	A
	PM	A	A	A
4	AM	A	A	A
	PM	A	A	A

AVERAGE Minute Level of Service

	Entries	Exits	Combined
AM	A	A	A
PM	A	A	A
AM	A	A	A
PM	A	A	A
AM	A	A	A
PM	A	A	A
AM	A	A	A
PM	A	A	A

Factors

	Entries	Exits	
15 Minute Peak Flow Factor (33% of peak hour flow)	33%	33%	[1]
5 Minute Peak Flow Factor (50% of 15 minute peak flow)	50%	50%	[2]
1 Minute Peak Flow Factor (5 minute peak flow)	20%	85%	[3]

	AM Peak Hour		PM Peak Hour	
	Entries	Exists	Entries	Exists
Location 1	23	211	146	52
Location 2	81	16	62	70
Location 3	98	18	48	103
Location 4*	7	63	44	16
*- assuming 30 percent of total people will use lift				

Pinch point locations	1 Stairs between the bridge and platform	2 Bridge, south of the platform stairs	3 Bridge, north of the platform stairs	4 Walkway to the proposed (bridge level)
Width (m)	2.70	3.20	3.10	1.40
handrail width (m)	0.15	0.00	0.00	0.00
Edge effect (m)	0.00	0.00	0.20	0.20
Shoulder overhang (m)	0.08	0.08	0.00	0.00
Width of a person waiting in area	0.00	0.30	0.30	0.30
Effective Width (m)	2.55	2.98	3.00	1.30

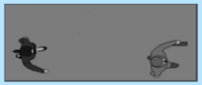
Level of Service Assumptions

Walkway

Fruin LOS	Pax/m/min
A	< 23
B	23 - 33
C	33 - 49
D	49 - 66
E	66 - 82
F	> 83

Stairs

Fruin LOS	Pax/m/min
A	< 16
B	16 - 23
C	23 - 33
D	33 - 43
E	43 - 56
F	> 56


Level of service A: < 23 pax/m/min


Level of service B: 33 pax/m/min


Level of service C: 49 pax/m/min


Level of service D: 66 pax/m/min


Level of service E: 83 pax/m/min


Level of service F: > 83 pax/m/min

Assumptions

[1] 15 minute peak flow is 33% of peak hour flow
[2] 5 minute peak flow is 50% of 15 minute peak flow
[3] Minute peak flow is an average of 5 minute peak flow
[4] 15% growth contingency factor is applied to the allocated design year
[5] Effective width (m) is determined by reducing the available width (m) by the standardised clearance width (m). Or, if width between handrails measured - additional space provided to account for shoulder and elbow room over handrail.

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2127503-55291/https://projects.ghd.com/oc/Sydney1/tap3pacrefs/Delivery/Documents/2127503_REP_RevB_Traffic Transport and Access Impact Assessment - Hazelbrook Station.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	OP / SC	OP / SC	On file	K. Day		19/11/2018

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