



## **Transport for NSW**

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

November 2018

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# 1. Introduction

## 1.1 Overview of the proposal

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.

Kingswood 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 Kingswood 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 Kingswood Station, interchange facilities and surrounding footpaths.

The station is located 52 kilometres west of the Sydney Central Business District (CBD) in the suburb of Kingswood and is serviced by the T1 Western Line. Platform 1 provides train services east towards the CBD and Platform 2 provides train services west towards Penrith. The Proposal is located within Penrith local government area adjacent to the Great Western Highway, Kingswood.

The key features of the Proposal are summarised as follows:

- installation of a new lift, glazed awnings and a new lift landing from the existing footbridge to the platform
- modification to the existing levels within the commuter car park, Railway Parade pedestrian crossing (including new road humps) and footbridge to provide DDA compliant pedestrian routes to the proposed new lift
- regrade existing platform surfaces to provide DDA compliant pedestrian routes between new lift, station building, toilets and the boarding zone on the platform
- upgrade of two DDA compliant parking spaces to the commuter car park
- relocation of existing bike storage and construction of a retaining wall within the existing commuter car park
- new canopies around the lift and over the new family accessible toilet (FAT)
- installation of new corridor fencing
- removal of some plants and gardens within and surrounding the station to allow for works
- modification of existing station building layout to allow for new amenities and station services equipment room (SSER)

- ancillary works including adjustments to lighting and additional opal card readers, new anti-throw screens, handrails, electrical upgrades, minor drainage works, landscaping, improvements to station communications systems including closed circuit TV (CCTV) cameras, hearing loops, public announcement (PA) system, wayfinding signage, emergency help points and installation of tactile ground surface indicators (TGSIs)
- a new padmount and upgrade of low voltage system to account for new lift.

Subject to planning approval, construction is expected to commence in early 2019 and take around 18 months to complete.

## **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 of Kingswood Station and provides input to the design of the proposed station accessibility upgrade as part of the Transport Access Program (TAP) project. An assessment of the proposed upgrade arrangements on pedestrian flows at pinch points in the pedestrian network is provided.

In addition, this report outlines the preliminary requirements for a Construction Traffic and Pedestrian Management Plan (CTMP) to guide future contractors when developing a Detailed CTMP prior to construction.

The Preliminary CTMP will include such details as:

- Construction Traffic and Pedestrian Management Plan objectives
- Vehicle approach departure routes to the site
- Preliminary construction vehicle types
- Identified areas of parking for construction personnel
- Public and active transport options for workers to the site
- Pedestrian, commuter and bicycle infrastructure.

## **1.3 Scope and limitations**

The scope of 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 Level of Service (LoS) spreadsheet model include the inability to model evacuation scenarios. Microsimulation modelling would be required to assess this type of dynamic scenario.

This Study has been limited to the following:

- The assessment has been undertaken based on a desktop review of the proposed station upgrade arrangement and forecast pedestrian traffic demands. No site inspection undertaken as part of this study. On site observations of existing pedestrian demands at the station were identified through undertaking weekday AM and PM peak pedestrian surveys
- The pedestrian modelling was undertaken using a “static” Fruin Level of Service (LoS) spreadsheet model. 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 provides 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. The scope of this study is to provide a review of pedestrian accessibility for the proposed station upgrade and provides a high level Preliminary CTMP
- Forecast station patronage for Kingswood Station was provided by Transport for NSW.

#### **1.4 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 Kingswood Station transport access program upgrade project. 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 Kingswood Station.

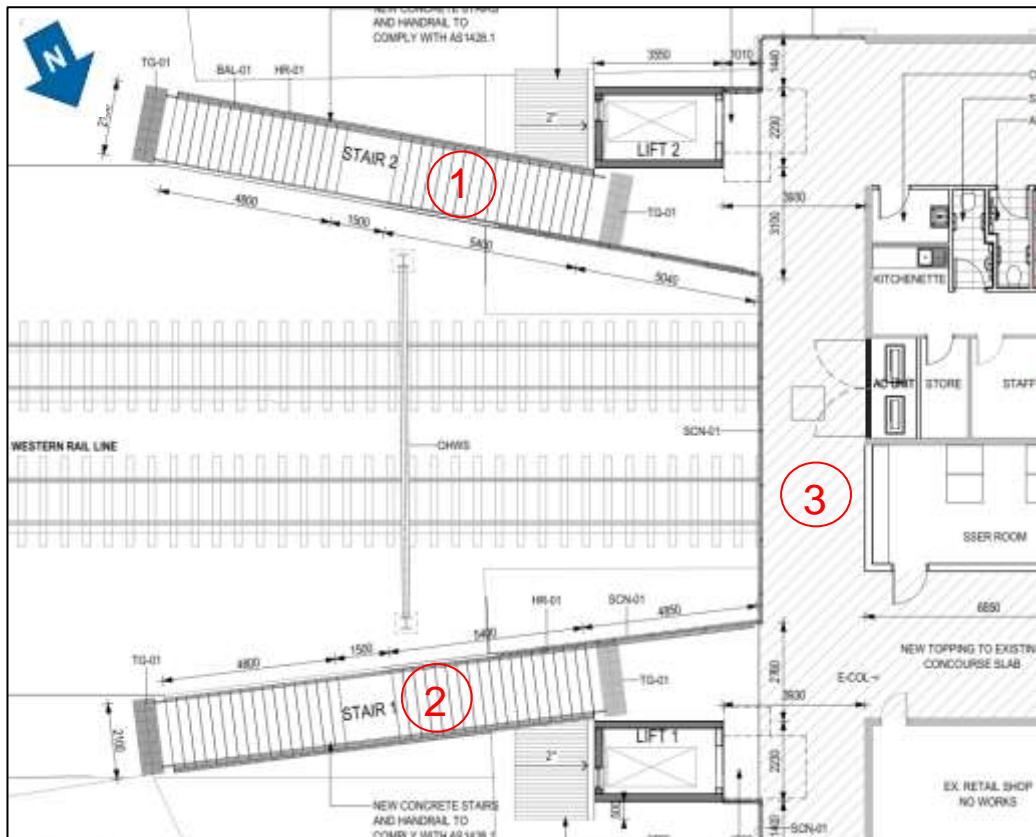
This pedestrian modelling assessment has been undertaken at “pinch points” in the pedestrian network at the station, including at the following locations:

1. Proposed stairs the at the southern station entrance
2. Proposed stairs the at the northern station entrance
3. New concourse (bridge level)
4. Proposed southern station entrance
5. Proposed northern station entrance
6. Proposed northern station entrance (stairs).

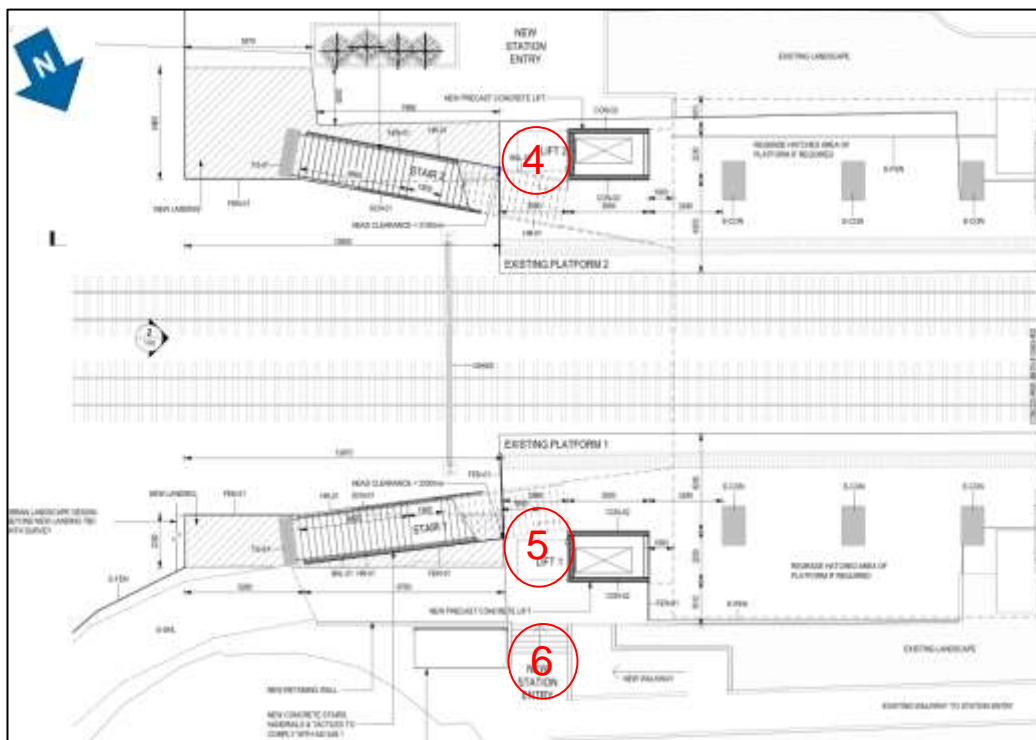
The pedestrian pinch point locations of the proposed station upgrade that have been assessed for the pedestrian modelling are identified at Figure 1-1 for the concourse level and Figure 1-2 for the ground and platform level.

The pedestrian modelling was undertaken using a “static” Fruin Level of Service (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 1-1 Pedestrian pinch point locations – concourse level**



**Figure 1-2 Pedestrian pinch point locations – ground / platform level**



## 1.5 Assumptions

The following conservative assumptions have been made in determining the future pedestrian demands at the station, which account 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
- The existing station entries and stairs will be retained as part of the proposed upgrade. For a conservative assessment of the proposed new station entries and new stairs, it has been assumed that 70 percent of the station patronage would use the proposed new station entries and stairs, with 30 percent using the existing station entries and stairs. This has been applied to the forecast 2036 (+ 15 percent contingency) AM and PM peak hour pedestrians shown in Figure 3-4 and Figure 3-5
- The following conservative assumptions have been applied in order to calculate the peak five minute and peak 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 (A44)**

The Great Western Highway (A44) is an arterial road, located directly south of Kingswood Station. It has three traffic lanes in each direction, separated by a raised centre median strip. The Great Western Highway has a signposted speed limit of 60 km/h within vicinity of the station.

To the southeast of Kingswood Station, the Great Western Highway forms a signal controlled intersection with Bringelly Road, where a right turn bay is provided on the Great Western Highway (western) approach. Signal controlled pedestrian crossings are provided at each approach at this intersection.

An indented bus stop bay is provided approximately 75 metres to the southeast of Kingswood Station (eastbound direction). A bus stop is also provided on the westbound carriageway, east of the Bringelly Road intersection.

Access to the off-street commuter car park located to the south of Kingswood Station, is provided from the Great Western Highway via separate left-in only and left-out only priority controlled intersections.

Based on traffic count data (2017) provided from the Roads and Maritime Traffic Volume Website (count station 86008 located near South Creek, Werrington – approximately 4 km east of Kingswood Station), the Great Western Highway carries around 32,750 vehicles per day. This data indicates that during the weekday AM peak hour (8 - 9 am) there were around 2,840 two way vehicle movements, with around 3,200 two way vehicle movements during the weekday PM peak hour (5 - 6 pm).

### **Richmond Road**

Richmond Road functions as a local collector road and provides access to a commuter car park located to the north of Kingswood Station and St Joseph's Catholic Church Centre Primary School. To the north, Richmond Road also provides a connection to Parker Street / The Northern Road (A9) via a signal controlled intersection with Coreen Avenue. Richmond Road forms has one traffic lane in each direction, separated by a solid double centre line (BB line).

Unrestricted parallel parking is provided on either side of the Richmond Road in the vicinity of Kingswood Station. A southbound bus zone is located adjacent to the primary school.

Richmond Road has a sign posted speed limit of 50 km/h outside of school zone hours. During school zone hours, the sign posted limit within vicinity of Kingswood Station and St Joseph's Catholic Church Centre Primary School is 40 km/h.

### **Cox Avenue**

Cox Avenue functions a local road, located to the north of Kingswood Station and forms the minor approach of a priority controlled 'give way' intersection with Richmond Road. Cox Avenue has one travel lane in each direction separated by a broken single line.

Access to the commuter car park located to the north of Kingswood Station is provided from Cox Avenue. Unrestricted parallel parking is provided on either side of the road.

Cox Avenue has a speed limit of 50 km/h outside of school zone hours. During school zone hours, the sign posted limit within vicinity of Kingswood Station is 40 km/h.

## Park Avenue

Park Avenue functions as a local collector road, and connects with the southern end of Richmond Road. Park Avenue has one travel lane in each direction separated by a broken single line.

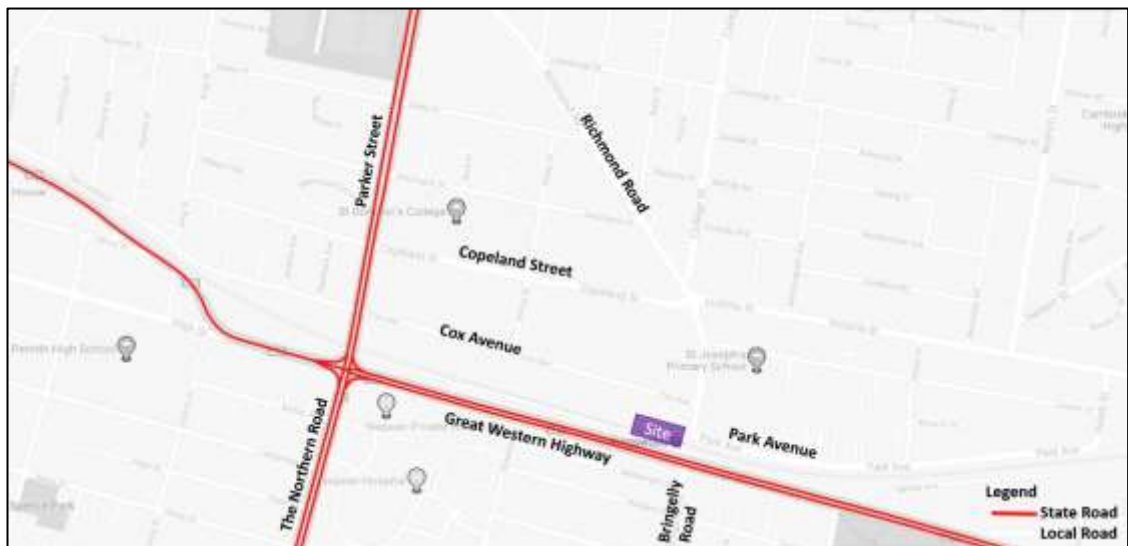
Unrestricted parallel parking is provided along on the northern side of the road. eastbound and westbound bus stops are located to the east of Richmond Road and the entrance to Kingswood Station.

Park Avenue has a sign posted speed limit of 50 km/h outside of school zone hours. During school zone hours, the sign posted limit within vicinity of Kingswood Station is 40 km/h.

## Parker Street (The Northern Road, A9)

Parker Road (and to the north becomes Richmond Road) forms part of the Northern Road (A9), is an arterial road, located approximately 750 metres to the west of Kingswood Railway Station. It has three travel lanes in both directions separated by a raised centre median strip.

Parker Road has a sign posted speed limit of 70 km/h in each direction within vicinity of Kingswood Station, with a 40 km/h school zone in operation during school pick-up and drop-off periods to the north of the intersection with the Great Western Highway.



**Figure 2-1 The road network surrounding Kingswood Train Station**

Source: Roads and Maritime Regional Road network - Modified by GHD

## 2.2 Public transport

### 2.2.1 Trains

#### *Kingswood Railway Station*

Kingswood Railway Station is served by Sydney Trains T1 Western Line services. This line provides connections between Emu Plains and Hornsby via Central Station.

Train service frequency is around one service every 10 minutes in the weekday morning peak (7 - 9 am) and one service every 12 minutes in the afternoon peak (between 4 - 6:30 pm) (Sydney Trains, 2018).

## 2.2.2 Buses

Bus stops servicing Kingswood Station are located on either side of the Great Western Highway. The following bus services operate from these bus stops:

- Bus route N70 (northern side of Great Western Highway) – Penrith and City Town Hall
- Bus route N70 (southern side of Great Western Highway) – City Town Hall and Penrith.

To the northeast of Kingswood Station, a bus stop located along Park Avenue, with the following bus services operating from this bus stop:

- Route 785 – Penrith and Werrington Station via Cambridge Park.

## 2.3 Walking network

Walking access to Kingswood Station is provided from the Great Western Highway to the southern station entrance, and Richmond Road to the north.

Footpaths are provided along both sides of each road in the vicinity of Kingswood Station, with the exception of the Park Avenue where a footpath is provided along the northern side of the road only. Other pedestrian facilities in the vicinity of the station include:

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

## 2.4 Bicycle network

Bicycle parking (shelter) is provided at Kingswood Station, located to the north and south of station.

The bicycle network around the vicinity of the station is illustrated in Figure 2-2. A shared path of low difficulty is provided along the northern side of the Great Western Highway.

Outside of the dedicated shared path, bicycle riders can use the on-road path on the Great Western Highway which provides a link to the Northern Road. This on-road route is of high difficulty.

Low difficulty on-road bicycle routes are also located along Richmond Road and Bringelly Road, although no dedicated bicycle paths are provided.



**Figure 2-2 Existing bicycle routes**

Source: [www.rms.nsw.gov.au/maps/cycleway\\_finder](http://www.rms.nsw.gov.au/maps/cycleway_finder) - Modified by GHD

## **2.5 Car parking**

Off-street commuter car parks are provided on both sides of Kingswood Station. The car park located on the northern side accessed from Richmond Avenue and Cox Avenue, provides approximately 200 spaces. The time restrictions are as follows:

- Monday to Friday: 8:30 am to 6:00 pm
- Saturday: 8:30 am to 4:30 pm

The car park located on the southern side accessed from the Great Western Highway, provides approximately 65 spaces, which are unrestricted. Unrestricted on-street car parking is also provided along Richmond Road, Cox Avenue and Park Avenue.

## **2.6 Taxi / kiss and ride facilities**

### **2.6.1 Taxi**

No formal taxi zones are provided within vicinity of Kingswood Station.

### **2.6.2 Kiss and ride**

A kiss and ride facility is located at Kingswood Station, adjacent to the southern station entrance and within the commuter car park, accessed from the Great Western Highway. There is no designated Kiss and Ride facility on the northern side of the station with a “No Stopping” zone is located at the corner of Richmond Road and Park Avenue.

# 3. Pedestrian modelling

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

## 3.1 Model calibration

The pedestrian analysis is based on the following design requirements and standards.

### 3.1.1 Design standards

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

- The 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.

### 3.1.2 Design requirements

The design requirements used in this appraisal include:

- The 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 Level of Service (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)**

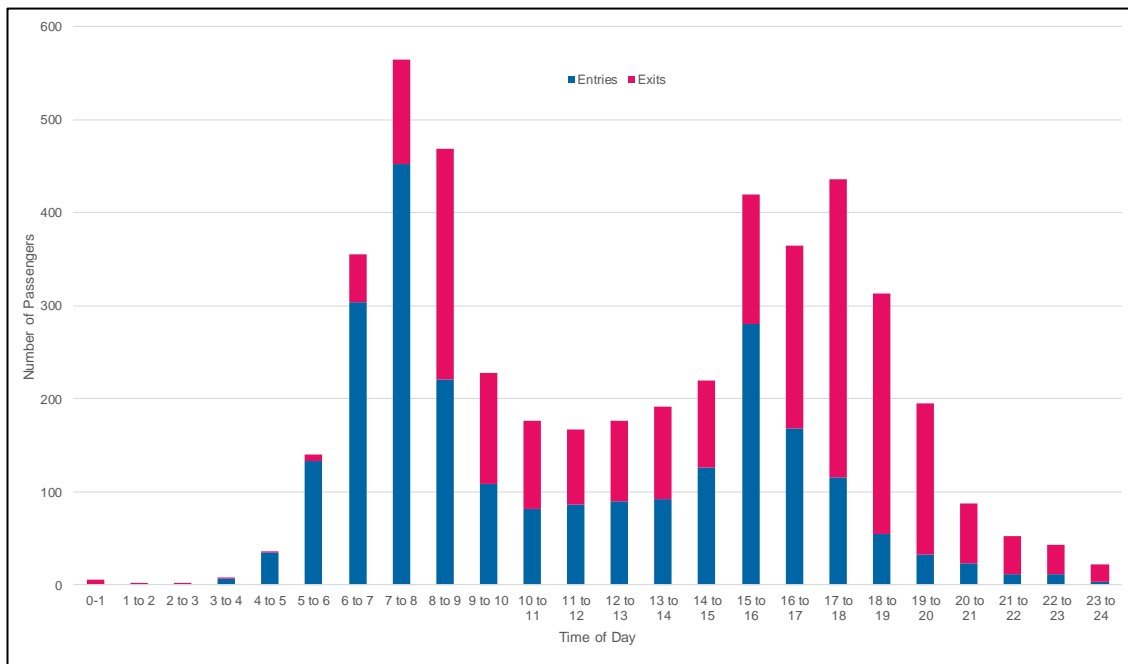
Level of Service	Pax/m/min for stairs	Pax/m/min for a walkway
A	< 16	< 23
B	16 – 23	23 – 33
C	23 – 33	33 – 49
D	33 – 43	49 – 66
E	43 – 56	66 - 82

Source: Fruin 1971



### 3.2 Opal data

Opal data for Kingswood Station was provided by TfNSW, which identified the number of station entries and exits 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 Kingswood Station Opal data – average weekday station entries and exists**

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	Entries	Exits	2-way
AM Peak (7-8 AM)	452	113	565
PM Peak (5-6 PM)	116	321	437
Saturday Peak (4-5 PM)	38	59	97
Sunday Peak (5-6 PM)	25	321	346

\*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 Kingswood Station precinct. The pedestrian counts were undertaken on Thursday 6 August 2018 during the following time periods:

- Weekday morning peak period, between 6.00 – 9.00 AM
- Weekday evening peak period, between 3.00 – 6.00 PM

The pedestrian count data is provided at Appendix A.

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

- Weekday morning peak hour, between 7.30 – 8.30 AM
- Weekday evening peak hour, between 3.05 – 4.05 PM.



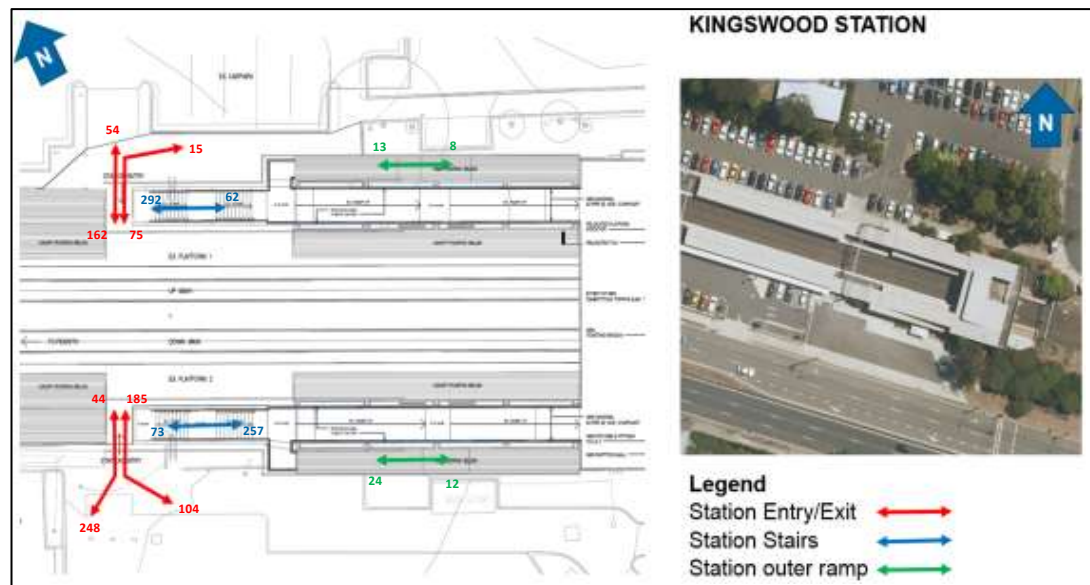
The morning and evening peak five minute periods, in terms of overall pedestrian demand, were observed to be as follows:

- Weekday morning peak five minute period, between 8.10 – 8.15 AM.
- Weekday evening peak five minute period, between 3.30 – 3.35 PM.

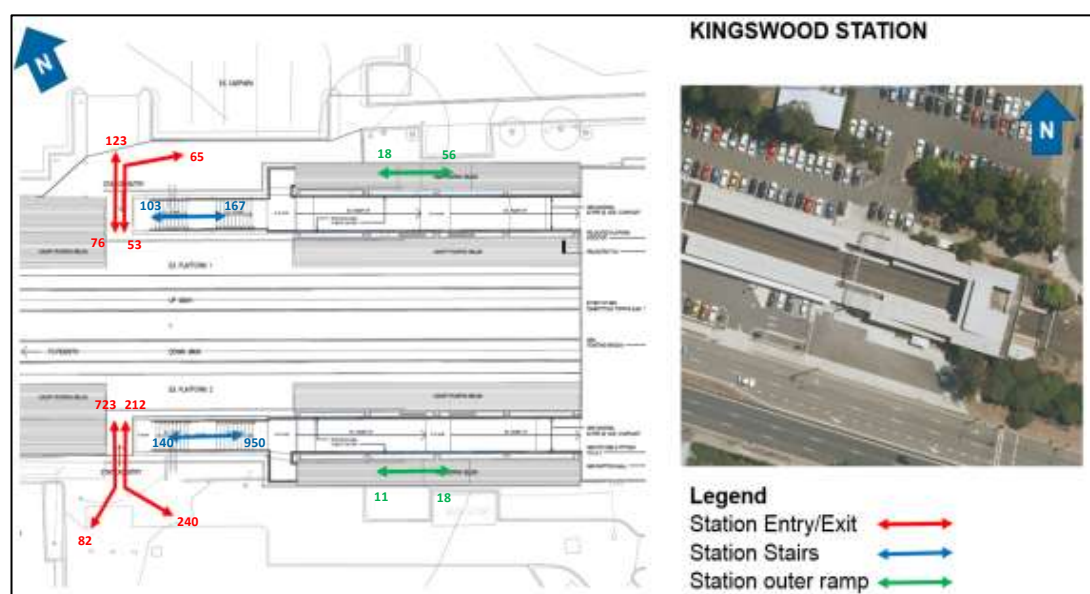
A summary of the surveyed peak hour pedestrian movements is shown in Figure 3-2 and Figure 3-3 for the weekday AM and PM peak hours respectively.

Analysis of the pedestrian surveys indicated that:

- In the AM peak hour, the peak five minute period pedestrian volumes accounted for 14 percent of the peak hour pedestrian movements (total recorded movements)
- In the PM peak hour, the peak five minute period pedestrian volumes accounted for 19 percent of the peak hour pedestrian movements (total recorded movements).



**Figure 3-2 2018 Pedestrian counts – AM peak hour (7.30 – 8.30 AM)**



**Figure 3-3 2018 Pedestrian counts – PM peak hour (3.05 – 4.05 PM)**

### 3.4 Forecast pedestrian volumes

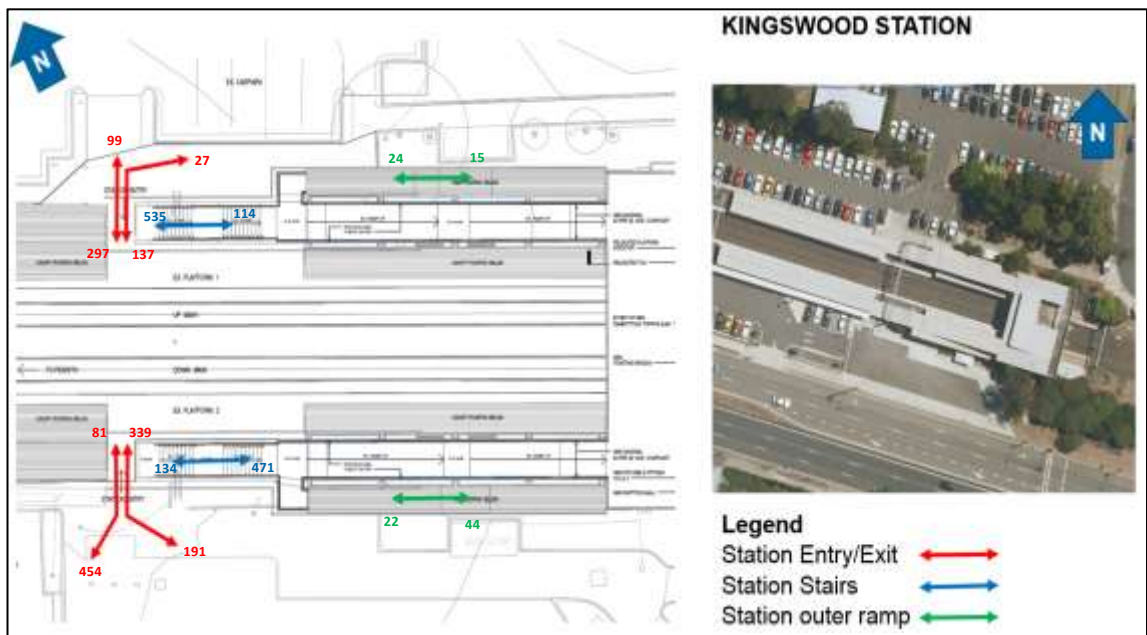
Transport for NSW have provided existing and forecast patronage for Kingswood Station, which is summarised in Table 3-3. The resulting growth rate is also shown.

**Table 3-3 Forecast station patronage – Kingswood Station**

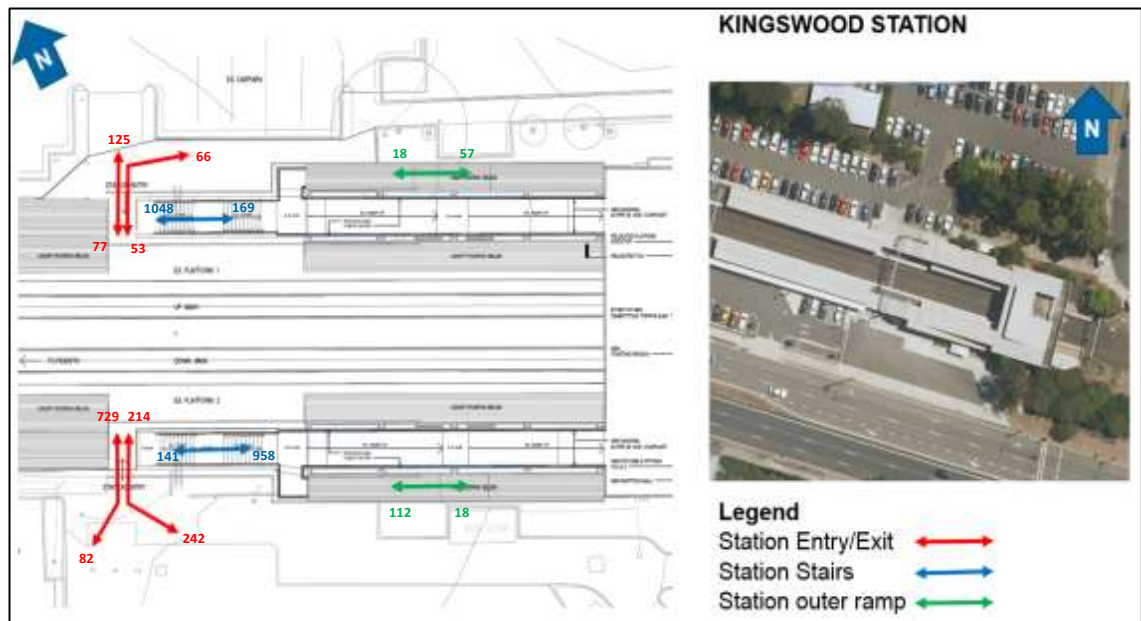
Peak Period	2017	2036	Annual Growth Rate
Average weekday AM peak (6 – 10 AM)	1,610	2,630	2.62%
Average weekday PM peak (3 - 7 PM)	1,515	2,475	2.62%

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 is 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	5	6
Pinch point locations	Southern stairs (proposed)	Northern stairs (proposed)	Concourse	Southern Entry	Northern Entry	Northern Entry (stairs)
Width (m)	2.10	2.10	2.90	2.80	2.80	2.50
Handrail width (m)	0.15	0.15	0.00	0.00	0.00	0.00
Edge effect (m)	0.00	0.00	0.20	0.20	0.20	0.20
Shoulder overhang (m)	0.08	0.08	0.00	0.00	0.00	0.00
Width of a person waiting in area	0.00	0.00	0.30	0.00	0.00	0.00
<b>Effective Width (m)</b>	<b>1.95</b>	<b>2.03</b>	<b>2.80</b>	<b>2.80</b>	<b>2.60</b>	<b>2.10</b>

\*Note – refer to Figure 1-1 and 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 a design year of 2036 (plus a 15 percent contingency factor), all of the pinch points are expected to operate at a satisfactory LoS C or better 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	Exists	Combined	
1 - Southern stairs (proposed)	2	8	10	A
2 - Northern stairs (proposed)	6	1	7	A
3 - Concourse	4	1	5	A
4 - Southern Entry	3	5	9	A
5 - Northern Entry	4	1	5	A
6 - Northern Entry (stairs) Bridge - between Platforms 3 & 4	5	1	6	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	Exists	Combined	
1 - Southern stairs (proposed)	2	11	13	A
2 - Northern stairs (proposed)	12	2	14	A
3 - Concourse	9	2	10	A
4 - Southern Entry	8	4	12	A
5 - Northern Entry	1	2	3	A
6 - Northern Entry (stairs) Bridge - between Platforms 3 & 4	1	2	3	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 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 construction plant, deliveries and removal of materials along with light vehicles from construction workers.

The duration of the construction activities for Kingswood Station is 18 months.

#### *Heavy vehicles*

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

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. Heavy vehicles are expected to access the site outside of the AM and PM peak hours. However, as a conservative approach 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).

It is proposed that all construction storage containment will be within the proposed construction compounds. However, this will be confirmed in the detailed construction planning stage.

This small 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. Although, should additional peak construction movement vary, the potential impacts will 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 around 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 car pool. Application of this car driver rate to the assumed workforce yields a traffic generation in the order of up to 30 light vehicles per day.

In conjunction with the proposed standard hours of construction (i.e. 7:30 am to 5:00 pm), it is expected that all workers would arrive at the site during the observed road network AM peak hour (7 - 8 am) while an assumed 50 per cent of workers would depart during the PM peak hour (5 - 6 pm). These peak hours were observed based on traffic data provided from the Roads and Maritime Traffic Volume Viewer Website. 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. Should the anticipated number of construction workers vary, the potential impacts will need to be assessed as part of the detailed design phase.

Construction light vehicles are expected to park on-street if required, with limited off site parking available. This would need to be addressed in greater detail in a Construction Traffic Management Plan (CTMP) for the proposed works. As such, light vehicle construction vehicles



are expected to utilise the road network surrounding both sides of the station during construction activities. It is recommended that workers be encourage to use alternate transport options such as public transport to access the site.

A detailed CTMP is should include the following:

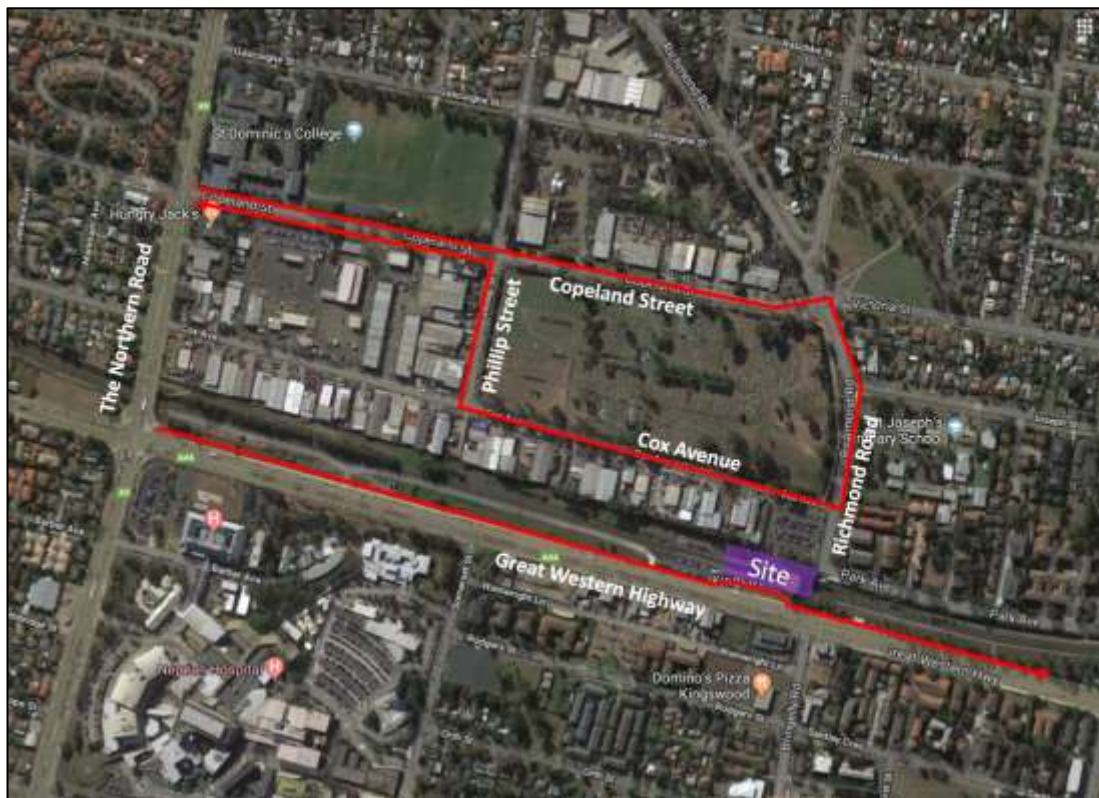
- Construction arrangements
- Heavy vehicles and light construction vehicles
- Pedestrian and bicycle access and safety
- Public transport access
- Parking and traffic impacts
- Recommended mitigation measures during construction.

#### 4.1.1 Construction vehicle access routes

To reduce the potential impacts on the performance of intersections in the vicinity of the site, it is recommended that construction vehicles arrive to the site from the west of Kingswood Station, from The Northern Road.

Construction vehicle access to the northern side of Kingswood Station should be via Copeland Street and Richmond Road. Subject to the location of the construction site / compound, which could potentially incorporate a section of the north car parking, the return route to The Northern Road could be via Cox Avenue, Phillip Street and Copeland Avenue.

Construction vehicle access to the southern side of the Kingswood Station will be via The Great Western Highway. No loading or unloading should occur from The Great Western Highway. A designated loading area (if required), should be positioned off the road carriageway and outside road network peak periods.



**Figure 4-1 Construction vehicle access routes**

Source: Google maps – modified by GHD

Temporary road closures could occur on Richmond Road / Park Avenue at various times during the construction period. Vehicles may need to take alternate road routes during this time. A CTMP would be developed to address how traffic would be redirected, if required.

## **4.2 Pedestrian and bicycle rider impacts**

Access to the station would be maintained at all times during rail operation. However, pedestrians and bicycle riders on both sides of the station are anticipated to be affected by the proposed construction activities.

Potential interactions between construction traffic and pedestrians and cyclists include:

- periodic restrictions on accessibility for pedestrian and bicycle rider movements on both sides of the station due to the movement of construction material, traffic diversions and the location of crane/s during construction
- pedestrian access is likely to be impacted due to the construction of temporary pedestrian access paths
- increased vehicle movements may reduce safety.

Mitigation measures for ensuring that pedestrian and cyclist access and safety are not compromised would include traffic control at the pedestrian and bicycle access points on the northern and southern side of the station.

## **4.3 Public transport impacts**

Bus services would continue to operate along the Great Western Highway and Park Avenue / Richmond Road in the vicinity of the station during construction. Potential interactions between construction traffic and bus services include:

- potential difficulty in accessing the bus stops along Park Avenue (subject to the construction staging/sequencing adopted by the Contractor)
- some impacts on access to buses for passengers during the demolition of the existing westbound bus stop at along Park Avenue and construction of a new bus shelter

It is recommended that consideration be given to possible traffic control requirements near the bus stop when large vehicles need to access the site during construction and operation.

Although not anticipated, should the existing westbound bus stop on Park Avenue require relocation during construction, it could be relocated at Richmond Road, to the north of Park Avenue, where there are around six unrestricted car parking spaces on the western side of the road.

## **4.4 Car parking impacts**

Construction of the Proposal is likely to impact off-street parking at the commuter car parks located to both the northern and southern sides of Kingswood Station. The compound locations are to be confirmed and the number of parking spaces that will be accommodated by these compounds and 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 that some workers would also park at on-street (and commuter) parking locations in the vicinity of the construction compound. This would reduce the available on-street parking, currently used by commuters and visitors in the vicinity of Kingswood Station.

On-street parking in the vicinity of the works is anticipated to be sufficient to cater for temporary parking losses during construction.

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 and not park within the commuter car parking areas.

#### **4.5 Taxi / kiss and ride impacts**

A kiss and ride facility is located within the southern commuter car park area. Preliminary construction compound areas have been identified adjacent to the parking (and subsequent) kiss and ride facility. While it is not anticipated that the current proposed compound area will impact on the facility, the CTMP should identify traffic control measures to avoid and minimise impact on its accessibility.

There is currently no formal taxi zone at Kingswood Station. As such, the impacts to taxis will be negligible.

#### **4.6 Construction Traffic and Pedestrian Management Plan**

The following sections provides a guide for the requirements for developing a Construction Traffic Management Plan (CTMP) for the proposed construction works for the Kingswood 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 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 of the 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 the construction site.
- 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 periods. This includes during the weekday AM and PM peak periods and during the middle of the day on the weekend, when higher traffic volumes occur within the road network.



Heavy vehicle activity should be avoided, where possible, during school pick-up and drop-off periods (8:00 to 9:30 AM and 2:30 to 4:00 PM school days) in the vicinity of schools, when pedestrian and vehicle activity is generally greater.

Construction vehicles should also avoid using local streets surrounding the Nepean Hospital, including Somerset Street, in order to minimise potential disruptions to emergency services.

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

#### **4.6.3 Oversize vehicles**

At this stage of the project, details of whether oversized vehicles are required to transport equipment or plant to site are not available. However, should oversized 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 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 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 and AS1742.3 – Traffic 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.

Encouraging carpooling between workers will decrease traffic activity and parking demand. The site is located directly at Kingswood Train Station, which forms part of the Sydney Train network. 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.

Site personnel should not utilise the commuter parking spaces. Details of the proposed parking area were not available at the time of this assessment.

#### **4.6.6 Pedestrian management**

Site access is to be restricted to authorised personnel only and existing employees on site. Pedestrian access to and around the site is to be maintained at all times. It is anticipated the

pedestrian activity in public areas surrounding the site will be high due to the site being positioned within Kingswood Train Station infrastructure, nearby local shopping precinct and bus services. This will be particularly evident during the AM and PM peak periods as a result of pedestrians demands associated with the nearby university and local shopping precinct and workers travelling to and from key employment areas such as Sydney central business district (CBD) and Parramatta CBD.

A designated path of travel for pedestrians is to be maintained past all worksites and free from trip hazards.

Within the site pedestrian travel paths are to 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 and AS1742.3 – Traffic Control for Works on Roads is to consider the pedestrian activity adjacent to the site area.

#### **4.6.7 Bicycle rider management**

There are currently several on and off-road bicycle routes within proximity of the site (refer to Figure 2-2) including:

- Off-road path:
  - Great Western Highway – northern and southern sides of the road.
- On-road route:
  - Great Western Highway.
  - Park Street.
  - Richmond Road.
  - Victoria Street.

Additionally, bicycle lockers are located on the southern of Kingswood Station with access to 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.
- Transport infrastructure:
  - Bus infrastructure.
  - Railway line and train services.
  - Bicycle facilities.

- General traffic.
- Pedestrian activity.
- Public facilities:
  - Education:
    - University of Western Sydney – Second Avenue.
    - St Joseph’s Primary School – Joseph Street.
    - St Dominic’s College – Gascoign Street.
  - Shopping:
    - Kingswood shopping precinct – accessed via 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 is to 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 are to 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. Notification can be provided by various means that will be outlined in a community liaison plan including, but not limited to:

- Letterbox distribution;
- Local paper; and
- Transport for NSW and Penrith City Council website.

#### **4.6.10 Emergency services**

Nepean Hospital is located approximately 500 m to the west of the site. Although the hospital is not directly impacted by the proposed works, ambulance services and other emergency services (fire and police) should be considered in developing the CTMP. The road network within the site area must facilitate the access of emergency service vehicles by providing minimum lanes width of 3.5 m. 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 upgrade of Kingswood Station.

### 5.1 Traffic impacts

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

### 5.2 Parking

The proposed works do not identify any changes to the current parking provisions on the northern or southern sides of Kingswood Station.

### 5.3 Pedestrian and bicycle rider impacts

Pedestrian access to Kingswood Station would be improved by providing new entries to the station at both the northern and southern sides of the station. The new entries would be located closer to the bus stops on the Great Western Highway and Park Avenue, allowing for improved access to the bus stops.

New lifts, in conjunction with existing accessible ramps, would improve accessibility to the station. In addition the proposed stairs at both the northern and southern sides of the station would improve access to the surrounding footpath network at Park Avenue / Richmond Road and the Great Western Highway / Bringelly Road.

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

The proposed improvements would provide better accessibility to the station, improve interchange between different modes of transport and encourage public transport use.

### 5.4 Bus impacts

No changes are proposed to the existing bus stop facilities or bus services at Kingswood 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 informal kiss and ride at Richmond Road is currently non-compliant due to the grade of the footpath servicing the area. As part of the Proposal, access paths will be upgraded to be DDA compliant, thereby improving accessibility.

No taxi zone is proposed. However, the proposed pedestrian access improvements to will provide better accessibility to the station, including between the kiss and ride zone and new station entries.

## 6. Conclusions and recommendations

This report details pedestrian modelling analysis of Kingswood Station and provides input to the design of the proposed station accessibility upgrade as part of the Transport Access Program (TAP) project. An assessment of the proposed upgrade arrangements on pedestrian flows along the at pinch points in the pedestrian network is provided.

In addition, a draft (preliminary) Construction Traffic and Pedestrian Management Plan (CTMP) is provided to guide future contractors when developing a detailed CTMP prior to construction.

### 6.1 Pedestrian modelling analysis

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

1. Proposed stairs the at the southern station entrance.
2. Proposed stairs the at the northern station entrance.
3. New concourse (bridge level).
4. Proposed southern station entrance.
5. Proposed northern station entrance.
6. Proposed northern station entrance (stairs).

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 both sides of the station are anticipated to be affected by the proposed construction activities. Potential interactions between construction traffic and pedestrians and cyclists include:
  - Impact to pedestrian and bicycle rider movements on both sides of the station due to the movement of construction material, traffic diversions and the location of crane/s during construction
  - Pedestrian access is likely to be impacted due to the construction of temporary pedestrian accesses
  - Increased vehicle movements may reduce safety.
- Potential interactions between construction traffic and bus services include:
  - Potential difficulty in accessing the bus stops along Park Avenue
  - Some impacts to bus passengers during the demolition of the existing westbound bus stop at along Park Avenue and construction of a new bus shelter

- Should it be required, the temporary relocation of the existing westbound bus stop at Park Avenue during construction. This could potentially be relocated at Richmond Road, to the north of Park Avenue, where there are around six unrestricted car parking spaces on the western side of the road
- There may be some minor impacts to off-street parking at the commuter car parks located to both the northern and southern sides of Kingswood Station 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 encouraged to utilise alternate transport options such as public transport to reduce parking demands
- Construction of the proposal may impact the kiss and ride facility on the southern side of Kingswood Station. Although this should be avoided, this may need to be temporarily relocated during construction, should the construction compound or staging impact the facility.
- There is currently no taxi parking at Kingswood Station. As such, there are no anticipated impacts to taxis.

### **6.3 Operational impacts**

The operational impacts include the following:

- Pedestrian access to Kingswood Station would be improved by providing new entries to the station at both the northern and southern sides of the station. The new entries would be located closer to the bus stops on Great Western Highway and Park Avenue, allowing for improved access to the bus stops
- The Proposal does not alter the current parking arrangements at Kingswood Station
- The informal kiss and ride at Richmond Road is currently non-compliant due to the grade of the footpath servicing the area. As part of the Proposal, access paths will be upgraded to be DDA compliant, thereby improving accessibility. The proposed upgrade is expected to result in negligible traffic impacts at roads in the vicinity of the station
- Impacts to bus and taxi operations would be minimal. However, the proposed pedestrian access improvements (station entry locations) 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 of the site and outline mitigation measures of construction traffic impacts. The plan is to include such items as:

- Vehicle approach routes.
- Traffic management and Traffic Control Plans (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 etc.)

- Methods of communicating traffic changes to the local community and visitors to the area.

The CTMP will be developed in consultation with Penrith 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 proposal provides satisfactory amenity and level of service for pedestrians and minimises adverse impact on the road system subject to the implementation of a detailed CTMP prior to construction by the contractor.

# Appendices



# **Appendix A** – Pedestrian Surveys

# **Appendix B** – Pedestrian Modelling Outputs

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