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Transport Infrastructure Development Corporation

North West Rail Link Environmental Assessment

Traffic, Transport, Parking and Access

October 2006

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Project Context

The North West Rail Link is a proposed passenger railway between Cheltenham and Rouse Hill via Castle Hill. The North West Rail Link would be the principal trunk public transport line in Sydney's North West. The proposed rail line is planned to be twin tracked and approximately 23km in length running from the Northern Line between Beecroft and Cheltenham Stations to Rouse Hill Regional Centre.

Purpose of this Project

This report raises key issues to be considered with respect to traffic, transport, parking and access requirements for the North West Rail Link both during construction and operation. It will form part of the Environmental Assessment (EA) required under Section 75(F) of the *Environmental Planning And Assessment Act 1979*.

Regional Benefits of the Project

The North West Rail Link is expected to deliver a range of benefits to future rail passengers and the wider community. These benefits include:

» Improved access to rail services and a reduction in travel times;

» Improved transport choice to help reduce the high car dependence characteristics in this region;

» Capacity relief on the Richmond, Western and Northern railway lines;

» Reduced demand on the region's arterial road network; and

» Improved integration at transport interchanges and stations to help encourage travel by public transport, walking and cycling in the region.

Analysis of Operational Impacts

After the North West Rail Link is constructed, a number of operational impacts could be expected at and around each rail station. These impacts and benefits may include:

» An increase in the number of local traffic movements leading to potential delays and conflict, the extent of this will be largely dependent on the design and the planned access arrangements to the rail station including the provision of park and ride facilities;

» An improved pedestrian environment and integration with other transport modes around rail stations with new road crossings, footpaths and interchange areas encouraged as part of the design; and

» Improved accessibility to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

It is recommended that future investigations be undertaken for station precinct designs in order to provide adequate priority for pedestrians, cyclists and public transport

services with appropriate traffic management for kiss and ride and park and ride movements.

Analysis of Construction Impacts

During construction of the North West Rail Link, a number of impacts could be expected around each rail station and work site. These impacts may include:

» Increased volumes of light and heavy vehicles on local roads surrounding work sites and arterial roads, potentially leading to some delays at intersections due to increased traffic volumes;

» Temporary deviations to roads, property accesses, footpaths, bicycle routes and bus services, which would be minimised and designed to provide safe and appropriate access throughout construction; and

» Potential temporary increase in parking demand on local streets as stations are constructed.

A number of suitable haulage routes for construction site deliveries and spoil removal have been identified along the RTA designated B-Double network and deemed to be appropriate for this purpose.

Further investigation is required to determine the likely future traffic volumes and turning movements surrounding each site in order to assess the potential impact of construction traffic on the road network between the years 2012-2019.

1. Introduction

1.1 Purpose of this report

This report has been prepared as part of the environmental assessment of the proposed North West Rail Link (the project). The Transport Infrastructure Development Corporation is the proponent of the project, and the environmental assessment is being prepared by GHD, in accordance with the requirements of Part 3A of the *Environmental Planning and Assessment Act 1979*.

This report raises the key issues to be considered with respect to traffic, transport, parking and access requirements for the North West Rail Link both during construction and operation and aims to provide a strategic level understanding of:

- The likely changes in the region (i.e. new road links, proposed development and other transport infrastructure);
- The regional constraints and opportunities along the transport network for construction and operation of the North West Rail Link;
- The construction and operational impacts relating to:
  - Six new stations at Franklin Road, Castle Hill, Hills Centre, Norwest Business Park, Burns Road and Rouse Hill.
  - Local access to stations for pedestrians, cyclists, taxis and buses.
  - Commuter parking including potential for new park and ride facilities.
  - Integration with Transitway interchanges at Burns Road and Rouse Hill Regional Centre.
- The potential impacts from the associated railway upgrades in the Epping-Beecroft section of the Northern Line;
- The potential impacts from the construction and operation of a reconfigured Cheltenham Station;
- The potential impacts from the construction and operation of the stabling facilities north of Rouse Hill; and
- Movement of construction materials and spoil, on-site operations, staff parking issues and equipment at the Balmoral Road construction site and proposed station locations.

This document has been prepared to meet the Department of Planning Director General's Requirements for the environmental assessment and traffic, transport, parking and access requirements.

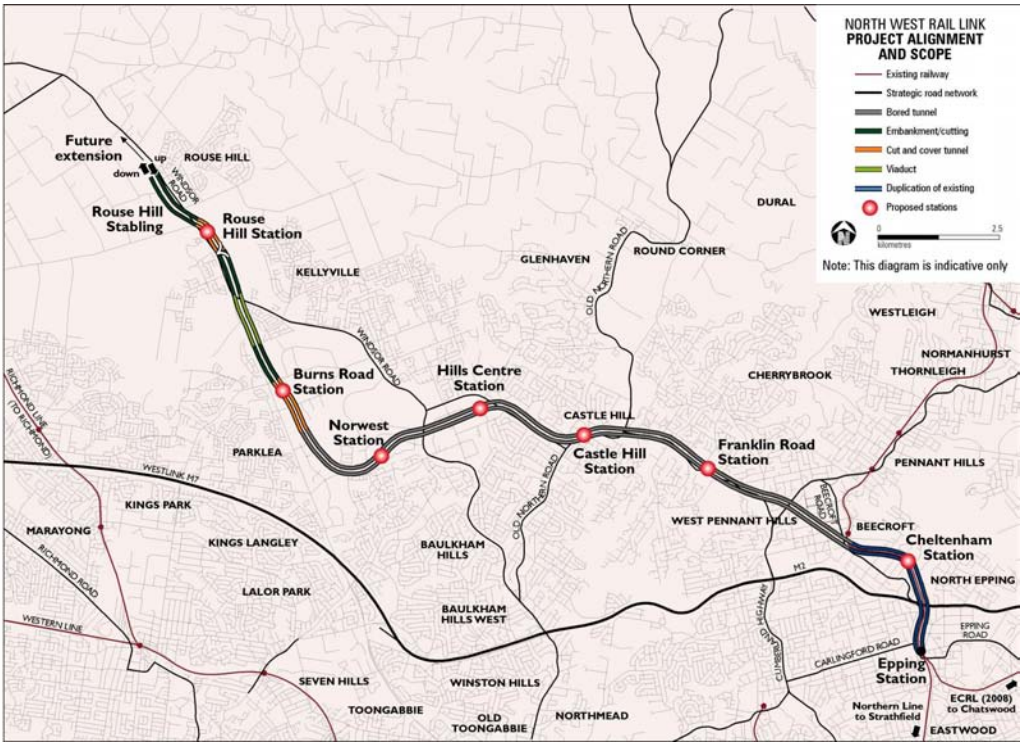
1.2 Project outline

The proposed North West Rail Link would be the principal trunk public transport line in Sydney's North West. It would connect with the Northern Line between Beecroft and Cheltenham Stations and terminate at Rouse Hill Town Centre. The rail link would be twin track, approximately 23 kilometres in length and would include:

- A 2.5 km surface quadruplication of the Northern Line between north of Epping Station and Beecroft Station (including works at Cheltenham Station);
- A 16 km section in tunnel from the Northern Line to north of Norwest Business Park, including four underground stations (Franklin Road Station, Castle Hill Station, Hills Centre Station and Norwest Station);
- A 4 km surface section from north of Norwest Business Park to Rouse Hill, including two underground stations (Burns Road Station and Rouse Hill Station)
- An interim train stabling facility at Rouse Hill;
- Ancillary tunnel support facilities such as tunnel ventilation, transformers and a water treatment plant(s); and
- Construction work sites, including a large site within the Balmoral Road Release Area.

The location of the project is shown in Figure 1.1

Figure 1.1 Location of the project



2. Study Approach

This *Traffic, Transport, Parking and Access Assessment* has been completed at a strategic level in order to identify critical issues and impacts and has been undertaken to inform the concept plan. The study is based on existing information and has not included new traffic counts or traffic modelling.

This study was based upon the following approach.

2.1 Review of background information

Relevant documents and previous reports were reviewed to identify key data sources for the transport assessment. Specifically, documents reviewed were expected to provide detail on:

» The project design (rail alignment, station and interchange design, associated modifications to the transport network) the following reports were reviewed:
  – Transport Infrastructure Development Corporation May 2006 – *North West Rail Link Project Review Report – Background to Project Report.* Parsons Brinckerhoff (PB);
  – Transport Infrastructure Development Corporation May 2006 – *North West Rail Link Project Review Report – Commuter Parking and Other Mode of Access Requirements Report.* Parsons Brinckerhoff (PB); and
  – Transport Infrastructure Development Corporation May 2006 – *North West Rail Link Project Review Report – Engineering and Infrastructure Technical Report* PB and KBR.
» Existing traffic volume data, future year traffic volumes and operating conditions for the surrounding and impacted road network;
» Railway patronage data (including expected mode of access) the following reports were reviewed:
  – Transport Infrastructure Development Corporation May 2006 – *North West Rail Link Project Review Report – Review of North West Rail Link Patronage Studies* PPM Consultants.
» Likely construction methods (detailing construction sites, expected numbers of vehicles, haulage routes and site access arrangements) the following reports were reviewed:
  – Transport Infrastructure Development Corporation May 2006 – North West Rail Link Project Review Report – Constructability and Programme Review. Evans and Peck.

2.2 Site investigation

A site inspection of existing road and traffic conditions was conducted along the project corridor on Wednesday 12 July 2006, focussing on the location of construction depots, future rail stations, and the arterial road network in the vicinity of the future rail line.

Existing public transport networks and sensitive land uses were also considered, with a view to understanding how these may be affected during construction and following the opening of the future rail line.

2.3 Consultation

Consultation was undertaken with the Network Planning and Multi Modal Planning Sections of the RTA and RailCorp's Network Development Department. Representatives of the above government departments were approached in order for the study team to obtain a better understanding of the likely future issues and changes to the regional transport network that could be associated with the North West Rail Link (NWRL).

2.4 Analysis of operational effects

The operational effects of the proposed rail line were reviewed, with particular focus given to:

- Regional road network performance;
- Local access issues;
- Sensitive land uses;
- Interaction with regional cycle and pedestrian infrastructure;
- Rail patronage and performance;
- Bus patronage and performance; and
- Car parking and commuter interchange facilities.

2.5 Analysis of construction impacts

The worst-case construction impacts of the proposed rail line have been reviewed, with particular focus given to regional road network performance, public transport and local access.

Key construction impacts are identified as they relate to regional traffic and other key transport infrastructure.

2.6 Director General's requirements

Table 2.1 Director General's Requirements

Requirements	Location in the report that addresses the requirement
Operational Impacts	
Opportunities for the integration of rail and bus services including modal interchange facilities, local bus services, strategic corridors and external network connections, access and mobility (particularly to Rouse Hill Station) considerations	Sections 4.3 & 4.4
Opportunities for the provision of pedestrian and cycle links across and alongside the rail line	Section 4.5
Potential impacts on local traffic taking into account mode of access to stations and the parking facilities provided (including park and ride and kiss and ride)	Section 5
Construction Impacts	
Identification of haulage routes, impacts to local and regional traffic from haulage and other construction activities (particularly around Beecroft and Epping)	Section 6
Impacts to station facilities such as parking and access during construction activities	Section 6
Impacts on bus and rail servicing during construction (particularly the impact of the proposed construction site on the North West Transitway)	Section 6

3. Existing and Future Transport Environment

This section of the report provides an overview of the transport context of the North West Region of Sydney, including existing infrastructure, and future key drivers such as population growth and travel demand.

3.1 Existing road network characteristics

The proposed North West Rail Link runs alongside or near to the following roads (from east to west).

The M2 Motorway connects Epping Road at North Ryde with the M7 Motorway at Baulkham Hills, and provides a freeway standard divided carriageway with two general travel lanes in each direction and bus lanes between Epping and Windsor Road. In 2006, the average weekday traffic volume reported by Transurban was approximately 93,500 vehicles per day.

Beecroft Road connects Pennant Hills Road at Pennant Hills with the M2 and Epping Road at Epping, and provides an undivided carriageway with two travel lanes in each direction. In 2002, the AADT traffic volume at Cheltenham was approximately 34,200 vehicles per day.

Pennant Hills Road connects Church Street at North Parramatta with the Pacific Highway at Wahroonga, linking the F3 Sydney-Newcastle Freeway at Wahroonga to the M2 and M7 Motorways at Pennant Hills. It generally provides a divided carriageway with three travel lanes in each direction. In 2002, the AADT traffic volume at West Pennant Hills was approximately 70,500 vehicles per day. Options have been proposed to directly link the F3 to M2, with the preferred option being a road tunnel beneath the present alignment of Pennant Hills Road.

Castle Hill Road connects Pennant Hills Road at Pennant Hills with Old Northern Road at Castle Hill, and provides an undivided carriageway with two travel lanes in each direction. In 2002, the AADT traffic volume at Rogans Hill was approximately 47,200 vehicles per day.

Old Northern Road connects Baulkham Hills to Wisemans Ferry via Castle Hill, and provides an undivided carriageway with two travel lanes in each direction. In 2002, the AADT traffic volume at Rogans Hill was approximately 47,600 vehicles per day.

Showground Road connects Old Northern Road at Castle Hill with Windsor Road at Kellyville, and provides a mixed arrangement including an undivided carriageway with one travel lane in each direction in the eastern section to Carrington Road and a divided carriageway with two lanes in each direction west of Carrington Road. In 2002, the AADT traffic volume at Kellyville was approximately 42,900 vehicles per day.

Old Windsor Road connects the Cumberland Highway at Old Toongabbie with Windsor Road at Stanhope Gardens, and provides a divided carriageway with two or three travel lanes in each direction in the vicinity of the project. In 2002, the AADT traffic volume at Balmoral Road, Kellyville was approximately 33,900 vehicles per day.

Windsor Road connects the Cumberland Highway at Northmead with Macquarie Street at Windsor, and provides a divided carriageway with two travel lanes in each direction south of Rouse Road. In 2002, the AADT traffic volume at Castle Hill was approximately 47,200 vehicles per day.

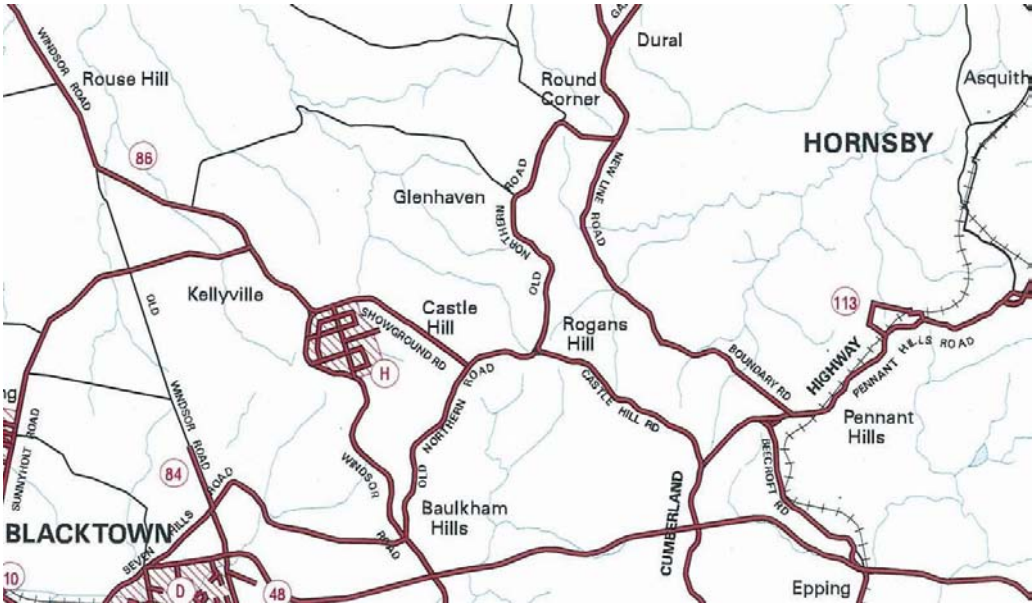
3.2 Existing B-Double routes

The RTA has published B-Double mapping showing designated B-Double routes in Metropolitan Sydney and regional NSW. This mapping indicates routes, which can suitably accommodate certain types of B-Double type vehicles. Roads that are relevant to the construction of the North West Rail Link are shown in Figure 3.1.

The roads that are designated B-double routes providing access to and from all the sites are as follows:

- Beecroft Road;
- Castle Hill Road;
- Old Northern Road;
- Showground Road;
- Windsor Road; and
- M7/M2.

Figure 3.1 RTA B-Double Routes



Source: RTA Website (http://www.rta.nsw.gov.au)

3.3 Future road network upgrades

The NWRL Commuter Parking and Other Mode of Access Requirements report (PB 2006), outlines major road improvements and new road links in Table 3.1 in the North West region. This table indicates that the region is expected to benefit from significant

investment in road infrastructure over the coming decades. Generally, most of these new road improvements will occur in the North West Growth Centre to support the intensification of land development and transport activity that will occur there in the coming years. Other major road improvements, such as the Old Windsor Road and Windsor Road upgrades, are planned to improve accessibility to existing areas. Table 3.1 tabulates the extent of these road improvements.

The timing of many future road network upgrades is currently unknown and is dependent upon future traffic growth, which can be associated with the development of land in the North West.

Table 3.1 Future Road Improvements In The North West Region

Future road improvement	Location
Withers Road (4 lane arterial)	Annangrove Road – Commercial Road
Hambledon Road (4 lane arterial)	Schofields – Burdekin
Stanhope Parkway/ Burdekin Road/Townson Road (4 lane arterial)	The existing Stanhope Parkway is to be extended to Burdekin Road; Burdekin Road is to be extended westward across the Richmond Line and Eastern Creek to connect with Meadow Road, Townson Road and then Richmond Road
Riverstone Central (4 lane arterial)	Garfield Road East – Schofields (possibly replacing McCulloch Street and Boundary Road)
Quakers Hill Parkway (4 lanes)	Completion of 4 lanes for Quakers Hill Parkway between Richmond Road and Sunnyholt Road
Schofields Road/Windsor Road intersection upgrade	Potential intersection upgrade
Burns Road/Old Windsor Road intersection upgrade	Potential intersection upgrade
Schofields Road (4 lane – Transit Boulevard)	Railway Terrace – Windsor Road; conversion of an existing 2 lane rural road to a 4 lane divided road, including on-road public transport priority to service the Rouse Hill Regional Centre and the North West Growth Centre
New Shanes Park Boulevard (4 lane – Transit Boulevard)	Richmond Road – Stoney Creek Road
Grange Road (4 lane – Transit Boulevard)	Richmond Road – Carnarvon Road and Carnarvon Road – Schofields Road

Future road improvement	Location
Garfield Road East and Garfield Road West (4 lane – Transit Boulevard)	Railway Terrace – Windsor Road and Richmond Road – Railway Terrace; Garfield Road East and Garfield Road West will be upgraded to strengthen the existing east–west link between Richmond Road, Riverstone town centre, Windsor Road and Box Hill town centre; Garfield Road currently crosses the Richmond Rail Line at grade: An overpass on Garfield Road would require extensive ramps either side, which would adversely affect the amenity of the existing Riverstone town centre
Terry Road (4 lane Transit Boulevard)	
Nirimba town centre overpass – south	Burdekin and Townson Roads
Nirimba town centre overpass – north	Schofields and South Streets
Garfield Road railway overpass	Bridge replacing railway crossing at Riverstone
Pennant Hills Road upgrade (6 lanes)	Upgrade to 6 lane standard from Mahers Road to Marsden Road
M2 to F3 Link	Shortest connection between end of F3 at Wahroonga and M2 near Terrys Creek, with connections to the M2 in both directions.
Richmond Road upgrade (4 lanes)	Assumed upgrade to 4 lanes from Garfield Road to Rooty Hill Road North
Richmond Road upgrade (4 lanes)	Assumed upgrade to 4 lanes from The Northern Road to Garfield Road
Castle Hill/County Drive/ High Street intersection upgrade	Intersection upgrade
South Creek crossing, McGraths Hill (4 lanes)	Assume 4 lane connection from Windsor Road/Macquarie Street intersection to Windsor Road/Pitt Town Road intersection
Sunnyholt Road (4 lanes)	4 lanes from James Cook Drive to Malvern Road
Old Windsor Road/ Windsor Road (4 lanes)	Completion of 4 lanes south of Garfield Road
Windsor Road (6 lanes)	Upgrade to 6 lanes between Roxborough Park Road and Showground Road
Windsor Road (4 lanes)	Upgrade to 4 lanes between Garfield Road and the South Creek crossing intersection at Pitt Town Road
Lane Cove Tunnel	
Castle Hill Town Centre Ring Road	Eastern Ring Road – providing a connection from McMullen Avenue in the east, along Terminus Street to Cecil Avenue, and connecting to Old Northern Rd at Cecil Avenue with 4 traffic flow lanes and contingent turning bays

Sources: NWRL Commuter Parking and Other Mode of Access Requirements, Parsons Brinckerhoff, 2006.

In addition to these potential road upgrades, a network of internal roads will be developed within the North West Growth Centre arising from planning currently being

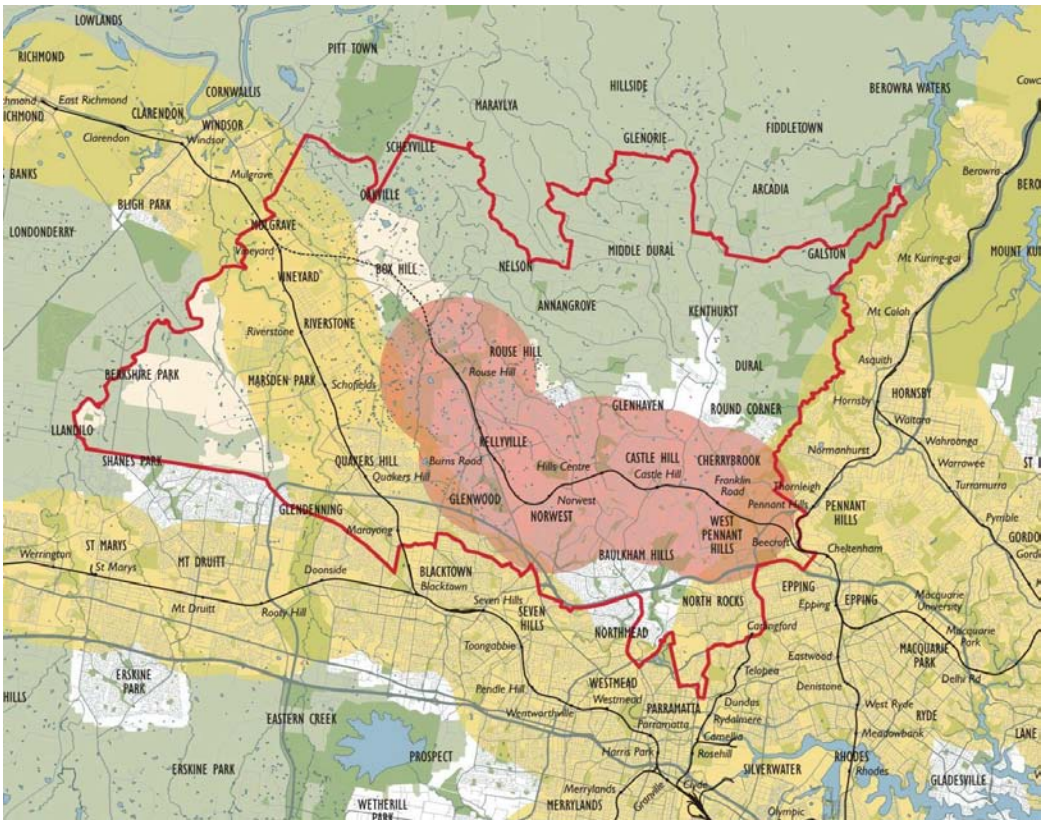
undertaken by the RTA, Growth Centres Commission and local Councils.

Further investigation would be required to determine future road conditions, traffic volumes and turning movements surrounding each construction site as part of future planning approval stages and design development. This will enable assessment of the actual impact of construction traffic on the local and arterial road network.

3.4 Existing and planned public transport corridors

Much of the urban growth in Sydney's north west has been developed without access to dedicated public transport infrastructure. As shown in Figure 3.2, the catchment for the existing CityRail network (shown in yellow and defined as a 3km radius in this illustration), leaves a significant area within the north west (bounded by the red line) without convenient access to rail services. The proposed north west Rail Link will service this catchment, as shown by the red shaded area.

Figure 3.2 Proximity to rail within the North West Region



Existing public transport corridors providing regionally significant services in Sydney's north west include the following key elements.

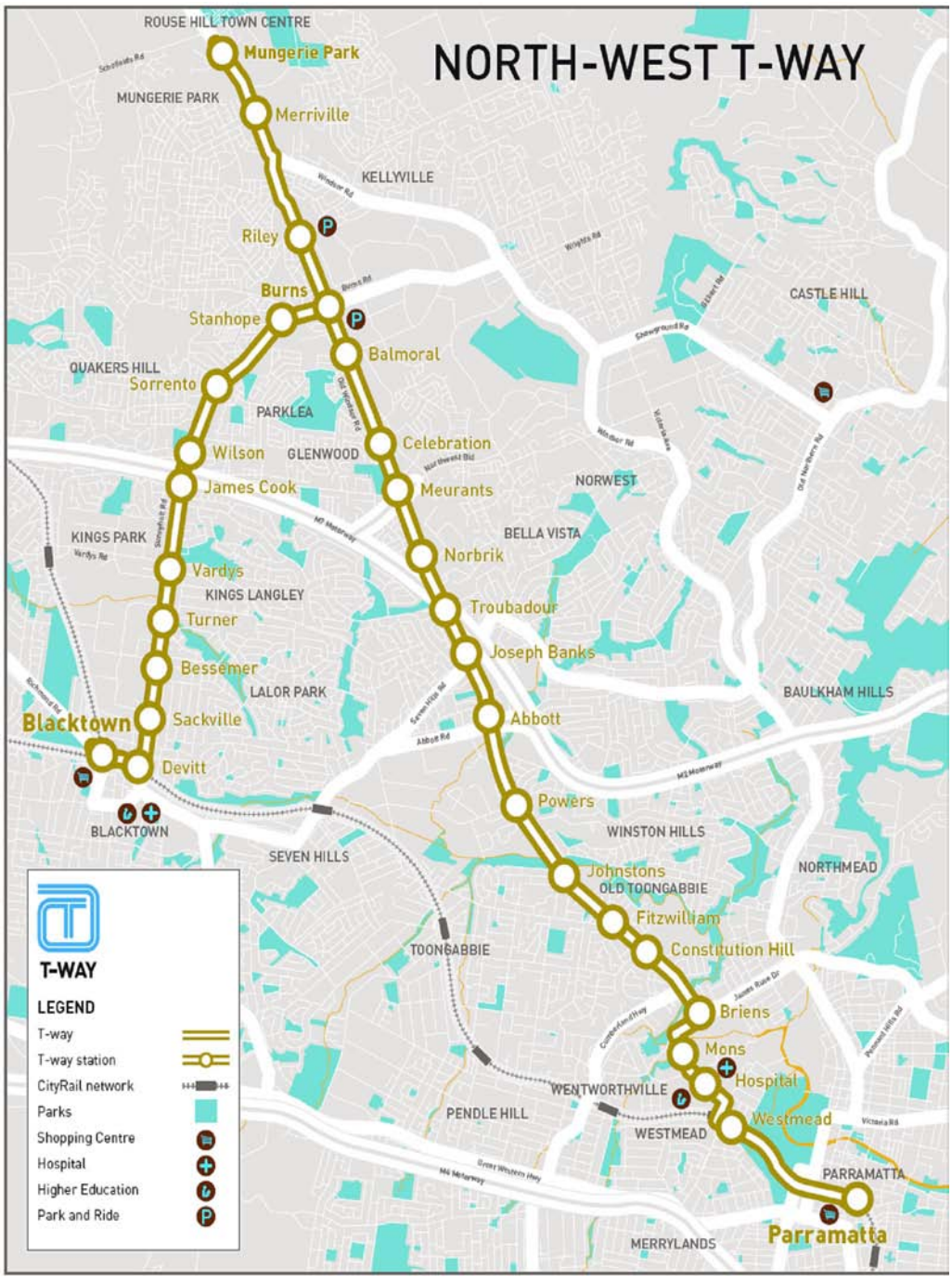
The Northern Rail Line provides passenger rail services between Hornsby and the City via Strathfield. Residents of the north west can currently access rail services via bus services to Pennant Hills, Beecroft and Epping or park and ride at stations between Cheltenham, Beecroft and Thornleigh.

The Western Rail Line and Richmond Rail Line provides passenger rail services

between Penrith or Richmond and the City via Parramatta and Strathfield. Residents of the north west can currently access rail services via connecting bus services to Blacktown, Seven Hills and Parramatta or park and ride at Seven Hills and other stations.

The North West Transitway Network is currently under construction and comprises of a Rouse Hill – Parramatta link via Windsor Road and Old Windsor Road, and a Blacktown – Parklea link via Sunnyholt Road and Burns Road. The network is illustrated in Figure 3.3. The Transitway network will facilitate high quality bus services along these corridors linking to regional centres and the CityRail network. These projects are expected to be operational by the end of 2007.

Figure 3.3 The North-West Transitway Network



Source: T-way Website (http://www.t-way.nsw.gov.au/)

The M2 Motorway provides a well-utilised busway that facilitates express bus services to the Lower North Shore and Sydney CBD. Westbus and Hillsbus operate bus services along this route. It is likely that the function and significance of the M2 busway will change following opening of the North West Rail Link and North West Transitways Network and possible modifications to bus contract conditions.

Strategic Bus Corridors are also currently being implemented across Sydney by the Ministry of Transport. This initiative builds on the recommendations of the *Review of Bus Services*, published by the NSW Government in February 2004. Strategic Bus Corridors recommended for the North West region included:

» Route 3 – Castle Hill to Blacktown and Wetherill Park;

» Route 5 – Castle Hill to Hornsby;

» Route 6 – Castle Hill to Epping;

» Route 42 – Rouse Hill to Parramatta (part of the North West Transitway Network); and

» Route 40 – Castle Hill to Parramatta.

3.5 Strategic planning context

The Sydney Metropolitan Strategy *(City of Cities – A Plan for Sydney's Future)* outlines the NSW Government's planning strategies for the Sydney Metropolitan Region for the next 25 years. Key objectives of the Metropolitan Strategy include the facilitation of new housing and employment opportunities in Western Sydney and integration of this growth with existing or planned transport infrastructure.

In particular, one of the key objectives of the Metropolitan Strategy is to "… *improve transport between Sydney's centres*" by extending the rail and bus networks to connect centres. One of the actions identified to achieve this goal is to "… *plan, and as appropriate, construct the North West – CBD – South West Rail Links*".[1]

The delivery of the North West Rail Link and development of the centres that it serves is a key part of the Strategic Planning Context for Sydney's North West.

3.6 Population and employment growth

Sydney's North West is an area that has seen significant urban growth over the last three decades. Areas such as West Pennant Hills, Cherrybrook, Baulkham Hills, Castle Hill and Kellyville have developed to become mature suburbs of metropolitan Sydney. Key centres that have developed in this area include Castle Hill, which is a significant retail centre inclusive of Castle Towers Shopping Centre, and the Norwest Business Park, a large office employment zone.

Further urban growth is planned to occur in the north west, as outlined by the Sydney Metropolitan Strategy. By 2031, the population of the north west is expected to increase by 300% to approximately 475,000 people, with employment increasing by 350% to 129,000 jobs[2]. Rouse Hill will become a new regional centre serving this Growth Centre.

A significant degree of employment growth is also expected in an area known as the Global Arc, between Macquarie Park and Sydney Airport, encompassing the Lower North Shore and Sydney CBD. The completion of the Epping to Chatswood Rail Link,

[1] City of Cities – A Plan for Sydney's Future, NSW Government, 2005.

[2] North West Rail Link Project Review Report - Background to the Project, PB, August 2006

expected in 2008, will allow a direct connection between this strategic corridor and the north west via the North West Rail Link.

Key centres served by the proposed North West Rail Link and their associated employment targets as outlined in the Metropolitan Strategy are presented in Table 3.2.

Table 3.2 Employment Growth in Key Centres served by the North West Rail Link

Centre	2001 Employment	2031 Employment Target	% Increase
Centres directly served by the North West Rail Link			
Norwest Business Park	4,651	15,000	223%
Castle Hill	9,091	12,000	32%
Rouse Hill	937	9,000	861%
Total	*14,679*	*36,000*	*145%*
'Global Arc' Centres served by the NW-CBD-SW rail link			
Macquarie Park	32,308	55,000	70%
Chatswood	22,923	28,000	22%
St Leonards	25,166	33,000	31%
North Sydney	49,160	60,000	22%
Sydney	331,572	380,000	15%
Sydney Airport	36,063	55,000	53%
Total	*497,192*	*611,000*	*23%*

Source: City of Cities – A Plan for Sydney's Future, NSW Government, 2005. p95

3.7 Travel demand

This significant growth in population and employment throughout the region will place an increased demand on the region's transport networks. The proposed North West Rail Link will be a key part of the regional public transport infrastructure to serve this increasing travel demand.

Growth in employment in the 'Global Arc' combined with residential growth in the north west is forecast to increase travel demand from north west Sydney. In 2001, 23% of the 116,500 daily trips to work from the north west were to Sydney's 'Global Arc'. In comparison, 15% of trips were to Parramatta and 10% to Blacktown. In 2031, it is forecast that the 'Global Arc' will be the destination for 25% of the 164,000 daily trips to work, whilst Parramatta and Blacktown will both account for 12% of trips. Thirty-three precent of work trips would be located within the north west. There is likely to be a similar growth in demand for other trip purposes (i.e. non-work trips) both within the north west and along the North West Rail Link corridor.

Residents of north west Sydney have the highest levels of car ownership and use per household in the Sydney metropolitan area. As illustrated in Figure 3.3, the proportion of car trips to work from the north west is amongst the highest levels in Sydney. This is likely to be due to the lack of public transport options in this area.

Figure 3.4 Proportion of Employees Travelling to Work by Car

Source: North West Rail Link Overview Report, Transport NSW, 2002.

4. Regional Benefits of the Project

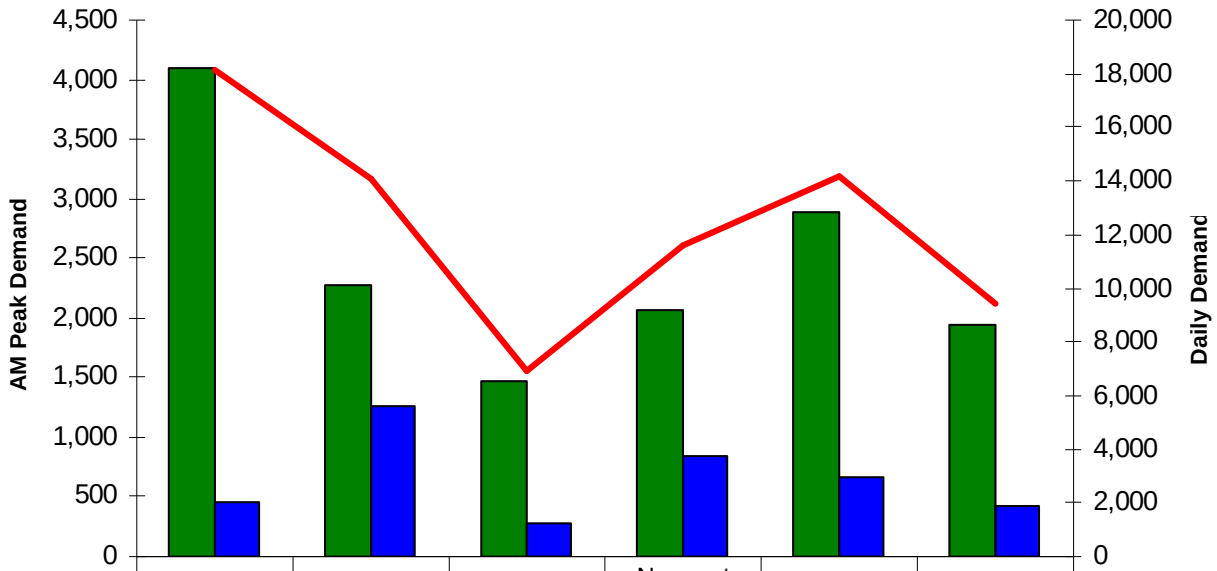
The North West Rail Link is forecast to provide a range of benefits to users and the wider community. This section of the report provides an overview of some of the key benefits expected for railway passengers, road users, pedestrians and cyclists.

4.1 Forecast passenger demand

The North West Transport Link Patronage Study (Parsons Brinckerhoff, 2005) developed a transport model to forecast patronage for 20 short-listed options including the North West Rail Link. This study forecast that patronage for the North West Rail Link was 17,900 trips (both directions) in the 2-hour AM peak period for the year 2021. The various patronage studies undertaken have resulted in a range of patronage estimates, from 15 million to 24 million trips per annum. This range reflects the different assumptions that have been made in the studies such as differences in surrounding land uses, accessibility, population and employment growth. Approximately 30% of forecast trips would be new passengers attracted to public transport, with the remaining 70% of trips transferring from existing services.

Patronage forecasts for each station, in terms of passenger entries and exits during the AM peak period and total daily demand are illustrated in Figure 4.1.

Figure 4.1 Forecast Passenger Demand



	Franklin Road	Castle Hill	Hills Centre	Norwest Business Park	Burns Road	Rouse Hill
Entry	4,103	2,277	1,472	2,067	2,882	1,937
Exit	457	1,253	275	843	667	420
Daily demand	18,163	14,060	6,958	11,590	14,135	9,388

Source: North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements, prepared by PB for TIDC, May 2006

Figure 4.1 illustrates the following information about the projected use of the North West Rail Link:

- Franklin Road Station will be the most heavily used station on the line, and will predominantly serve passengers travelling to other destinations;
- Burns Road Station is the second most patronised station on the line, and will form an important interchange point with the North West Transitway Network;
- Castle Hill Station will provide a location for both inbound and outbound trips, reflecting the substantial employment role of this centre; and
- Norwest Station will also attract a significant number of passengers travelling to employment.

4.2 Travel time savings

The North West Rail Link will provide considerable travel time savings for passengers.

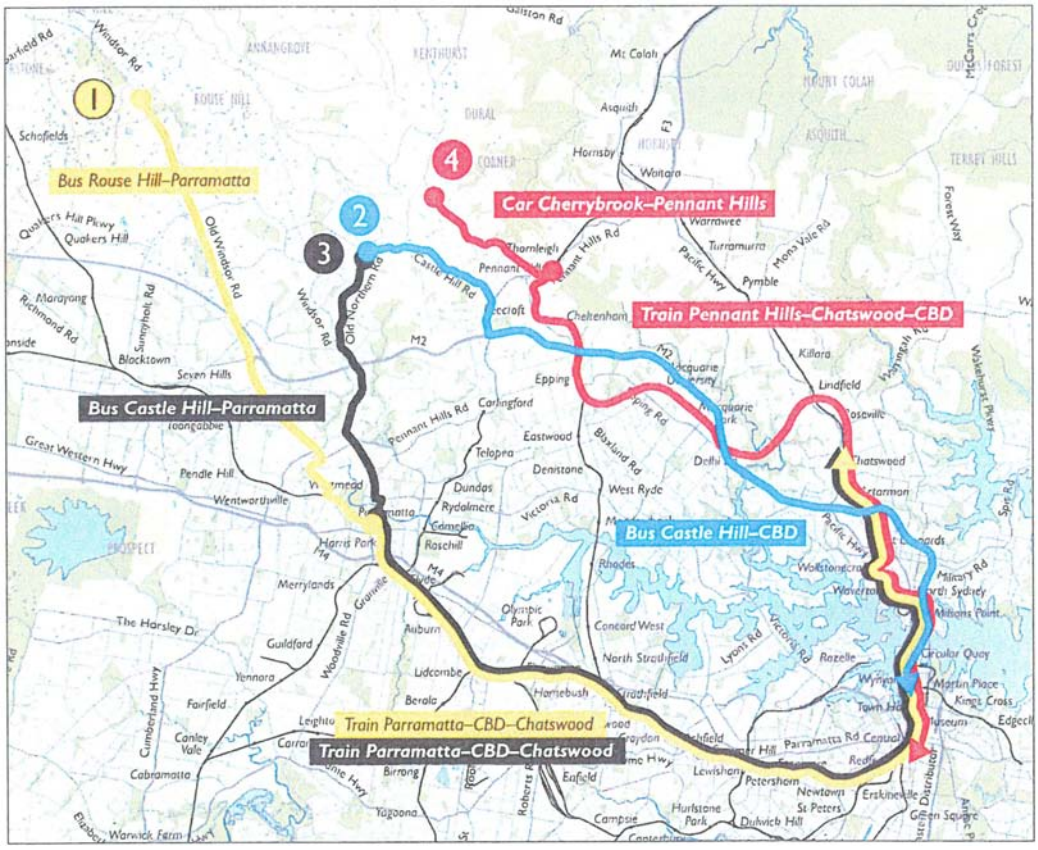
For example, the time taken for patrons to access the rail network would decrease by up to 30 minutes as a result of new stations being located close to passenger demand

in the north west.

Overall journey times would also be significantly reduced, most notably for those travelling between the north west and the employment centres in the 'Global Arc', such as Macquarie Park, Chatswood and St Leonards.

Figure 4.1 and Figure 4.1 show four example journeys by public transport in the morning peak, assuming the 2008 train timetable and network.

Figure 4.2 Current Travel Scenarios from the North West to Key Centres



Source: Project Application and Preliminary EA, SKM, May 2006, p22

Table 4.1 shows the expected travel time savings for the typical journeys illustrated above.

Table 4.1 Travel Time Savings Forecast for Selected Journeys arising from the North West Rail Link

	From	To	Mode(s)	Previous duration	New duration	Time Saving
1	Rouse Hill	Chatswood	Bus and train	86 min	39 min	47 min
2	Castle Hill	CBD	Car	70 min	45 min	25 min
3	Castle Hill	CBD	Bus and train	72 min	45 min	27 min
4	Cherrybrook	CBD	Car and train	59 min	45 min	14 min

It can be seen that for a range of journeys, significant travel time savings for both present car and public transport users can be expected. This will further support the NSW Government's objective of attracting users to public transport.

4.3 Road network benefits

The North West Rail Link would also provide a range of benefits to road users throughout the region.

Parsons Brinkerhoff (2005) found that in the absence of the North West Rail Link, car travel times from the north west area are expected to increase beyond current levels as growth in demand exceeds the available road network capacity.

The North West Rail Link would present an opportunity for a significant proportion of residents of the north west to transfer to the new railway and therefore reduce the number of cars using the road network. This could provide improved travel times for those persons who continue to use the road network, particularly on arterial routes during peak travel periods.

Benefits would also be seen in areas around the existing Northern Line. Residential areas surrounding stations such as Beecroft, Thornleigh and Pennant Hills currently experience high levels of on-street parking and localised congestion due to commuters travelling from areas to the west and northwest of the line. The North West Rail Link would reduce the need for commuters from the north west area to park at these rail stations by providing a direct rail service from many of these areas.

4.4 Rail network benefits

Parsons Brinkerhoff (2005) found a range of benefits that would flow to existing users of the CityRail network as a result of the construction of the North West Rail Link.

For example, rail passenger demand is predicted to double along the Richmond Line and parts of the Main West Line by 2021 if the proposed North West Rail Link does not proceed. This demand would be well in excess of available capacity on the western lines, resulting in significant overcrowding during peak periods.

However, with the North West Rail Link, passengers would be drawn to the new stations in the north west from the Richmond, Main West and Northern Lines. This would reduce overcrowding and provide some potential for future patronage growth.

It is proposed that services from the North West Rail Link would proceed to the CBD via the Epping-Chatswood Rail Link. In this corridor, an additional four services per hour would therefore travel via new stations at Epping, Macquarie University, Macquarie Park, Delhi Road and Chatswood before travelling down the North Shore Line. Rail passengers travelling to or from these areas would benefit from an increased service frequency of up to 12 services per hour, or one service every 5 minutes in peak periods.

4.5 Walking and cycling improvements

4.5.1 Improved facilities around stations

As part of station precinct planning, pedestrian and cyclist facilities would be provided for safe and convenient access to the railway, these facilities would provide an improvement also to the surrounding community. Typically, facilities would include pedestrian crossings, footpaths leading to station entrances and bicycle parking. Local Councils would be able to link these facilities into existing or planned local walking and cycling networks.

4.5.2 New walking and cycling links along the corridor

There are two locations where surface railway construction may provide an opportunity for walking and cycling links along the corridor.

Epping-Beecroft

As the Northern Rail Line is upgraded to four tracks, an opportunity would exist to provide a shared walking and cycling path in the Epping-Beecroft corridor.

A shared pedestrian-cycle facility along the Epping-Beecroft corridor would be a regionally significant link available to both pedestrians and cyclists. It would be likely to be used by wide range of users, including school children, recreational walkers, and cyclists travelling to work or shopping.

Local Councils could use this path to connect to local walking and cycling routes, providing improved access between residential areas, town centres and train stations.

Key issues to be considered in developing a preferred concept for this route are provision of direct links to rail stations, crossing of the M2 Motorway, possible links to the M2 cycleway, and potential for co-location within the rail corridor, subject to the corridor upgrading works.

Norwest-Rouse Hill

The second aboveground section of the North West Rail Link would be north of Norwest Business Park to Rouse Hill. In this section of the corridor, a new walking and cycling path is currently under construction along the Parramatta-Rouse Hill Transitway. As part of the planning for the North West Rail Link, the opportunity to connect to this regional walking and cycling link should be considered.

5. Analysis of Operational Impacts

This section of the report provides a discussion of the key issues to be considered during the operational phase of the project, with particular focus given to each of the proposed rail stations and the interaction with local and regional transport.

5.1 Rail operations

Key features of the operating plan for the North West Rail Link are outlined below.

5.1.1 Service route and stops

Trains on the North West Rail Link would most likely operate from Rouse Hill to the City via the Epping-Chatswood Rail Link and the Harbour Bridge. Trains would stop at all stations on the North West Rail Link and Epping-Chatswood Rail Link before meeting the North Shore Line and stopping at St Leonards, Mount Street (North Sydney), and new CBD stations. Trains would then continue south towards Wolli Creek via either Sydenham or the Airport Lines. North West Rail Link trains are not planned to stop at Cheltenham Station, with Epping providing the connection.

5.1.2 Travel time

It is estimated that train services would take 22 minutes to travel from Rouse Hill Station to Epping Station, stopping at North West Rail Link stations approximately every 3 minutes. From Epping, trains would take a further 17 minutes to reach Chatswood and 38 minutes to reach Town Hall.

5.1.3 Service frequency

In 2017, up to eight trains per hour would operate in the peak hour, equivalent to a train service every 5-10 minutes during peak times, and every 15 minutes in the off peak period.

5.2 Station access

Existing access modes for RailCorp train passengers in Sydney include walking, cycling, car driving, car passengers and bus travel. The proportion of each mode of access varies by station, depending on the interchange facilities provided and surrounding development.

The NWTL Patronage Study (Parsons Brinckerhoff 2005) forecast the mode of access to the proposed North West Rail Link. Due to the strategic nature of the model, it did not estimate mode of access by station. However, the study found that car access would be the single most popular mode of transport to rail stations (41%), including 22% by kiss and ride and 19% by park and ride. In addition, it was forecast that 36% of passengers would walk, 22% would arrive by bus, and 1% would arrive by other modes (including bicycle and taxi). It was acknowledged that park and ride access would depend on the availability and supply of parking at each station.

Accordingly, provision for each mode of access has been planned as part of station concepts for the North West Rail Link. This includes:

» Provision of high quality pedestrian links to each station;

» Provision for bicycle parking at each station;

» Kiss and ride passenger drop off zones at all stations;

» Bus interchanges at stations where bus services are likely to integrate with rail services; and

» Commuter car parking at stations where sufficient land and access to major roads is available.

Further studies will be required to optimise the integration of all transport modes at each proposed station, providing high quality access to North West Rail Link services.

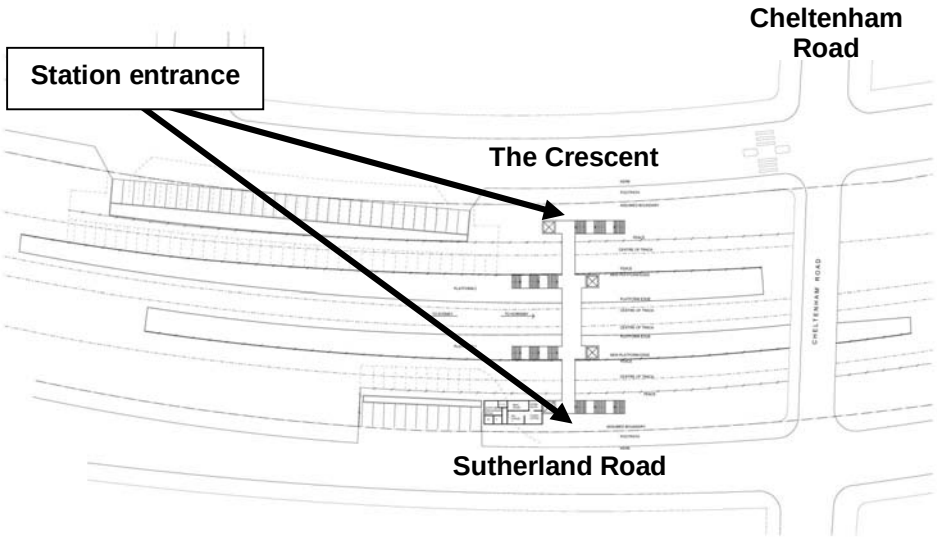
5.3 Cheltenham Station

North West Rail Link trains are not proposed to stop at Cheltenham Station. However, the quadruplication of the Northern Line between the North West Rail Link dive site and Epping would require station modifications at Cheltenham, which are discussed below. No additional works would be required at Epping Station.

5.3.1 Key features

An indicative station layout at Cheltenham Station is shown in Figure 5.1.

Figure 5.1 Cheltenham Station Indicative Layout



Source: Hassell, 2006.

Key features of the proposed station are as follows:

» Two island platforms at ground level accessed via a pedestrian bridge or tunnel; and

» Rail corridor widening works would require at least partial removal of commuter car

parking.

5.3.2 Passenger demand

Patronage demand has not been forecast for Cheltenham Station, as North West Rail Link trains are not proposed to stop at this station. However, it would be expected that patronage at this station could decrease following the opening of the North West Rail Link as commuters from suburbs west of Cheltenham access new stations at Franklin Road.

5.3.3 Integration with bus services

Currently, no regular bus routes service Cheltenham Station. Night ride bus services travel via Beecroft Road and do not connect with the station.

5.3.4 Integration with the road network

Cheltenham Station is located approximately 500m northeast of Beecroft Road and is accessed via a signalised intersection at Cheltenham Road.

Roads immediately surrounding Cheltenham Station are minor collector roads.

5.3.5 Interchange requirements

Bus

As no regular bus routes currently serve Cheltenham Station it is unlikely that a bus interchange will be required.

Taxi

It is unlikely that a dedicated taxi bay will be required. Taxi pick up and drop off could be conducted at the kiss and ride point.

Kiss and Ride

A kiss and ride point would be required at the redeveloped rail station. This facility should be conveniently located to the station entrance, and would most likely be on The Crescent, south of Cheltenham Road.

Park and Ride

Commuter parking is currently provided at Cheltenham Station as follows:

- Eastern side – 13 spaces (including 1 disabled space)
- Western side – 68 spaces (including 4 disabled spaces)
- Unrestricted kerbside parking is also available in most streets surrounding the railway station.

It is anticipated that both car parks would be removed as a result of the rail corridor widening.

Following the opening of the North West Rail Link, parking demand could be expected to decrease as commuters from suburbs west of Cheltenham access the park and ride

facility at Franklin Road Station.

Further study of the parking demand and impacts following the opening of the North West Rail Link on the local area may be required. Disabled passenger car parking should be maintained during construction and operation of the North West Rail Link.

Bicycle Parking

Bicycle parking is currently provided at Cheltenham Station, accessed from The Crescent. If bicycle parking is to be removed during construction works, temporary facilities should be provided and conveniently located bicycle parking should be provided following completion of works. Permanent facilities will also need to be appropriately located.

5.3.6 Pedestrian access

Pedestrian access to the rail station would be via a pedestrian bridge or tunnel accessible from The Crescent and Sutherland Road. A key pedestrian desire line is to Cheltenham Girls High School, which is located on The Promenade.

5.3.7 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Cheltenham Station are likely to be as follows:

» A decrease in overall passenger demand as passengers join rail services west of Cheltenham;

» A reduction in the number of dedicated commuter parking spaces available. It is possible that this may be mitigated by the decrease in passenger demand and relative availability of unrestricted kerbside parking near the station; and

» Improved facilities at the station, including easy access lifts, to be constructed as part of the rail quadruplication works, which would provide a higher quality station for passengers.

5.3.8 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:

  – parking demand and potential impacts following removal of commuter parking at the station;

» Design and delivery of the station should provide:

  – suitable car parking to replace existing facilities for disabled passengers;

  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;

  – bicycle parking and access routes to enable convenient access to the station.

5.4 Franklin Road Station

5.4.1 Key features

Key features of the proposed station are as follows:

» One underground island platform accessed via a pedestrian concourse;

» Interchange with local buses; and

» Provision for Park and Ride.

5.4.2 Passenger demand

Franklin Road Station is forecast to be the highest patronised station on the North West Rail Link.

Passenger demand for Franklin Road Station is forecast for the year 2021 as follows:

» 2 hour AM peak entries = 4,103

» 2 hour AM peak exits = 457

» Daily demand = 18,163

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.4.3 Integration with bus services

Westbus currently operates approximately ten bus routes along Castle Hill Road, past the proposed Franklin Road Station. It is possible that there will be changes to some of these routes following the opening of the North West Rail Link and further studies will be required to ensure optimised integration with the new rail station.

5.4.4 Integration with the road network

Franklin Road Station would be located immediately north of Castle Hill Road, which would provide good east-west connectivity to surrounding areas.

North-south access from Cherrybrook and West Pennant Hills is limited by a lack of suitable road connections. County Drive is the most direct route, which connects New Line Road to Castle Hill Road.

Other roads immediately surrounding the proposed Franklin Road Station are Franklin Road and Robert Road, which are local residential roads.

5.4.5 Interchange requirements

Bus

Franklin Road Station would play a minor bus interchange role. Bus interchange is expected at two locations:

» Local bus interchange on the station access road, with bus bays in each direction outside the station entrance; and

» Regional bus interchange on Castle Hill Road, with two bus bays in each direction outside the station entrance;

Covered, well-lit pedestrian paths would be required between all bus stops and the station entrance. Bus stops on the southern side of Castle Hill Road should be located within close proximity of Glenhope Road to enable pedestrians to cross at the proposed signalised intersection.

Taxi

It is unlikely that a dedicated taxi bay would be required. Taxis pick up and drop off could be conducted at the kiss and ride point and bus stops.

Kiss and Ride

A kiss and ride point would be required at the new rail station. This facility should be conveniently located to the station entrance, and would most likely be on the station access road, off Castle Hill Road.

Park and Ride

A high of demand is forecast at Franklin Road Station, including passengers from Cherrybrook, Castle Hill and West Pennant Hills and some potential transfer of passengers currently using the Northern Line. A target of about 500 spaces would be investigated noting that this precinct has some road network constraints.

Bicycle Parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.4.6 Impact on surrounding road network

The park and ride facility has the potential to impact on the operation of local roads during peak periods. For this reason, it is recommended that any future park and ride facility should be accessed via Castle Hill Road or collector roads directly accessible from Castle Hill Road. Depending on the size of the facility, numerous egress points may be required to reduce the potential for queuing following the arrival of a train. It is also recommended that park and ride access and egress routes are segregated from bus routes in order to ensure that impacts to bus services are minimised during peak periods.

The intersection of Castle Hill Road with Glenhope Road would be the preferred point of access to the park and ride facilities, as this location provides improved sight distances to the intersection of Franklin Road. The impact of a new intersection at this location would require further investigation to ascertain the impact on through traffic on Castle Hill Road.

A local connectivity study is required to manage vehicle access to the station and mitigate the impacts of any increase in traffic on local roads.

5.4.7 Pedestrian access

Pedestrian access to the rail station site is currently constrained due to large block

sizes, unconnected street networks, topography and a lack of pedestrian crossings on Castle Hill Road.

Key pedestrian desire lines to be considered include local bus stops, the park and ride facility, Tangara and Inala Schools, the IBM campus on Coonara Avenue, and connections north to Cherrybrook and south to West Pennant Hills.

Where possible, opportunities for new pedestrian connections should be investigated to maximise pedestrian permeability through the surrounding area.

Due to an increase in pedestrian activity around the station, a signalised pedestrian crossing is likely to be required on Castle Hill Road at Glenhope Road. If the intersection at Franklin Road were signalised, a pedestrian crossing would also be beneficial at this location.

5.4.8 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Franklin Road Station are likely to be as follows:

» An increase in the number of local traffic movements and potential for congestion, the extent of which will be largely determined by the capacity and access arrangements of the park and ride facility; and

» An improved environment for pedestrians as new road crossings, footpaths and interchange areas provide access to the rail station; and

» Improved accessibility of the Franklin Road area to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.4.9 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:
  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to areas north and south of the proposed station;
  – the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the location and access to the park and ride facility, minimising delay to bus services, potential impacts on local residential streets and operation of intersections on Castle Hill Road;
  – integration of bus services with the new rail station including the design and location of the bus interchange;

» Design and delivery of the station should provide for:
  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;
  – signalised pedestrian crossings would be required to facilitate pedestrian access across Castle Hill Road;

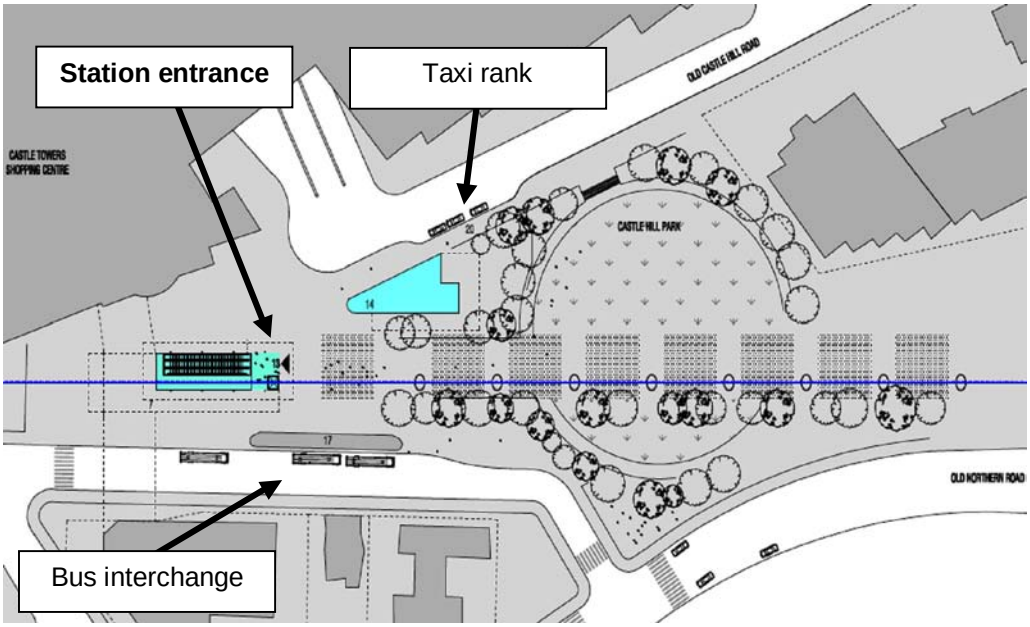
– bicycle parking and access routes to enable convenient access to the station.

5.5 Castle Hill Station

5.5.1 Key features

The indicative station layout at Castle Hill Station is shown in Figure 5.3.

Figure 5.2 Castle Hill Station Indicative Layout



Source: TIDC, 2006

Key features of the proposed station are as follows:

» One underground island platform accessed via a pedestrian concourse; and

» Interchange with local and regional buses;

5.5.2 Passenger demand

Castle Hill Station is forecast to be the third most patronised station on the North West Rail Link.

Passenger demand for Castle Hill Station is forecast for the year 2021 as follows:

» 2 hour AM peak entries = 2,277

» 2 hour AM peak exits = 1,253

» Daily demand = 14,060

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.5.3 Integration with bus services

Westbus currently operates numerous bus routes around Castle Hill, with Old Castle

Hill Road being a major terminus. Castle Hill is also a focus of a Strategic Bus Corridor and the potential future Castle Hill – Burns Road Transitway linking to Blacktown, Parramatta and Rouse Hill.

5.5.4 Integration with the road network

Castle Hill Station is located immediately adjacent to Old Northern Road and provides good east-west connectivity to surrounding areas.

Baulkham Hills Council and the RTA have developed a plan for a future bypass of Castle Hill Town Centre that would see through traffic diverted from Old Northern Road to Terminus Street. This has the potential to create an environment in which pedestrian and public transport is favoured over through vehicle movements.

5.5.5 Interchange requirements

Bus

Castle Hill Station would play a major bus interchange role. Bus interchange is expected on Old Northern Road, immediately south of the proposed station access. Most bus routes would be expected to terminate at Castle Hill.

It is estimated that up to eight bus ranks, two set down ranks and four layover ranks will be required for buses at Castle Hill Station[3]. Driver facilities would also be required.

A high quality bus interchange would be required to provide for the large number of passenger interchange movements at Castle Hill Bus Interchange, including shelters, lighting, signage and walkways.

Taxi

A dedicated taxi rank would be required and could be located at the rear of the station in Old Castle Hill Road. Alternative taxis pick up and drop off could be conducted at the kiss and ride point and bus stops.

Kiss and Ride

Dedicated kiss and ride locations would be required at the new rail station. It would be preferable to provide at least two kiss and ride facilities to the north and south of the station most likely on Old Castle Hill Road and Old Northern Road. In selecting the location for kiss and ride, it would be necessary to ensure that the kiss and ride does not conflict with bus movements and that pedestrians can safely and conveniently access the station entrance.

Park and Ride

No commuter park and ride facility is proposed at Castle Hill Station due to its location within the Castle Hill CBD and transit oriented land uses.

[3] *Commuter Parking and Other Mode of Access*, TIDC, 2006.

Bicycle parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.5.6 Pedestrian access

Pedestrian access to the rail station site is currently good with nearby pedestrian signalised crossings across Old Northern Road and connections to a number of nearby streets. The future works associated with the Old Northern Road bypass should also provide for enhanced pedestrian connectivity to the site.

Key pedestrian desire lines to be considered include local bus stops, Castle Towers Shopping Centre, shops on Old Northern Road, local schools and the community centre.

There is potential in the future to directly link the rail station with the Castle Towers Shopping Centre via an underground pedestrian link. Consultation should be undertaken with Council to allocated land areas for this future purpose and then further investigation into its feasibility can be completed as part of the detailed design development process.

5.5.7 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Castle Hill Station are likely to be as follows:

» An increased focus and requirement for prioritised bus, pedestrian and cycle movements in the town centre providing access to land uses and the interchange, with through traffic to be diverted around the centre; and

» Improved accessibility of Castle Hill town centre to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.5.8 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:

  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, including potential pedestrian connections to the bus interchange, Castle Towers Shopping Centre, other shops on Old Northern Road, and local schools and community facilities;

  – the potential impacts of traffic accessing the station from the surrounding road network following the completion of the proposed town bypass, with particular attention given to minimising delay to bus services, interaction with nearby retail and employee parking and operation of intersections on Old Northern Road;

  – optimised integration of bus services with the new rail station including the design and location of the bus interchange;

» Design and delivery of the station should provide for:

– well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;
– signalised pedestrian crossings would be required to facilitate pedestrian access across Old Northern Road;
– bicycle parking and access routes to enable convenient access to the station.

5.6 Hills Centre Station

5.6.1 Key features

Key features of the proposed station are as follows:

» One underground island platform accessed via a pedestrian concourse;

» Interchange with local buses; and

» Provision for Park and Ride.

5.6.2 Passenger demand

Hills Centre Station would be sixth (lowest) patronised station on the North West Rail Link.

Passenger demand for Hills Centre Station is forecast for the year 2021 as follows:

» 2 hour AM peak entries = 1,472

» 2 hour AM peak exits = 275

» Daily demand = 6,958

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.6.3 Integration with bus services

Westbus currently operates approximately two bus routes along Carrington Road and two bus routes along Showground Road, past the proposed Hills Centre Station.

Future operation of a Strategic Bus Corridor is also planned along Carrington Road, linking Burns Road to Castle Hill.

It is unlikely that bus services would terminate at Hills Centre Station.

5.6.4 Integration with the road network

Hills Centre Station would be located approximately 250m southwest of Showground Road, which provides good connectivity to surrounding areas.

Direct access to the station is likely to be via Carrington Road and Doran Drive. A secondary access road could be provided to meet with Showground Road and improve access/circulation.

North-south access from Cherrybrook and West Pennant Hills is limited by a lack of suitable road connections.

Other roads immediately surrounding Hills Centre Station are local residential roads.

5.6.5 Interchange requirements

Bus

Hills Centre Station would play a minor bus interchange role. Bus interchange is expected at two locations:

» Local bus interchange on Doran Drive, with two bus bays in each direction near Carrington Road;

» An opportunity for local bus interchange on Carrington Road, near Doran Drive; and

» An opportunity for interchange with a future Strategic Bus Route on Carrington Road (infrastructure to be determined in the future);

Provision of a high quality pedestrian connection (covered, lit pathway) to a Carrington Road bus stop would provide a more attractive travel option for through bus services.

Well-lit pedestrian paths will be required between all bus stops and the station entrance.

Taxi

It is unlikely that a dedicated taxi bay will be required. Taxis pick up and drop off could be conducted at the kiss and ride point and bus stops.

Kiss and Ride

A kiss and ride point would be required near the new rail station. This facility should be conveniently located to the station entrance, and would most likely be on the extension of Doran Drive.

Park and Ride

High demand for park and ride is expected at Hills Centre Station as an attractive park-and-ride location for commuters from Kellyville, Baulkham Hills and Castle Hill. A target of between 1,000 and 1,200 spaces would be investigated. Space constraints may limit the ability to achieve this target. This facility could be available for shared use by Showground and Hills Centre visitors, as demand associated with these facilities would not coincide with periods of high commuter demand.

Bicycle parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.6.6 Impact on surrounding road network

The park and ride facility has the potential to impact on the operation of the local roads during peak periods. Future investigations should consider the egress requirements for this car park and interaction with traffic on the adjacent Showground Road. It is likely that access via an intersection with Showground Road would be limited to left-in, left-out only with alternative access provided via Carrington Road. It is also recommended that park and ride access and egress routes be segregated from bus

routes in order to ensure that the impact to bus services is minimised during peak periods.

5.6.7 Pedestrian access

Pedestrian access to the rail station site is currently constrained due to large block sizes, unconnected street networks, and a creek to the west of the station.

Key pedestrian desire lines to be considered include local bus stops, the park and ride facility, the Hills Centre, Baulkham Hills Council, and businesses located in the Castle Hill Industrial Zone.

Where possible, opportunities for new pedestrian connections should be investigated to maximise pedestrian permeability through the surrounding area.

Due to an increase in pedestrian activity around the station, some form of pedestrian crossing will be required on Carrington Road to allow access from local areas and potential bus stops in this area.

5.6.8 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Hills Centre Station are likely to be as follows:

» An increase in the number of local traffic movements and potential for congestion, the extent of which will be largely determined by the capacity and access arrangements of the park and ride facility; and

» An improved environment for pedestrians as new road crossings, footpaths and interchange areas provide access to the rail station; and

» Improved accessibility of the Hills Centre area to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.6.9 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:

  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to pedestrian generators within the Showground Area, the Hills Centre, Baulkham Hills Council and the Castle Hill Industrial Area;

  – the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the location and access to the park and ride facility, minimising delay to bus services, potential impacts on local residential streets and operation of intersections on Showground Road;

  – the potential for shared use of an existing or future parking facility for use by rail commuters;

  – optimised integration of bus services with the new rail station including the

design and location of the bus interchange;

» Design and delivery of the station should provide for:

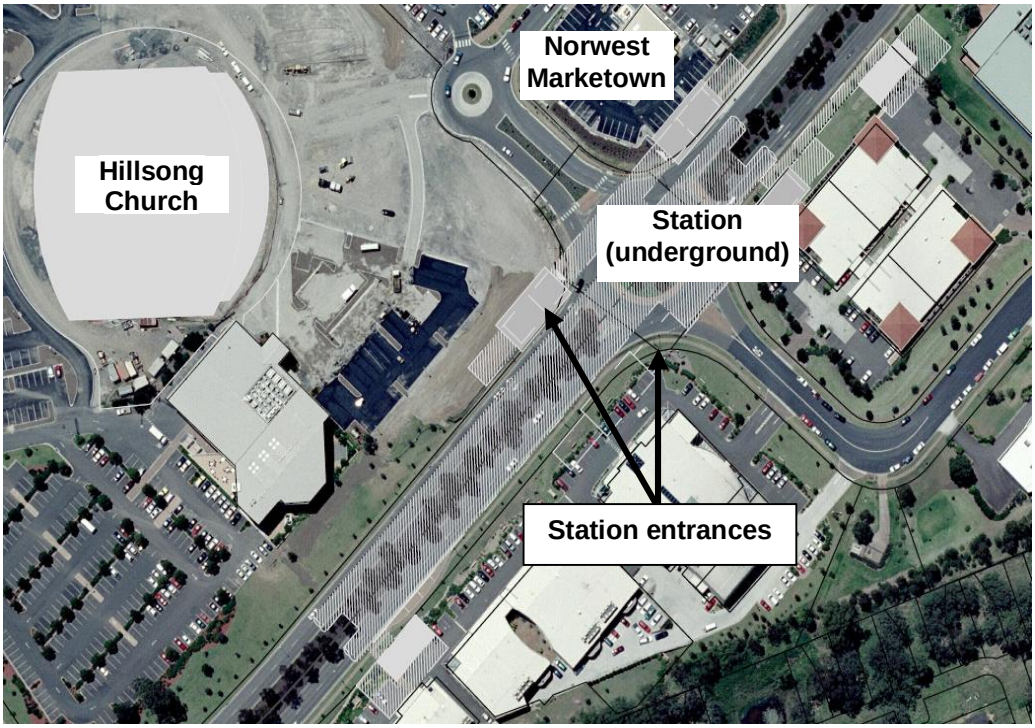
  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;
  – pedestrian crossing facilities across Carrington Road;
  – bicycle parking and access routes to enable convenient access to the station.

5.7 Norwest Station

5.7.1 Key features

An indicative station layout at Norwest Station is shown in Figure 5.5.

Figure 5.3 Norwest Station Indicative Layout



Source: TIDC, 2006

Key features of the proposed station are as follows:

» One underground island platform accessed via a pedestrian concourse;

» Interchange with local buses; and

5.7.2 Passenger demand

Norwest Station is forecast to be the fourth most patronised station on the North West Rail Link.

Passenger demand for Norwest Station is forecast for the year 2021 as follows:

- 2 hour AM peak entries = 2,067
- 2 hour AM peak exits = 843
- Daily demand = 11,590

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.7.3 Integration with bus services

Westbus currently operates approximately ten bus routes along Norwest Boulevard, past the proposed Norwest Station.

It is unlikely that bus services would terminate at Norwest Station.

5.7.4 Integration with the road network

Norwest Station would be located immediately underneath Norwest Boulevard, which provides good east-west connectivity to surrounding areas. North-south access is available via a number of local roads.

Other roads immediately surrounding the proposed Norwest Station are local roads serving businesses in the Norwest Business Park. Access to the station would be difficult from the residential areas of Bella Vista and Baulkham Hills, a future study should be undertaken to ensure good access to the station.

5.7.5 Interchange requirements

Bus

Norwest Station would play a minor bus interchange role. Bus interchange is expected on Norwest Boulevard near Brookhollow Avenue with two bus bays in each direction outside the station entrance.

Covered, well-lit pedestrian paths would be required between all bus stops and the station entrances. Grade separated and signalised pedestrian crossings would be required to facilitate pedestrian access to bus stops on each side of Norwest Boulevard.

Taxi

It is unlikely that a dedicated taxi bay would be required. Taxis pick up and drop off could be conducted at the kiss and ride point and bus stops.

Kiss and Ride

A kiss and ride point would be required at the new rail station. This facility should be conveniently located to the station entrance, and would most likely be on the new Brookhollow Avenue and / or Century Circuit.

Park and Ride

Commuter parking would be desirable at this location to service commuters from Blacktown and Kellyville. However, access and space constraints limit the ability to provide parking facilities at this station and therefore no commuter parking is proposed.

However, opportunities for shared use arrangements with adjacent properties would be investigated.

Bicycle parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.7.6 Impact on surrounding road network

Commuters accessing the station by bus and kiss and ride will add to the level of traffic on roads leading to the rail station. This traffic demand has the potential to coincide with arrival and departure of employees working within the Norwest Business Park during peak periods. For this reason, it is recommended that access requirements of the station be considered further during design of the station and surrounds to minimise the impact on local roads and intersections. It is also recommended that bus routes are segregated from potential conflict points in order to ensure that bus services are not delayed during peak periods as a result of local congestion.

5.7.7 Pedestrian access

Pedestrian access to the rail station site is currently constrained due to large block sizes and a lack of pedestrian crossings on Norwest Boulevard.

Key pedestrian desire lines to be considered include Norwest Marketown, Hillsong Church and nearby businesses/residential.

Where possible, opportunities for new pedestrian connections should be investigated to maximise pedestrian permeability through the surrounding area. This would be undertaken within a local connectivity study, focusing upon connections to residential areas in Kellyville and Bella Vista.

Due to an increase in pedestrian activity around the station, grade separated and signalised pedestrian crossings would be required to facilitate pedestrian access across Norwest Boulevard.

5.7.8 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Norwest Station are likely to be as follows:

» An increase in the number of local traffic movements and potential for congestion;

» An improved environment for pedestrians as new road crossings, footpaths and interchange areas provide access to the rail station; and

» Improved accessibility of the Norwest Business Park to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.7.9 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:
  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to pedestrian generators such as Norwest Marketown, Hillsong Church and nearby businesses and access to residential areas north and south of the station;
  – the potential impacts of traffic accessing the station from the surrounding road network, minimising delay to bus services and operation of intersections on Norwest Boulevard;
  – the potential for shared use of an existing or future parking facility for use by rail commuters;
  – optimised integration of bus services with the new rail station including the design and location of the bus interchange;
» Design and delivery of the station should provide for:
  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;
  – grade separated and signalised pedestrian crossings would be required to facilitate pedestrian access across Norwest Boulevard;
  – bicycle parking and access routes to enable convenient access to the station.

5.8 Burns Road Station

5.8.1 Key features

The surrounding land uses are indicative only and would be subject to extensive planning by relevant stakeholders.

Key features of the proposed interchange are as follows:

» One underground island platform accessed via a pedestrian concourse;

» Interchange with local buses and Transitway services; and

» Provision for Park and Ride.

5.8.2 Passenger demand

Burns Road Station is forecast to be the second most patronised station on the North West Rail Link.

Passenger demand for Burns Road Station is forecast for the year 2021 as follows:

» 2 hour AM peak entries = 2,882

» 2 hour AM peak exits = 667

» Daily demand = 14,135

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.8.3 Integration with bus services

Burns Road Station would be located at the junction of two Transitway routes – Rouse Hill to Parramatta and Burns Road to Blacktown. A major bus and rail interchange is planned at this location.

Hillsbus also currently operates a number of bus routes along Old Windsor Road, past the proposed Burns Road Station.

It is possible that a number of bus services would terminate at Burns Road Station and this would be likely to occur within the Transitway interchange.

5.8.4 Integration with the road network

Burns Road Station would be located adjacent to Old Windsor Road and Burns Road, which provides good arterial connectivity to surrounding areas.

Balmoral Road provides an alternative access point from the south of the station.

Other roads immediately surrounding Burns Road Station are local residential roads.

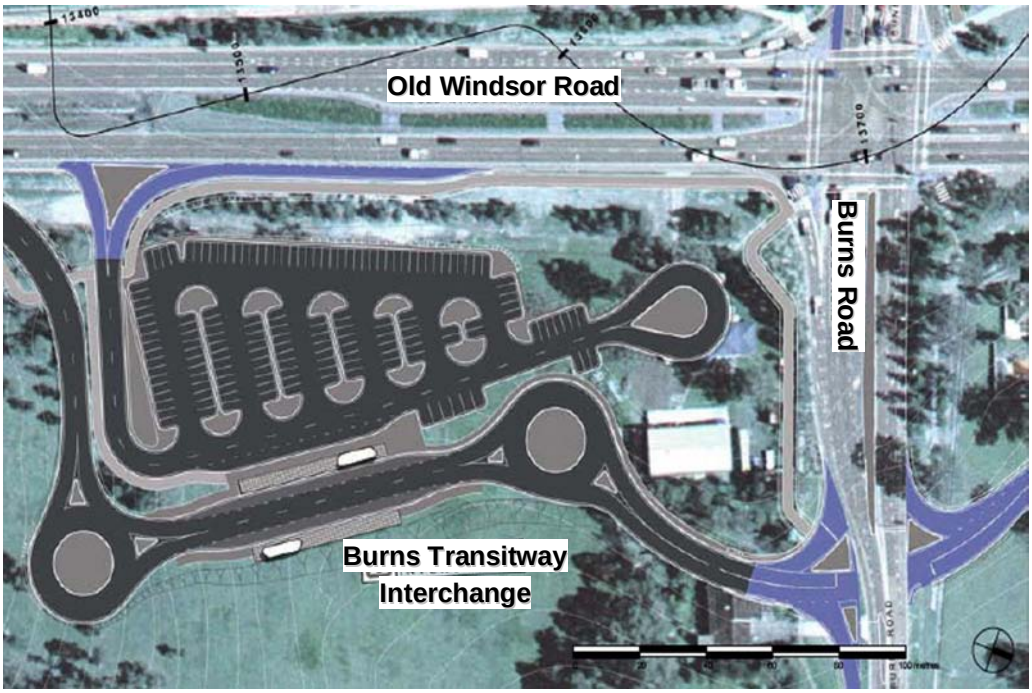
A network of new local roads are planned as part of the Balmoral Road Release Area. A preliminary review of the Baulkham Hills Development Control Plan No. 20 shows that the local road network is not well integrated with the proposed Burns Road Station. The road network in this area should be reviewed with the aim of maximising local access to the proposed railway station.

5.8.5 Interchange requirements

Bus

Burns Road Station would play a major bus interchange role. The proposed bus interchange layout is illustrated below.

Figure 5.4 Burns Road Transitway Interchange Layout



Source: Transitway Website (http://www.tway.nsw.gov.au/)

Bus interchange is expected within the dedicated Transitway interchange. It is currently expected that local bus services and Transitway services would both use the bus interchange facility.

It is noted that the latest design for the Burns Transitway Interchange has changed since the initial design exhibited in the Environmental Impact Statement. However, the Burns Road Station Concept has been developed on the basis of this earlier design. Therefore, there is a need to update the concept plan for Burns Road Station and surrounds.

Covered, well-lit pedestrian paths will be required between the Transitway interchange and the station entrance.

Taxi

It is unlikely that a dedicated taxi bay will be required. Taxis pick up and drop off could be conducted at the kiss and ride point and bus stops.

Kiss and Ride

A kiss and ride point would be required at the new rail station. This facility should be conveniently located to the station entrance, and would most likely be located within the station development site on an internal access road.

Park and Ride

High demand for park and ride from Blacktown and Kellyville would be expected at Burns Road Station, particularly if parking is not available at Norwest Station. A target of up to 1,200 would be initially investigated. However, this would be subject to review

based on patronage associated with the Bus Transitway.

Bicycle parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.8.6 Impact on surrounding road network

The park and ride facility has the potential to impact on the operation of local roads during peak periods. Depending on the size of the parking areas, a number of egress points may be required in order to reduce the potential for queuing following the arrival of a train. It is also recommended that park and ride access and egress routes be segregated from bus routes in order to ensure that the impact on bus services is minimal during peak periods.

5.8.7 Pedestrian access

Pedestrian access to the rail station site is currently constrained due to large block sizes, unconnected street networks and the physical barrier formed by Old Windsor Road which can only be crossed at signalised intersections.

Key pedestrian desire lines to be considered include the Transitway interchange and nearby park and ride facilities and links to the shared path being constructed as part of the Transitway.

Future developments surrounding the site, including the Balmoral Road Release Area, are expected to provide a source of patronage and other pedestrian attractions. A local connectivity study is required to review Baulkham Hills Development Control Plan No. 20 and plans for local pedestrian connections to the station to allow convenient pedestrian access to the station from surrounding areas.

Due to an increase in pedestrian activity around the station, consideration should be given to the availability of pedestrian crossings across roads in the surrounding area.

5.8.8 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Burns Road Station are likely to be as follows:

» An increase in the number of local traffic movements and potential for congestion, the extent of which will be largely determined by the capacity and access arrangements of the park and ride facility and the design of the future local road network; and

» An improved environment for pedestrians as new road crossings, footpaths and interchange areas provide access to the rail station; and

» Improved accessibility of the Burns Road area to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.8.9 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative

impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:
  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to pedestrian generators including the Transitway interchange and nearby park and ride facilities, and access to residential areas east and west of the station;
  – effective integration of the proposed Balmoral Road Release Area with regard to efficient local access to the rail station and planning for development that will place trip generators within close proximity of the rail station to develop as a local centre;
  – the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the location and access to the park and ride facility, minimising delay to Transitway and other bus services and operation of intersections on Burns Road and Old Windsor Road;
  – optimised integration of Transitway and other bus services with the new rail station including the design and location of the bus interchange;
» Design and delivery of the station should provide for:
  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;
  – signalised pedestrian crossings would be required to facilitate pedestrian access across Burns Road and Old Windsor Road;
  – bicycle parking and access routes to enable convenient access to the station.

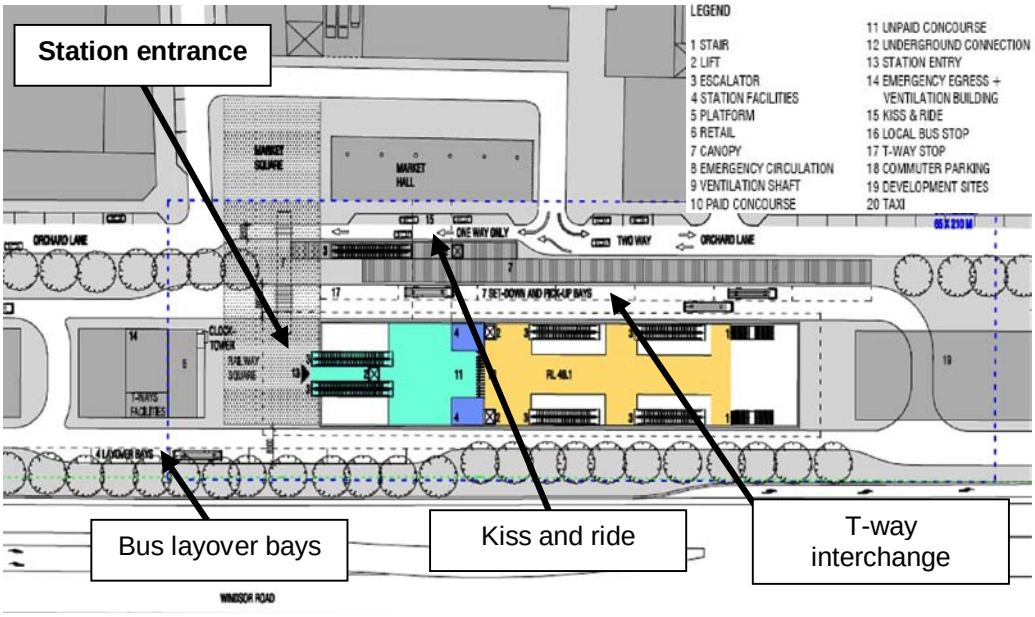
5.9 Rouse Hill Station

5.9.1 Key features

Two indicative station layouts at Rouse Hill Station are shown in Figure 5.8 and Figure 5.9. The two options are differentiated by the direction of that Transitway bus services travel around a loop road at the interchange.

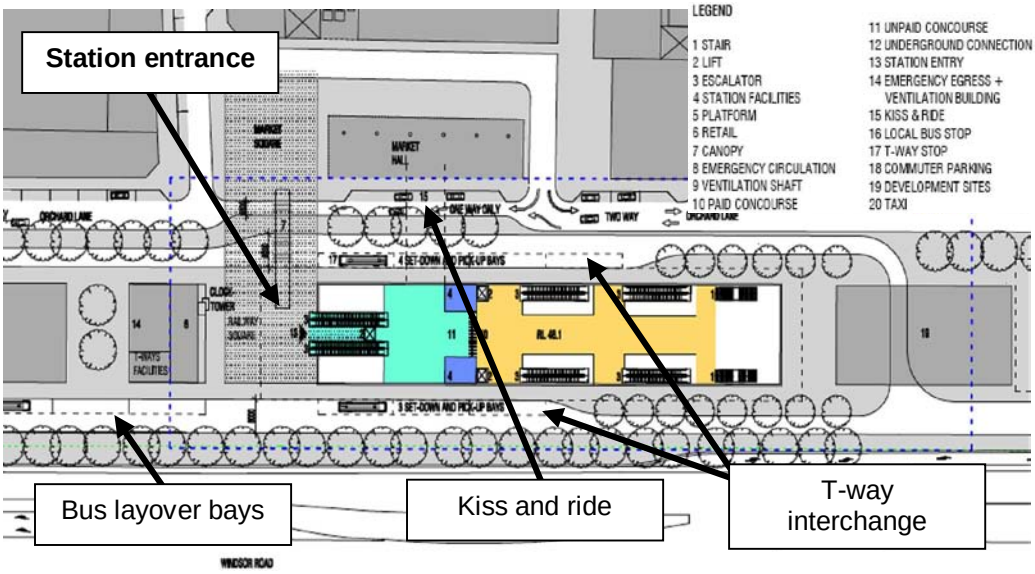
The layout and surrounding land uses are indicative only and would be subject to extensive planning by relevant stakeholders.

Figure 5.5 Rouse Hill Station Proposed Layout – Option 1 (Clockwise T-way)



Source: TIDC, 2006

Figure 5.6 Rouse Hill Station Proposed Layout – Option 2 (Anti-clockwise T-way)



Source: TIDC, 2006

Key features of the proposed interchange are as follows:

» Two underground island platforms accessed via a pedestrian concourse; and

» Interchange with local buses and Transitway services.

5.9.2 Passenger demand

Rouse Hill Station is forecast to be the fifth most patronised station on the North West

Rail Link.

Passenger demand for Rouse Hill Station is forecast for the year 2021 as follows:

» 2 hour AM peak entries = 1,937

» 2 hour AM peak exits = 420

» Daily demand = 9,388

Source: *North West Rail Link Project Review Report, Commuter Parking and Other Mode of Access Requirements*, prepared by PB for TIDC, May 2006

5.9.3 Integration with bus services

Rouse Hill is identified in the Metropolitan Strategy as the planned regional centre for the North West Growth Centre and as a result is expected in the future to become a major destination for key bus routes serving the region.

The Rouse Hill Station is also planned to be served by the Rouse Hill to Parramatta Transitway, which will operate from a major bus interchange situated above the planned rail station.

Hillsbus also currently operates a number of local and express bus services along Old Windsor Road, past the proposed Rouse Hill Station. It is expected that in the future that imost bus services would terminate at Rouse Hill Station and this is likely to occur within the Transitway interchange.

5.9.4 Integration with the road network

Rouse Hill Station is located adjacent to Windsor Road, which provides good north-south connectivity to surrounding areas. Schofields Road and Commercial Road would be the primary access roads for east-west movements.

Rouse Hill Station would be accessed via a network of local roads within the Rouse Hill Regional Centre site, currently under construction.

5.9.5 Interchange requirements

Bus

Rouse Hill Station would play a major bus interchange role.

Bus interchange is expected within the dedicated Transitway interchange. It is currently expected that local bus services and Transitway services would both use the bus interchange facility. Current plans allow for seven bus bays and four layover bays.

It is noted that the Parramatta to Rouse Hill Transitway is currently under construction and a temporary interchange is to be constructed. The construction of the North West Rail Link will require temporary relocation of the interchange and reconstruction above the new station.

Covered, well-lit pedestrian paths will be required between the Transitway interchange and the station entrance.

Taxi

A dedicated taxi bay would be required and should be located within close proximity to the station entrance.

Kiss and Ride

A kiss and ride point would be required at the new rail station. This facility should be conveniently located to the station entrance, and would be access via a local road adjacent to the station.

Park and Ride

Consistent with the planning principles established at Rouse Hill, park and ride facilities are not proposed as part of the North West Rail Link.

Bicycle parking

Bicycle parking should be provided in a conveniently located position outside the station entrance.

5.9.6 Impact on surrounding road network

As there is no park and ride facility proposed for Rouse Hill Station, vehicular access to the station would be limited to bus services and kiss and ride access. Therefore, station access movements are not expected to have a significant impact on the local road network.

5.9.7 Pedestrian access

Pedestrian access to the rail station site is currently constrained due to large block sizes, unconnected street networks and the physical barrier formed by Old Windsor Road which can only be crossed at signalised intersections.

Key pedestrian desire lines to be considered include the Transitway interchange and nearby park and ride facilities. Future development forming the Rouse Hill Regional Centre surrounding the site will provide other pedestrian attractions.

Future development of the Rouse Hill Regional Centre has been designed to provide a high level of pedestrian permeability. In neighbouring areas, opportunities for new pedestrian connections should be investigated to maximise pedestrian permeability through the surrounding area.

Due to an increase in pedestrian activity around the station, consideration should be given to the availability of pedestrian crossings and footpaths in the vicinity of Windsor Road to provide direct pedestrian access between the railway station and Kellyville Ridge.

5.9.8 Assessment of likely benefits and impacts

After the North West Rail Link is operational, the key impacts at Rouse Hill Station are likely to be as follows:

» An increased focus and requirement for prioritised bus, pedestrian and cycle movements in the town centre providing access to land uses and the interchange;

» An increase in the number of local traffic movements and potential for congestion; and

» Improved accessibility of Rouse Hill Regional Centre to Sydney's public transport network, providing improved travel choice and potential for travel time savings.

5.9.9 Recommended mitigation measures

In order to maximise the benefits of the new station and minimise any negative impacts, the following mitigation measures are recommended:

» Further studies should be undertaken to determine:

  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to pedestrian generators within the future Rouse Hill Regional Centre and access to surrounding residential areas such as Kellyville Ridge and Beaumont Hills;

  – the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the minimising delay to Transitway and other bus services and operation of intersections on Windsor Road;

» Design and delivery of the station should provide for:

  – well-lit and covered pedestrian paths between the bus stops, car parking and the station entrance;

  – signalised pedestrian crossings would be required to facilitate pedestrian access across Windsor Road;

  – bicycle parking and access routes to enable convenient access to the station.

5.10 Rouse Hill Stabling Facility

The train stabling facility for the North West Rail Link is proposed to be located north of Rouse Hill Station, to the west of Windsor Road. Stabling for eight 8-car trains is planned as part of the NWRL project.

The tracks within the stabling facility would be located in a cut section open to the air. The tracks will pass underneath Rouse Road, passing under a new road bridge. Staff would access the site via a small car park accessed from Windsor Road at the northern end of the stabling.

Assessment of Likely Impacts

The stabling yards are not expected to significantly affect the transport network (inclusive of traffic, pedestrians, cyclists and public transport) during operation.

5.11 Summary of Recommendations

The following recommendations have been developed in order to control, manage and minimise the potential impacts on road network operations, bus services and the movement of pedestrians and cyclists and access to properties surrounding the rail network during the operation of the North West Rail Link.

» At each station, further studies should be undertaken to determine:

  - local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to nearby pedestrian generators and surrounding residential areas;
  - the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the location and access to the park and ride facilities, minimising delay to bus services, potential impacts on local residential streets and operation of intersections on nearby arterial roads;
  - optimised integration of Transitway and other bus services with the new rail station;
- Design and delivery of each station should provide for:
  - well-lit and covered pedestrian paths between the bus stops, car parking and station entrances;
  - pedestrian crossing facilities across nearby roads; and
  - bicycle parking and access routes to enable convenient access to the station.

Furthermore, further investigation is required on the following specific issues:

- Parking demand and potential impacts following removal of commuter parking at Cheltenham station;
- The potential for shared use of an existing or future parking facility for use by rail commuters at Norwest and Hills Centre Stations;
- The potential for new pedestrian and cycle links along the rail corridor between Epping and Beecroft; and
- Effective integration of the proposed Balmoral Road Release Area with regard to efficient local access to the rail station and planning for development that will place trip generators within close proximity of the rail station to develop as a local centre.

6. Analysis of Construction Impacts

This section of the report provides a broad level assessment of traffic and transport impacts that could be expected during the construction phase of the project. The potential impacts that could result from the construction phase of the project are:

» Safety and capacity issues associated with the movement of construction related materials and equipment by trucks along the regional road network;

» Congestion and amenity issues caused by construction traffic accessing the proposed construction sites from the local road network; and

» Temporary disruption to traffic flows, car parking, pedestrian and cycle links, bus service routes as a result of staged construction works.

The above impacts will be identified for a typical worst-case scenario construction activity at each of the proposed construction sites.

6.1 Background

The following section provides an understanding of the proposed construction activity associated with the project.

6.1.1 The Project

The delivery of the North West Rail Link project will comprise of the following components:

» The quadruplication of the Northern Line between Epping and Beecroft and other associated construction works including:
  – modification to Cheltenham Station;
  – modification to the Cheltenham Road overbridge;
  – duplication of the M2 Motorway overbridge;
  – construction of a rail junction with the Northern Line; and
  – Construction of the Cheltenham Dive Structure.

» The construction of a 14 kilometres (km) tunnel section including stations from the Cheltenham Dive Structure to the Balmoral Road construction site. The tunnel will be constructed using tunnel-boring machines (TBMs); and

» 6 km of surface works from the Balmoral Road construction site to Rouse Hill, which includes an elevated section of the line, stations and the Rouse Hill stabling yards.

It is currently planned to concentrate the main construction activity at a large site situated within the Balmoral Road Release Area. This site is located at the proposed northern western portal for the proposed 14km rail tunnel and will be used as a collection point for spoil removal. It is proposed to start the construction of the tunnels at the Balmoral Road construction site and travel continuously to the Cheltenham Dive Structure site creating station locations on the way. The spoil generated by the TBM's whilst constructing the tunnel will be transported back to the Balmoral Road

construction site via conveyors.

Smaller construction sites will also be required at the proposed station locations and road/creek crossings. It is assumed that once the stations have been established by the TBMs, the remaining area of the stations will be mined. Where possible, the spoil created by the establishment of the stations will be transported back to the Balmoral Road construction site via convey. This is aimed to limit construction activity at station locations and minimise the size of the construction site required above the proposed station locations.

Based on the above construction techniques it can be assumed that the majority of spoil generated by the project will be collected at the Balmoral Road construction site and then removed off site by truck.

The construction and commissioning duration for the project is estimated to be approximately 5 years, from the award of the contract to handover and commencement of operations.

6.1.2 Proposed work hours

Construction activities are likely to occur over approximately 5 years. The working hours proposed for the construction period generally would be as follows:

» Monday to Friday (7:00 am – 6:00 pm);

» Saturday (8:00 am – 1:00 pm); and

» Sunday and public holidays (no work).

It is likely that some night work will be required in order to minimise disruption when constructing, assembling or modifying bridges, underpasses and rail lines.

Construction sites that are associated with tunnelling activities (i.e. Balmoral Road construction site) are proposed to operate 24 hours a day.

6.2 Quadruplication of the Northern Line

This project will include the quadruplication of the Northern Line between Epping and Cheltenham. The construction activities and impacts associated with this component are discussed below.

6.2.1 Construction activities

This part of the project involves the construction of two additional rail lines running parallel with the existing Northern Line between Epping and Beecroft and a new junction connecting the new North West Rail Link Up and Down main lines running from the proposed tunnel portals to the modified Northern Line at Beecroft. This work will also include:

» Construction of cut and cover tunnels under the Northern Line to carry the North West Rail Link Up main under the Northern Line;

» Construction of dive structures for the North West Rail Link Up and Down main lines. These dive structures connect the proposed rail junction between the

Northern Line and the North West Rail Link with the tunnel portals. The dive structures will also be used to remove the TBMs;

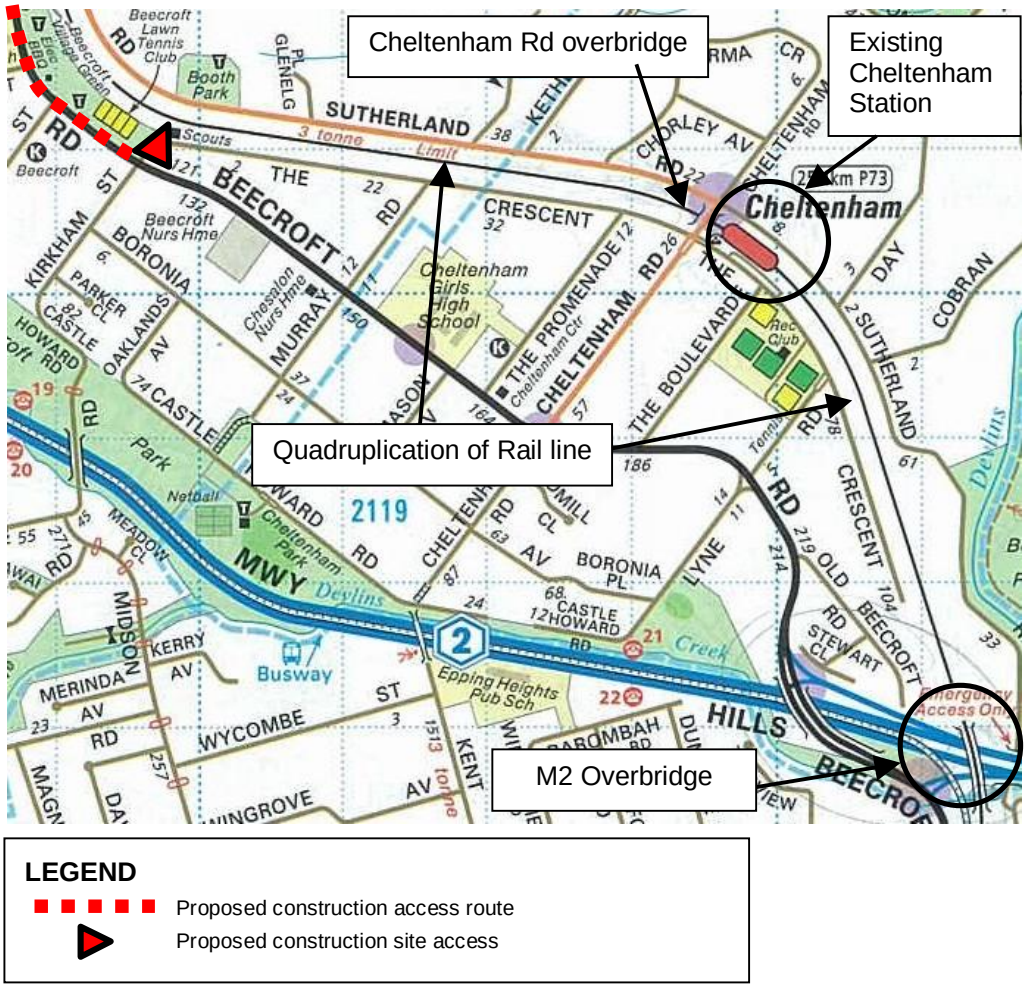
» Re-development of the existing Cheltenham Station;

» Reconstruction of the Cheltenham Road overbridge; and

» Duplication of the M2 overbridge.

The majority of works associated with the dive structures would be confined to the rail corridor, however it is likely that there will be some impact on areas surrounding the rail corridor.

Figure 6.1 Areas Impacted by the Quadruplication of the Northern Line



6.2.2 Traffic generation

Traffic generation during construction has been estimated and is based on a worst-case scenario. Typically for rail tunnelling projects this is associated with the transporting of spoil as the movement of equipment can be less intensive and may not require movement by road. The Spoil Management Report dated August 2006 has been used to understand and estimate the likely quantities and movement of spoil. Heavy vehicle (HV) traffic generation associated with the movement of spoil and

transporting of construction materials is provided in Table 6.1.

Table 6.1 Construction Period Traffic Movements at the Northern Line

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Movements (HV)	67	7
Construction Movements (HV)	7	1
Light Vehicles (workers)	100	50
Total	**174**	**58**

The movement of spoil and other construction material is likely to generate in the order of 37 heavy vehicles per day. Based on this worst case scenario, the daily heavy vehicle traffic generation during peak periods is likely to be in the order of 74 vehicle trips per day, comprising 37 In/ 37 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the assumption presented above, the heavy vehicle traffic generation during the AM and PM peak periods will be 8 vehicle trips per hour, comprising 4 In and 4 Out movements.

During the construction period it is also estimated that there would be a maximum of 50 workers accessing the site on a daily basis. A typical worse case scenario approach was used to determine traffic generation for workers arriving and departing from the site. Application of this approach to the proposed workforce yields a traffic generation in the order of 100 light vehicle trips per day with a split of 50 In and 0 Out movements in the AM peak and movement in the opposite direction for the PM peak.

6.2.3 Site access

Access to the construction site would be off The Crescent approximately 50m from the intersection with Beecroft Road. Work undertaken at the Cheltenham Station and for the quadruplication of the rail line will be contained within the rail corridor. It is anticipated that two additional access points would be required in order to obtain access to downstream section of the rail corridor. These access points are likely to be situated along The Crescent, with one being west of The Promenade and the second being in the vicinity of Lynne Road.

It is envisaged that the majority of the construction activity would occur within the rail corridor with the main access to the construction site being proposed to be in the vicinity of the Beecroft Village Green and Tennis Club.

6.2.4 Haulage routes

The location for the disposal of excess spoil would be determined during the detailed design stage of this project. The proposed routes would be detailed in Traffic

Management Plans.

For the purpose of understanding the likely routes used by trucks transporting spoil or equipment to and from the site, it has been assumed that all trucks would travel via the M2 Motorway. The M2 Motorway is situated close to the construction site and offers easy access to all major destinations along with the main known spoil deposit sites and equipment storage facilities.

The access route for construction traffic to access the M2 from The Crescent would be as follows:

» Right onto Beecroft Road;

» Left onto Pennant Hills Road; and

» Both left and right movements onto the M2 are possible at the Pennant Hills Interchange.

6.2.5 Parking

It is expected that the construction workers would park on The Crescent between Cheltenham Road and Beecroft Road for the duration of the works due to a lack of space within the construction site.

It is likely that during peak construction activities that up to 50 cars could require parking within close vicinity to the site. Observations undertaken during a typical weekday has indicated that there is adequate availability of parking.

6.2.6 Impacts on surrounding land use

Land uses surrounding the Cheltenham Station and the proposed construction site are mainly residential. Cheltenham Girls High School is also located in this area. The main access to Cheltenham Girls High School is off Beecroft Road and The Promenade, which should not be impacted by the proposed construction activity.

Parts of the Beecroft Village Green could be required to accommodate the construction site.

On street parking is available on local roads surrounding Cheltenham Station and is currently unrestricted. Any removal of commuter parking associated with quadruplication and modification to Cheltenham Station is likely to result in more commuters parking along local streets in the short term.

6.2.7 Impacts on intersections

The intersection of Beecroft Road and The Crescent currently operates under stop priority control. Based on site observations it is likely that controls at this intersection will need to be upgraded in order to provide safe access for trucks turning right from The Crescent onto Beecroft Road.

Access to the site via the existing signalised intersection at Cheltenham Road is not being considered to be an option as this route is unsuitable for heavy vehicle traffic. Cheltenham Road currently provides direct access to residential properties and is used by students from Cheltenham Girls High School and commuters accessing

Cheltenham Station.

The installation of traffic signals at The Crescent and Beecroft Road intersection would provide appropriate intersection arrangements for trucks wanting to access the designated B-Double route of Beecroft Road and then Pennant Hills Road from The Crescent.

Photo 1 – Beecroft Road and The Crescent Intersection

6.2.8 Impacts on existing station access

Existing access characteristics of Cheltenham Station are summarised in Table 6.2.

Table 6.2 Existing facilities at Cheltenham Station

Transport mode	Type of facility
Pedestrian	Pedestrian crossings on The Crescent and Cheltenham Rd
Private vehicle	76 free commuter parking spaces 5 disabled parking spaces Unrestricted on-street parking
Bicycle parking and marked cycle routes	8 parking rails for bikes in the parking area off The Crescent

Pedestrian access to station

Cheltenham Station would remain operational during the quadruplication of the lines and the re-construction of the station platforms. Pedestrian access would be maintained to the platforms through the installation of temporary pedestrian

overbridges.

Commuter parking

Commuter parking areas are currently provided on both sides of Cheltenham Station with 13 spaces accessed from Sutherland Road and 68 spaces accessed from The Crescent. It is likely that both of these parking areas would be removed during construction. Commuters driving to the station would use available unrestricted on-street parking spaces situated along surrounding local streets.

6.2.9 Cheltenham Road overbridge

During the reconstruction of Cheltenham Road overbridge abutments, temporary road closures may be necessary. Full road closures at this site are likely to only occur at night and the alternative route during these times would be via the Copeland Road bridge at Beecroft.

6.2.10 M2 overbridge

Whilst the M2 rail bridge is duplicated, lane closures on the M2 would need to be implemented. It is expected that this work would occur over a two-month period as part of weekday night and weekend works. It is also possible that the M2 would need to be closed to lift the bridge beams into place. It is anticipated that night works to undertake such works would occur between 8pm to 6am. Access to the abutments will be from the rail corridor and therefore construction traffic is unlikely to impact on M2 traffic operations.

6.2.11 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

- Upgrade intersection controls at the intersection of The Crescent and Beecroft Road during the construction period to allow trucks to turn right into Beecroft Road;
- Maintain pedestrian access to platforms through the installation of temporary pedestrian overbridges;
- Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes;
- Monitor the impact from commuter parking on local roads during the construction and post construction period;
- Develop contingency transport and parking demand management strategies;
- Limit road closures associated with the Cheltenham Road overbridge to a temporary arrangements that occur at night; and
- Ensure that an alternative routes is provided during the closure of the Cheltenham Road overbridge (via the Copeland Road bridge at Beecroft).

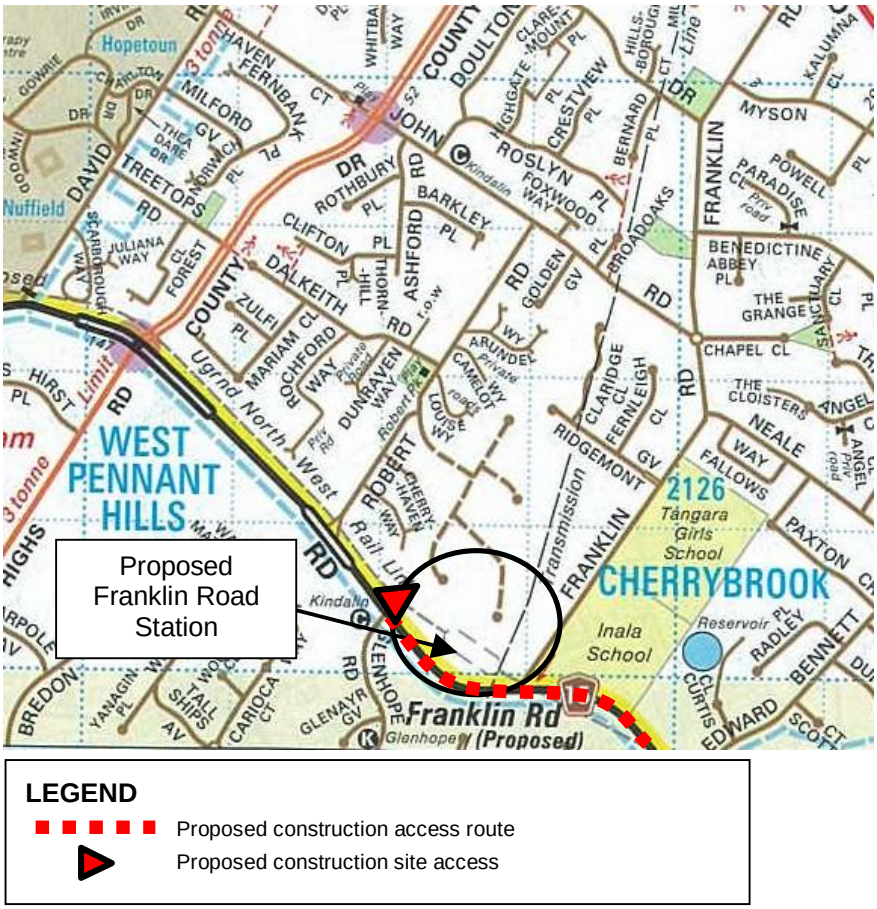
6.3 Franklin Road Station

Construction activity at Franklin Road Station is associated with the construction of the 14km tunnel. Construction activities and impacts are discussed below.

6.3.1 Construction activities

The proposed Franklin Road Station would be constructed 25m underground on the corner of Castle Hill Road and Franklin Road and would include the construction of commuter car park. All tunnel spoil and the majority of station spoil would be removed via a conveyor to the Balmoral construction site.

Figure 6.2 Franklin Road Station



6.3.2 Traffic generation

Similar to section 6.2.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the transporting of spoil, which represents the worse case scenario for traffic generation at the Franklin Road Station is approximately 2 months. The traffic generation during this period is summarised in Table 6.3.

Table 6.3 Construction Period Traffic Movements at Franklin Road Station

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	78	8
Construction Truck Movements	8	1
Light Vehicles	100	50
Total	**186**	**59**

The movement of spoil and construction equipment is likely to generate in the order of 43 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 86 vehicle trips per day, comprising 43 In/ 43 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 9 vehicle trips per hour, comprising 4.5 In and 4.5 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.3.3 Site access

Two construction site access point options have been identified and are as follows:

» Access to site from the western side of Franklin Road. This could potential impact on surrounding residential properties and the operation of two schools within close vicinity to the site; or

» Provide direct access from Castle Hill Road into the site, by creating a four way signalised intersection with Glenhope Road.

Further investigation is required to determine the preferred site access point.

6.3.4 Haulage routes

As noted in section 6.2.4, the location of sites for the disposal of spoil are currently unknown. As result, this assessment of haulage routes assumes that all spoil will be transported along arterial road network designated by RTA to be a B Double route that provide direct access to the M2 / M7 Motorways.

The access route for construction truck traffic wanting to travel east or west along the M2 Motorway from the intersection of Castle Hill Road with Franklin Road would be as follows:

» Left onto Castle Hill Road;

» Right onto Pennant Hills Road; and

» Left/Right onto the M2 at the Pennant Hills Interchange.

6.3.5 Parking

It is expected that construction workers would park within the construction site for the duration of the works.

6.3.6 Impacts on surrounding land use

The proposed station is located within a large block of undeveloped land, however residential development is situated adjacent to this site. Franklin Road is residential in character and is currently used by local residential traffic to access Castle Hill Road. Two schools are also situated on Franklin Road; with the Inala School main entrance located approximately 20m from the intersection of Franklin Road and Castle Hill Road.

The potential impacts from construction traffic movements on each of the above land uses will need to be considered and managed by identifying an appropriately located preferred access point.

6.3.7 Impacts on intersections

Franklin Road is currently restricted to left out only at the intersection with Castle Hill Road with no access from Castle Hill Road. There is currently inadequate visibility at this intersection for it to be used as a construction access without upgrading the signals. Due to the nature of the land use in Franklin Road and the potential impact from construction traffic on the operation of schools, it is recommended that a temporary signalised access be provided directly to the site. It is assumed that this will be provided in Castle Hill Road, unless an alternative access option is established.

Photo 2 – Castle Hill Road at the intersection of Franklin Road

Upgrade of the existing intersection of Castle Hill Road with Glenhope Road would be the preferred access option as it allows construction traffic to directly access the site, has minimal impact on surrounding land uses, and adequate sight distances.

The impact on the operation of Castle Hill Road of a new intersection at this location will need to be considered as part of further investigations.

6.3.8 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» Undertake further investigation into the feasibility of providing a direct access point to the site from Castle Hill Road;

» Investigate the potential impact from providing a four way signalised intersection at the existing intersection of Glenhope Road with Castle Hill Road;

» Develop a construction management strategy in order to limit any potential construction impacts on land use situated along Franklin Road; and

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

6.4 Castle Hill Station

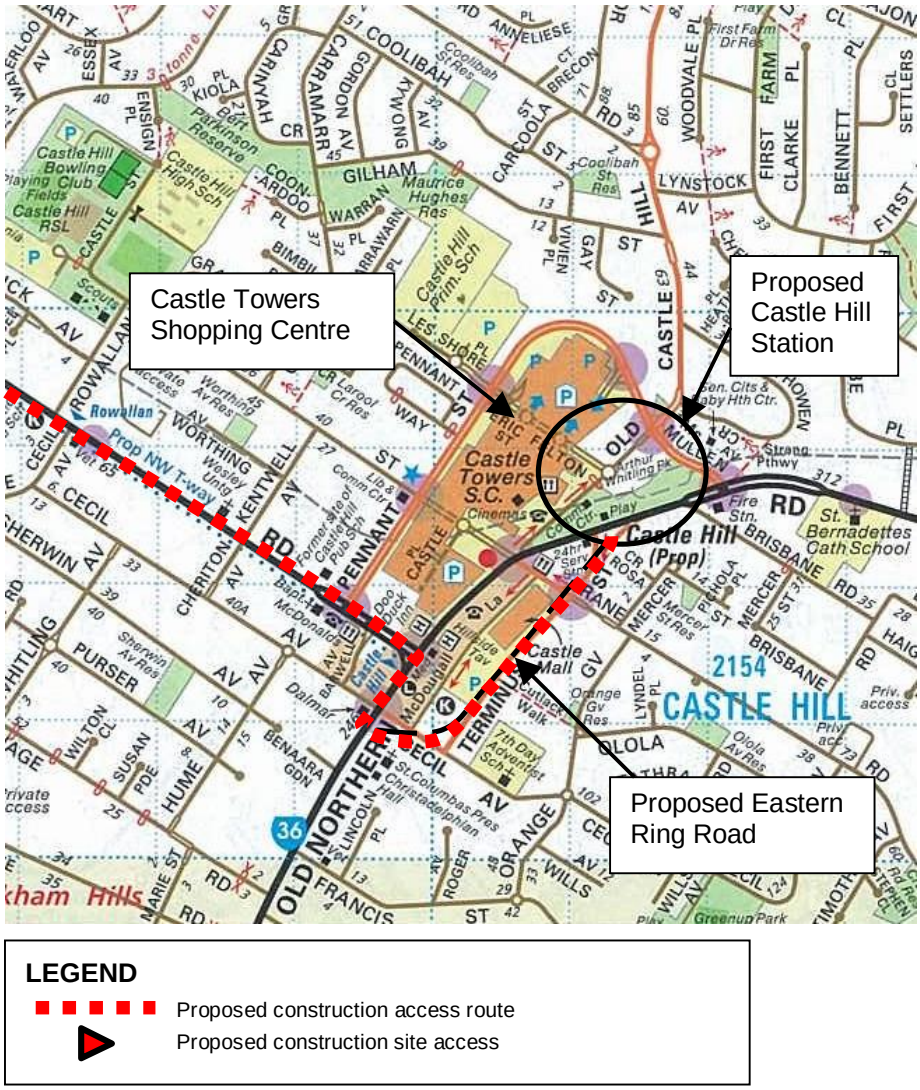
Similar to Section 6.3 (Franklin Road Station), construction activity at Castle Hill Station is associated with the construction of the 14km tunnel. Construction activities and impacts are discussed below.

6.4.1 Construction activities

Castle Hill Station is to be constructed 35m underground on the north side of Old Northern Road under Arthur Whitling Park adjacent to Castle Towers Shopping Centre. The underground station could include connections to the shopping centre and local services.

All tunnel spoil and the majority of station spoil would be removed via a conveyor to the Balmoral construction site.

Figure 6.3 Castle Hill Station



6.4.2 Traffic generation

As noted in to section 6.2.2 and 6.3.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the transporting of spoil, which represents the worse case scenario for traffic generation at Castle Hill Station, approximately three months. The traffic generation during this period is summarised in Table 6.4.

Table 6.4 Construction Period Traffic Movements at Castle Hill Station

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	72	8

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Construction Truck Movements	8	1
Light Vehicles	100	50
Total	**180**	**59**

The movement of spoil and construction equipment is likely to generate in the order of 40 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 80 vehicle trips per day, comprising 40 In/ 40 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 9 vehicle trips per hour, comprising 4.5 In and 4.5 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.4.3 Site access

Access to the site is currently under investigation and will be dependant upon the timing of the completion of the Eastern Ring Road bypass. Access via Old Castle Hill Road should be avoided where possible as it is considered to be at conflict with pedestrian and bus movements.

6.4.4 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for westbound and eastbound truck movements.

For construction traffic wanting to travel east:

» Via the proposed Eastern Ring Road;

» Left onto Old Northern Road;

» Left onto Windsor Road; and

» Right onto the M2 at the Windsor Road Interchange.

For construction traffic wanting to travel west:

» Via the Proposed Eastern Ring Road;

» Right onto Old Northern Road;

» Left onto Showground Road;

» Right onto Windsor Road;

» Left onto Burns Road;

» Straight through onto Sunnyholt Road; and

» Right onto the M7 at the Sunnyholt Road Interchange.

The proposed Eastern Ring Road will provide a bypass for through traffic around the Castle Hill CBD and would be alternative route to that offered by the existing Old Northern Road alignment. Once constructed this road would become under the care and control of the RTA.

6.4.5 Parking

Parking opportunities for construction workers in the vicinity of the work site are limited. A suitable number of parking spaces for employees within close proximity to the site would be required.

6.4.6 Impacts on surrounding land use

The construction site is surrounded by mixed land uses including retail, commercial, recreational and residential. The proposed station location is underneath Arthur Whitling Park. A large section of Arthur Whitling Park will be required to be used for permanent access arrangement for the station including pedestrian access, emergency exist, service shafts and ventilation buildings.

A development application for the expansion of Castle Towers Shopping Centre is currently being considered by on Baulkham Hills Shire Council. The area currently proposed for developed is situated to the south of the existing shopping centre. The timing and programming of this development may have a cumulative impact on the construction activities at the station site. Further investigation of the timing, and potential impacts of the Castle Hill Draft Masterplan and DCP is required.

6.4.7 Impacts on intersections

The development of an Eastern Ring Road around the Castle Hill Town Centre will change traffic flow conditions in the vicinity of the station construction site and potentially offer opportunities for construction access. As a result of the planned upgrades to the area, the impact on intersection operations is likely to be minimal.

6.4.8 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» Prevent construction access via Old Castle Hill Road to avoid potential conflict with pedestrian and bus movements;

» Ensure that the successful contractor sources and provides suitable parking arrangements within close proximity to the site for all on-site employees;

» Undertake further investigations into the potential impacts on planned construction activities associated with the planned Castle Hill station from the proposed expansion of the Castle Towers Shopping Centre;

» Undertake further investigations to ensure that the design and construction planning

for Castle Hill Station avoids conflict and is appropriately integrated with planned works associated with the Castle Hill Draft Masterplan and DCP;

» Undertake further investigation to identify an appropriate construction vehicle access to the planned construction site for Castle Hill Station; and

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

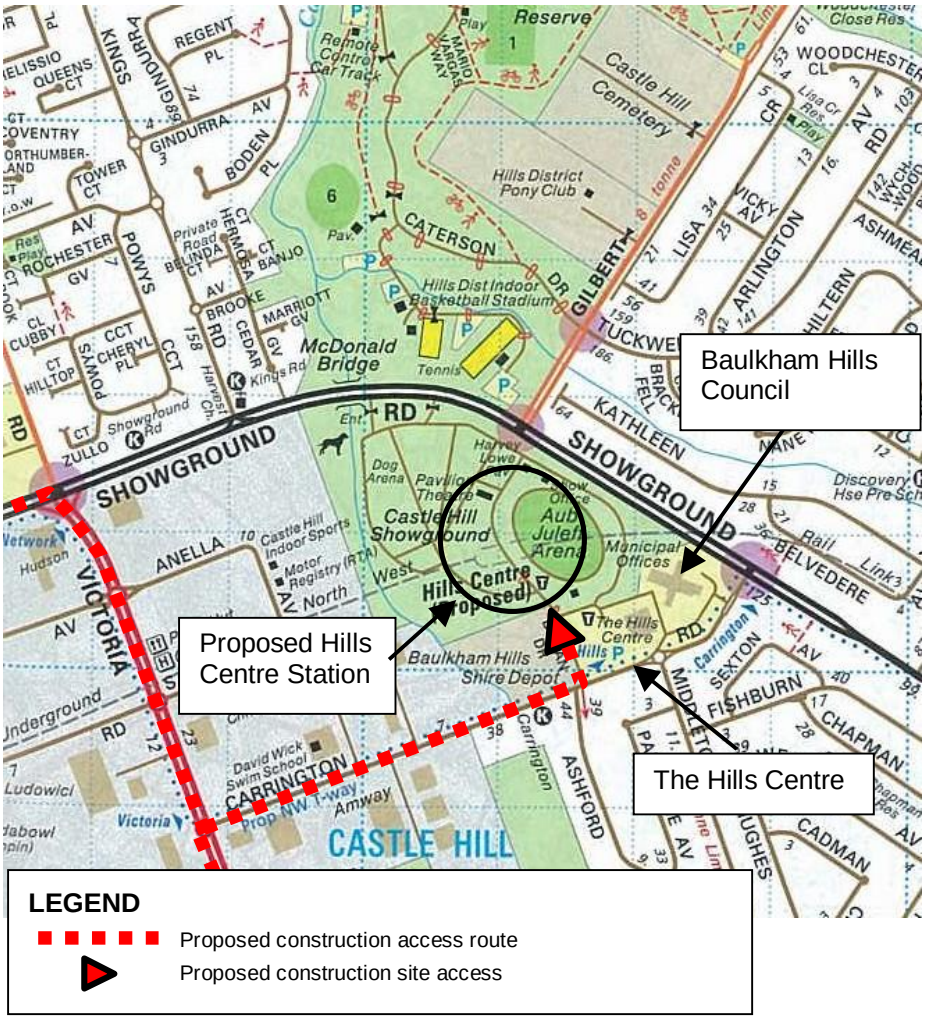
6.5 Hills Centre Station

As noted in Section 6.3 (Franklin Road Station), construction activity at Hills Centre Station is associated with the construction of the 14km tunnel. Construction activities and impacts associated with the delivery of Hills Centre Station are discussed below.

6.5.1 Construction activities

Hills Centre Station is to be constructed 21m underground close to the existing Castle Hill Showground. Park and ride facilities are proposed. All tunnel spoil and the majority of station would be removed via a conveyor to the Balmoral portal.

Figure 6.4 Hills Centre Station



6.5.2 Traffic generation

As noted in sections 6.2.2 and 6.3.2, the potential traffic generation for the construction period has been based on a worst-case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the transporting of spoil, which represents the worse case scenario for traffic generation at the Hills Centre Station is approximately two months. The traffic generation during this period is summarised in Table 6.5.

Table 6.5 Construction Period Traffic Movements at Hills Centre Station

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	74	8
Construction Truck Movements	8	1
Light Vehicles	100	50
Total	**182**	**59**

The movement of spoil and construction equipment is likely to generate in the order of 41 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 82 vehicle trips per day, comprising 40 In/ 40 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 9 vehicle trips per hour, comprising 4.5 In and 4.5 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.5.3 Site access

Access to the site would be from Doran Drive, which currently provides access to the Council depot, Showground and The Hills Centre.

Photo 4 – Doran Drive access to Norwest Station Site

6.5.4 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for westbound and eastbound truck movements.

For construction traffic wanting to travel east:

» Right onto Carrington Road;

» Left onto Victoria Ave;

» Left onto Windsor Road; and

» Right onto the M2 at the Windsor Road Interchange.

For construction traffic wanting to travel west:

» Right onto Carrington Road;

» Right onto Victoria Ave;

» Left onto Showground Road;

» Right onto Windsor Road;

» Left onto Burns Road;

» Straight through onto Sunnyholt Road; and

» Right onto the M7 at the Sunnyholt Road Interchange.

6.5.5 Parking

If appropriate and in consultation with Council, construction workers could park within the Council depot area for the duration of the works.

6.5.6 Impacts on surrounding land use

The proposed station location is adjacent to the Castle Hill showgrounds, the Baulkham Hills Shire Council offices and depot, the Pavilion Theatre and The Hills Centre.

The construction environmental management plan would need to include measures to minimise impacts on surrounding land uses and take into account events planned at the Showground and Pavilion Theatre.

6.5.7 Impacts on intersections

The intersection of Doran Drive and Carrington Road is currently under Give Way control. The movement of construction vehicles at this intersection could impact on the operation of this intersection during the peak periods. Further investigation into the future projected traffic volumes and likely operation of this intersection during the planned construction period will be required.

6.5.8 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» The construction environmental management plan should include measures to minimise impacts on surrounding land uses and takes into account events planned at the Showground and Pavilion Theatre;

» Further investigation into the future projected traffic volumes and likely operation of the Doran Drive and Carrington Road intersection during the planned construction period is required to understand any potential future impacts on the road network; and

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

6.6 Norwest Station

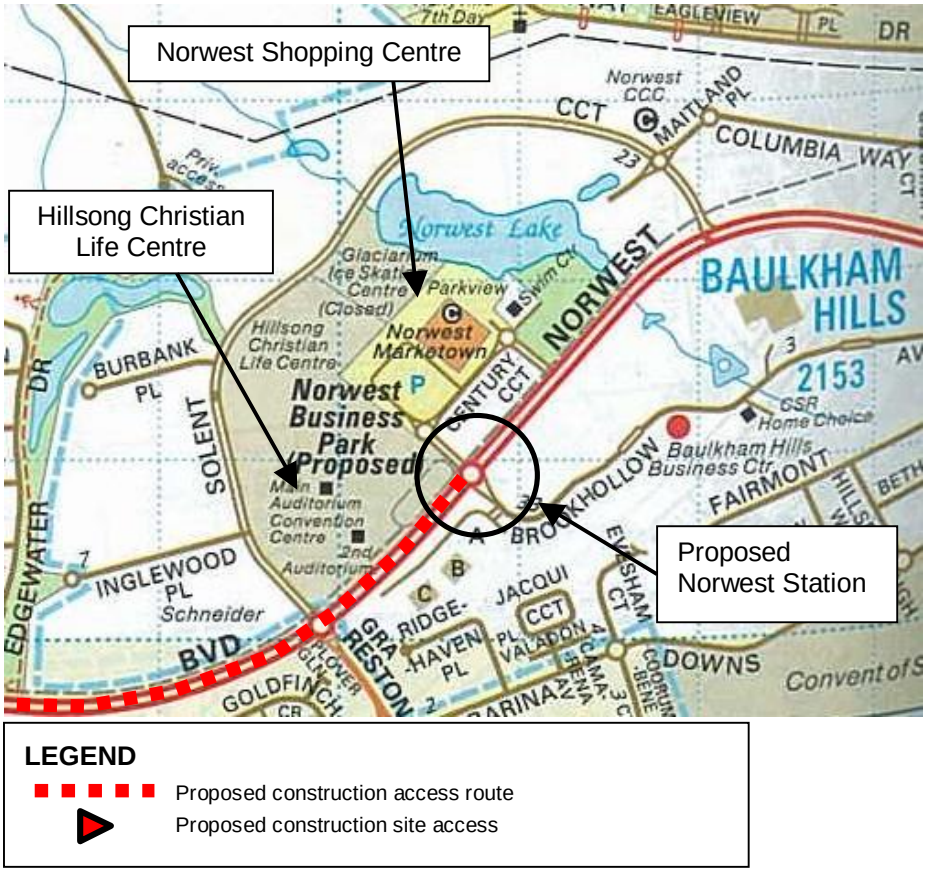
As noted in Section 6.3 (Franklin Road Station), construction activity at Norwest Station is associated with the construction of the 14km tunnel. Construction activities and impacts associated with the delivery of Norwest Station are discussed below.

6.6.1 Construction activities

Norwest Station is to be constructed 32m below the existing intersection of Norwest Boulevard and Brookhollow Avenue.

All tunnel spoil and the majority of station spoil will be removed via a conveyor to the Balmoral portal.

Figure 6.5 Norwest Station



6.6.2 Traffic generation

Similar to section 6.2.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the transporting of spoil, which represents the worse case scenario for traffic generation at the Norwest Station is approximately two months. The traffic generation during this period is summarised in Table 6.6.

Table 6.6 Construction Period Traffic Movements at Norwest Station

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	76	8
Construction Truck Movements	8	1
Light Vehicles	100	50
Total	**184**	**59**

The movement of spoil and construction equipment is likely to generate in the order of

42 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 84 vehicle trips per day, comprising 42 In/ 42 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 9 vehicle trips per hour, comprising 4.5 In and 4.5 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.6.3 Site access

It is likely that access to the site would be provided in the vicinity of the existing roundabout on Brookhollow Avenue, this would be determined during the construction planning process. Conflicts with traffic accessing the Norwest Marketown Shopping Centre and Hillsong Christian Life Centre would need to be managed.

Photo 5 – Norwest Boulevard

6.6.4 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for westbound and eastbound truck movements.

For construction traffic wanting to travel east:

» Via Norwest Boulevard;

» Straight through the signalised intersection at Old Windsor Road onto the new link to the M7.

For construction traffic wanting to travel west:

» Via Norwest Boulevard;

» Left onto Old Windsor Road;

» Left onto the M7.

Norwest Boulevard is not identified on RTA mapping as being part of the designated B-Double routes around this area of Sydney. As a result, if the movement of material by B Double type vehicles, then permission should be sought from RTA and council for vehicles of this type to operate along this road during the construction period. Norwest Boulevard is suitably designed to accommodate larger trucks with wide traffic lanes and a divided solid median.

6.6.5 Parking

Parking opportunities for construction workers in the vicinity of the work site are limited. A suitable number of parking spaces for employees within close proximity to the site would be required. This could potentially include an arrangement with local property owners.

6.6.6 Impacts on surrounding land use

The construction site is in the Norwest Business Park and surrounded by mixed land uses including retail, commercial, religious (Hillsong church) and to some extent residential. The proposed station location is underneath Norwest Boulevard. Some sections of existing footpaths and roadside landscaping on approaches to the intersection of Norwest Boulevard and Brookhollow Avenue is likely to be required to be used for permanent access arrangements to the station including pedestrian access and emergency exits.

Development of a construction management plan is required that minimises impacts on surrounding land uses and takes into account the peak operating periods of the Norwest Marketown Shopping Centre and events planned at the Hillsong Christian Life Centre.

6.6.7 Impacts on intersections

The intersection of Norwest Boulevard and Brookhollow Avenue will be directly affected by construction traffic. This intersection is a roundabout with two circulating lanes.

The movement of construction vehicles at this intersection could impact on the operation of this intersection during the peak periods. Further investigation into the future projected traffic volumes, ability to accommodate heavy vehicle turning paths and likely operation of this intersection during the planned construction period will be required.

6.6.8 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on

the surrounding area during the construction period:

» Conflict between construction traffic and other traffic accessing the Norwest Marketown Shopping Centre and Hillsong Christian Life Centre would need to be managed;

» Ensure suitable parking arrangements within close proximity to the site for all on-site employees;

» Ensure that pedestrian paths are retained in close proximity to the intersection of Norwest Blvd and Brookhollow Avenue;

» Undertake further investigation into the future projected traffic volumes and likely operation of the Norwest Blvd and Brookhollow Avenue roundabout during the planned construction period;

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes; and

» If required, obtain approval from RTA and Council for the operation of B Double type vehicles along Norwest Boulevard during the construction period.

6.7 Balmoral Construction Site and Burns Road Station

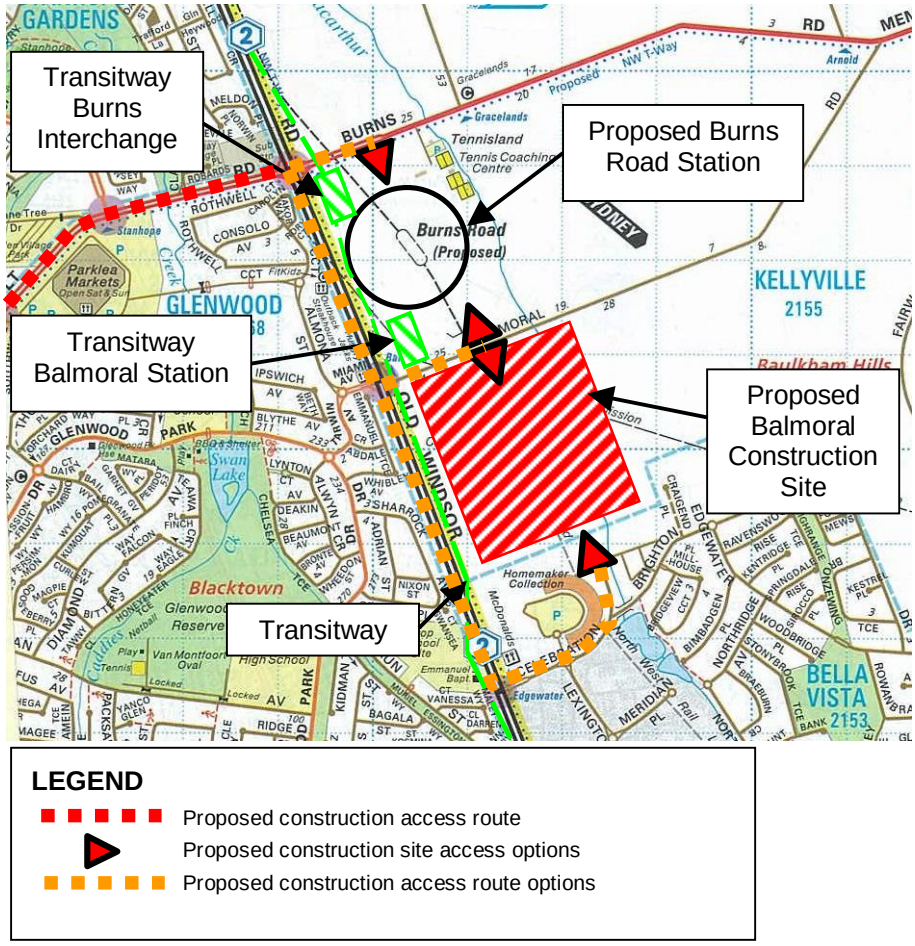
The Balmoral Construction Site would be the primary construction site associated with the North West Rail Link.

Based on the Constructability and Programme review undertaken by Evans and Peck (May 2006), it is assumed that all spoil created by the bored tunnel and mined underground station sites would be transported along the external road network via the Balmoral construction site. The spoil created by the bored tunnel and mined station sites will be put on conveyors and transported back to the Balmoral portal.

The Balmoral portal is situated between Balmoral Road and Celebration Drive adjacent to Old Windsor Road as shown in Figure 6.6. Access to the site is currently via an unsealed access road off the northern end of Celebration Drive.

The Burns Road station is proposed to have good connectivity with the Burns Road Transitway Station and park and ride facility. It is currently planned to be positioned between Burns Road and Balmoral Road.

Figure 6.6 Balmoral Construction Site and Burns Road Station



6.7.1 Construction activities

During the construction period, traffic movements would predominantly be related to the following:

» Delivery of material and equipment, including track, signals, overhead wiring, concrete, etc;

» Removal of excess spoil from the site (approximately 2653,800 m^3) with the ultimate disposal sites for excess spoil yet to be determined); and

» The arrival and departure of construction workers.

6.7.2 Traffic generation

Similar to section 6.2.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The Balmoral Road construction site (within the Balmoral Road Release Area) would be the main construction site for the project. The estimated period for the generation of construction traffic associated with spoil removal at this site is approximately two and half years. Each station excavation would take up to approximately six months

each, with up to three stations being excavated at one time.

The traffic generation from both Balmoral Construction Site and Burns Road Station during the construction period is summarised in Table 6.7.

Table 6.7 Construction Period Traffic Movements at Balmoral and Burns Rd

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	786	79
Construction Truck Movements	400	40
Light Vehicles	200	100
Total	**1386**	**219**

The movement of spoil and other construction material is likely to generate in the order of 593 heavy vehicles per day. Based on this worst case scenario, the daily heavy vehicle traffic generation during peak periods is likely to be in the order of 1186 vehicle trips per day, comprising 593 In/ 593 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the assumption presented above, the heavy vehicle traffic generation during the AM and PM peak periods will be 134 vehicle trips per hour, comprising 67 In and 67 Out movements.

During the construction period it is also estimated that there would be a maximum of 300 workers accessing the site on a daily basis. Based on the characteristics of the site it has been assumed that 100 of these workers would arrive in construction trucks while the remainder would arrive by car. A typical worse case scenario approach was used to determine traffic generation for workers arriving and departing from the site. Application of this approach to the proposed workforce yields a traffic generation in the order of 200 light vehicle trips per day with a split of 100 In and 0 Out movements in the AM peak and movement in the opposite direction for the PM peak.

6.7.3 Site access

The proposed construction site access points are situated on opposite sides of Balmoral Road. The Balmoral construction site is proposed to have two vehicular access points into the site with the majority construction traffic encouraged to the Balmoral Road entrance to access the external road network and transport material and equipment to Burns Road Station.

Utilisation of the Balmoral Road access point by heavy vehicles would help minimise the impact on the operation of Celebration Drive. It is recommended that further investigation of future traffic levels along Balmoral Road be undertaken in order to understand potential network operational impacts.

6.7.4 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for truck movements.

» Left or Right into Old Windsor Road;

» Left into Sunnyholt Road; and

» Right or Left onto the M7 at the Sunnyholt Road Interchange.

Both the Sunnyholt Road and Old Windsor Road routes provide direct access for construction vehicles from the Balmoral Road and Burns Road Station construction site to the Westlink M7 Motorway.

Under the current situation a feasible access arrangement option that would minimise traffic conflict and operational impacts would be to restrict construction truck traffic travelling between Balmoral Road and Old Windsor Road to a left in and left out arrangement. Under this arrangement the movement of trucks would be to approach the site via Sunnyholt Road, turn right into Old Windsor Road and then left into Balmoral Road, and on departure from the site, trucks would turn left from Balmoral Road into Old Windsor Road and then travel south to the M7 Westlink Interchange.

All routes except for a section of Old Windsor Road are mapped as RTA designated B-Double Routes. However, it is noted that Old Windsor Road was previously approved by the RTA as a truck route during the construction phase of the M7 Westlink Motorway and therefore probably has an appropriate design layout for accommodate larger sized trucks.

If B Double type vehicles are required to transport material and equipment and approval is not obtained to use Old Windsor Road for access to the M7 Westlink Motorway, then two-way access via Sunnyholt Road would be the other option for larger sized vehicles. If Sunnyholt Road was to be used by two-way B Double movements to and from the site the following options are available:

» Upgrade the intersection of Balmoral Road with Old Windsor Road to allow a right turn movement from Balmoral Road to Old Windsor Road;

» Use an alternative route to access Burns Road by allowing truck traffic to travel from the Balmoral Road construction site via the Burn Road Station construction site to Burns Road and then travel across Old Windsor Road to Sunnyholt Road; or

» Permit B Double vehicle to access the site via the signalised intersection with Celebration Drive.

Further investigation into the preferred truck route option should be undertaken by the successful contractor as part the detailed planning stages.

6.7.5 Parking

A suitable number of parking spaces in close proximity to the site for on-site construction workers would be required.

6.7.6 Impacts on surrounding land use

The majority of the area immediately surrounding both sites is currently undeveloped, however, mixed land uses containing retail, commercial, recreational and residential uses is situated along Celebration Drive, which is one of the access routes to the Balmoral Road construction site. As a result, under the existing situation a construction access point on Balmoral Road is desirable in terms of minimising construction traffic impacts on existing surrounding development.

However, at the same time, it should be noted that the Balmoral Road Release Area will gradually be developed overtime resulting in the delivery of predominant residential development. The future delivery of this development will need to be considered and managed in order to allow for the future planning of construction activity associated with the North West Rail Link.

6.7.7 Impacts on Transitway

The Parramatta-Rouse Hill Transitway is currently under construction and runs along the western boundary of both the Balmoral Construction Site and Burns Road Station. The planned alignment of this Transitway runs along the eastern side of Old Windsor Road in the north from Rouse Hill to the intersection with Celebration Drive were it crosses to the western side of Old Windsor Road. Construction works for the North West Rail Link will be undertaken outside of the Transitway corridor, however construction traffic from both the Balmoral Construction Site and Burns Road Station will potentially impact on Transitway operations where it crosses Balmoral Road.

Key to the successful delivery of the Burns Road Station would be for the design to be integrated with the Burns Road Transitway Interchange. This may require modification to the current Transitway station and park and ride facility design in order to improve connectivity with the proposed Burns Road railway station.

Mitigation measures may be required in order to ensure that delays to Transitway services are minimised. This may include temporary deviations to the traffic or Transitway route, temporary traffic control, and restrictions on queuing over Transitway intersections. These matters should be further detailed in the Construction Management Plan.

6.7.8 Impacts on intersection

The existing road network in the vicinity of the proposed Balmoral Road and Burns Road Station construction site comprises the following important traffic management features.

Table 6.8 Intersections surrounding the Balmoral Construction Site

Roads	Control Type
Burns Road / Old Windsor Road	Signals
Miami Avenue/ Old Windsor Road	Signals
Balmoral Road / Old Windsor Road	Give Way – Left In / Left out only

Roads	Control Type
Celebration Drive / Old Windsor Road	Signals
Memorial Av / Windsor Road	Signals

The performance of the existing road network is largely dependent on the operating performance of key intersections, which act as critical capacity control points. Further investigation is required to be undertaken in order to understand the potential construction traffic impacts on the performance of intersection under peak hour conditions. The critical intersections associated with proposed construction traffic movements are as follows:

» Balmoral Road and Old Windsor Road;

» Sunnyholt Road/ Burns Road and Old Windsor Road; and

» Celebration Drive and Old Windsor Road.

As discussed in section 6.7.3, it is proposed to use Balmoral Road for construction truck traffic. As indicated in Table 6.8, Balmoral Road's intersection with Old Windsor Road currently operates under Give Way control and is restricted to left turn in and left turn out movements only. As discussed in section 6.7.4 access arrangements between Balmoral Road and Windsor Road may need to be altered in order to allow construction vehicles to right from Balmoral Road into Old Windsor Road. This could be achieved by realigning Balmoral Road approach to the existing signalised intersection with Miami Avenue.

These matters along with future intersection arrangements along Old Windsor Road should be further investigated and included as part of the Construction Management Plan.

Photo 7 – Balmoral Road and Old Windsor Road Intersection

Photo 8 – Celebration Drive and Old Windsor Road Intersection

6.7.9 Recommended mitigation measures and further studies

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

- Ensure that the successful contractor sources and provides suitable parking arrangements within close proximity to the site for all on-site employees;
- Undertake further investigation into the future projected traffic volumes and traffic arrangements at the Balmoral Road and Old Windsor Road Intersection during the planned construction period;
- Develop the main construction access for truck traffic on Balmoral Road and minimise construction traffic movement on Celebration Drive,
- Undertake further investigation on the performance of the surrounding road network under AM and PM peak construction traffic.
- Restrict construction traffic movement during peak periods if further investigations indicate that the road network performance is impacted;
- Undertake further investigations in order to identify the potential impacts on proposed residential development within close proximity of the construction site;
- Ensure that a detailed Construction Management Plans minimise delay to Transitway services.
- Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes; and
- If required, obtain approval from RTA for the operation of B Double type vehicles along Old Windsor Road during the construction period.

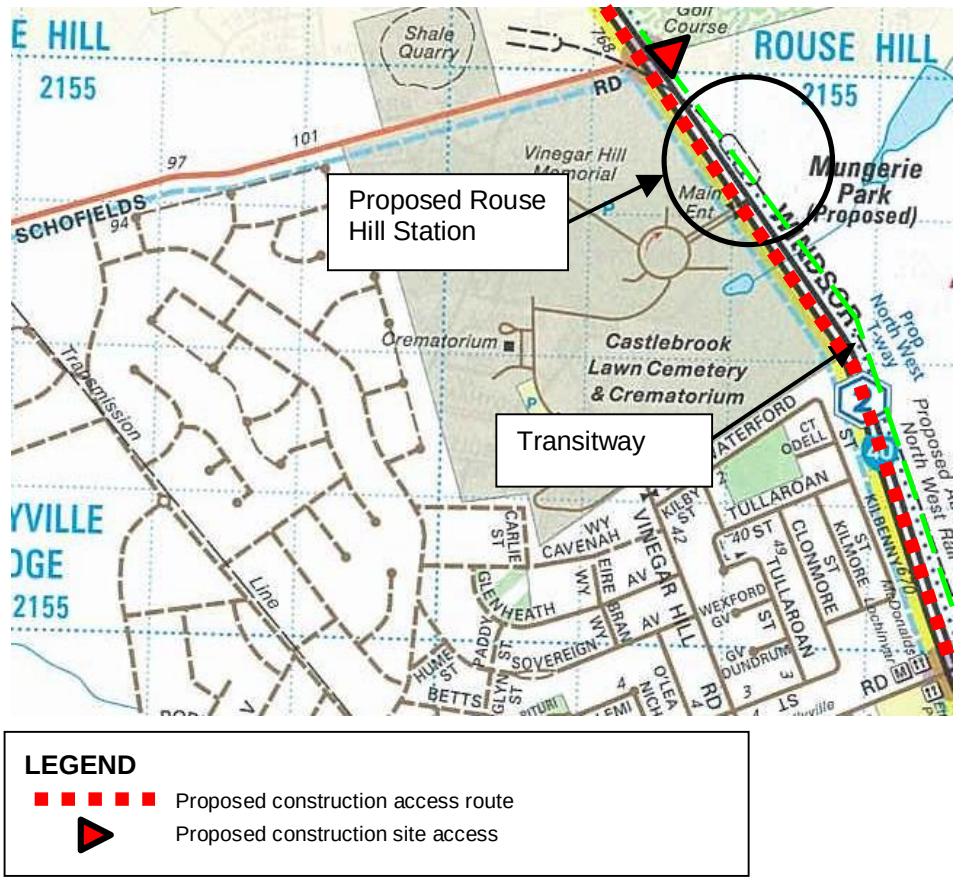
6.8 Rouse Hill Station

Construction activity generated by Rouse Hill Station includes the rail line section between Rouse Hill Station and Samantha Riley Drive. Construction activities and impacts associated with the delivery of Rouse Hill Station are discussed below.

6.8.1 Construction activities

Rouse Hill Station (see Figure 6.7) is to form an integral part of the Rouse Hill Regional Centre development, which is situated on the eastern side of Windsor Road, to the south east of Schofields Road. Construction of the station and approaches will be cut and cover with the station being located underground. At grade the station will incorporate a joint transitway-bus interchange and kiss and ride facilities.

Figure 6.7 Rouse Hill Station



LEGEND

- Proposed construction access route
- Proposed construction site access

6.8.2 Traffic generation

Similar to section 6.2.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the generation of construction traffic associated with spoil removal at the Rouse Hill Station is approximately seven months. Spoil quantities for this site also include the surface cut/fill railway through to Samantha Riley Drive.

Table 6.9 Construction Period Traffic Movements at Rouse Hill Station

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	376	40
Construction Truck Movements	40	4
Light Vehicles	100	50
Total	**516**	**94**

The movement of spoil and construction equipment is likely to generate in the order of 208 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 416 vehicle trips per day, comprising 208 In/ 208 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 44 vehicle trips per hour, comprising 22 In and 22 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.8.3 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for truck movements to and from the site:

» Left onto Windsor Road;

» Straight onto Old Windsor Road;

» Right onto Sunnyholt Road; and

» Right or Left onto the M7 at the Sunnyholt Road Interchange.

All routes except for a section of Old Windsor Road between Windsor Road and Sunnyholt Road are designated B-Double Routes. Old Windsor Road was approved by the RTA as a construction route during the construction of the M7 and is considered to provide an appropriate direct route for construction vehicles from the Rouse Hill Station site to the M7.

6.8.4 Parking

Parking opportunities for construction workers in the vicinity of the work site would be expected to be limited following the construction of the Rouse Hill Regional Centre. A suitable number of parking spaces for employees within close proximity to the site could potentially include an arrangement with local property owners.

6.8.5 Site access

The proposed location of the station is opposite the Castlebrook Lawn Cemetery and Crematorium. Access to the site should be incorporated with the existing signalised intersection of Windsor Road and Schofields Road, which would provide direct access onto Windsor Road.

6.8.6 Impacts on surrounding land use

The area surrounding the proposed station location is currently being developed as the new Rouse Hill Regional Centre with the majority of land to the north has already been developed as housing. It is likely that the Rouse Hill Regional Centre will be mostly developed during the period when the NWRL is being constructed and therefore would be temporarily impacted. Further consideration of these impacts and development of mitigation measures should be provided as part of the Construction Management Plan for the area.

6.8.7 Impacts on Transitway

The Parramatta-Rouse House Hill Transitway is currently under construction on the eastern side of Windsor Road adjacent to Rouse Hill. Construction works for the North West Rail Link will be undertaken underneath the Transitway corridor, this is likely to require temporary deviations around cut and cover sections. Modification of the Rouse Hill Transitway Interchange may also be required in order to integrate the interchange and proposed Rouse Hill railway station.

Mitigation measures may be required to ensure minimal delay to Transitway services. This may include temporary deviations to the traffic or Transitway route, temporary traffic control, a temporary T-way station and restrictions on queuing over Transitway intersections. These matters would be further detailed in the Construction Management Plan.

6.8.8 Impacts on intersections

The following intersections are likely to be impacted by construction vehicles:

» Schofields Road and Windsor Road; and

» Commercial Road and Windsor Road.

Both intersections are currently under signalised control.

It is recommended that the site access be integrated with the existing signalised intersection of Schofield Road and Windsor Road. Further investigation into the future projected traffic volumes and performance operation of this intersection during the planned construction period will be required.

6.8.9 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» Ensure that the successful contractor provides the following:

  - undertakes further investigations into the impacts on Rouse Hill Regional Centre during construction and as a result develops mitigation measures that form part of the Construction Management Plan;
  - construction management plans that minimise delays to Transitway services;
  - adequate temporary facilities to replace services that are lost temporarily during staged construction period;
  - sources and provides suitable parking arrangements within close proximity to the site for all on-site employees; and
  - retains pedestrian paths to the Transitway interchange.
- Undertake further investigation into the future projected traffic volumes and likely operation in the future of the Old Windsor Road and Schofield Road during the planned construction period; and
- Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

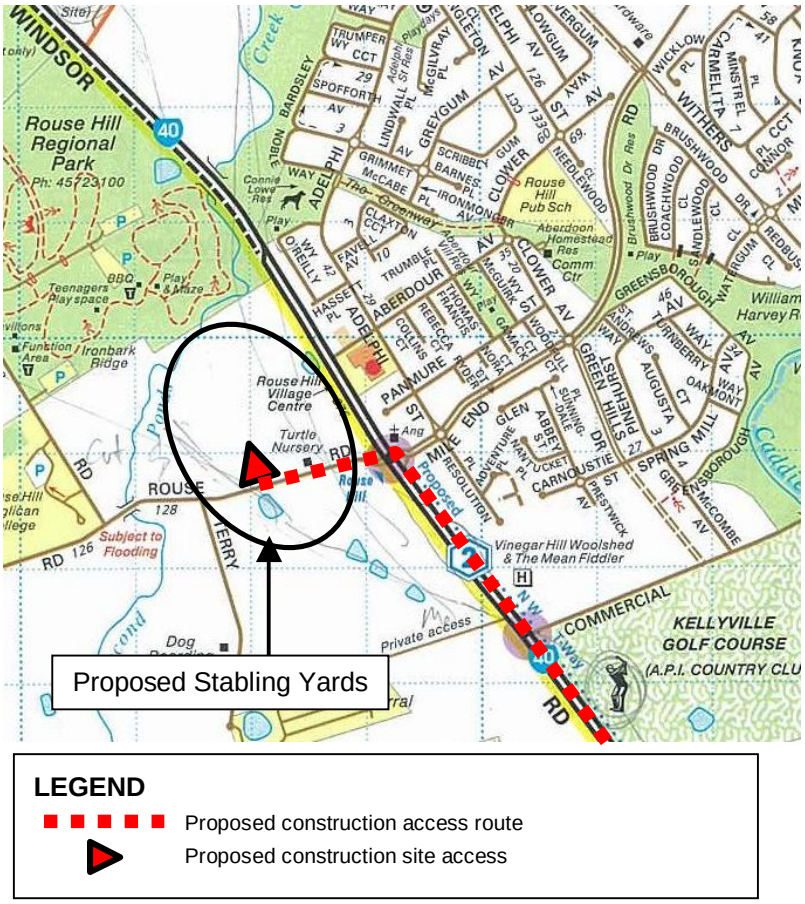
6.9 Rouse Hill Stabling Yards

Construction activities and impacts associated with the delivery of Rouse Hill Stabling Yards are discussed below.

6.9.1 Construction activities

The Rouse Hill stabling yards is proposed to incorporate a turnaround facility, holding yards and a cleaning and general maintenance facility. It is currently proposed to construct this facility on the western side of Windsor Road, north of Rouse Road.

Figure 6.8 Rouse Hill Stabling Yards



6.9.2 Traffic generation

Similar to section 6.2.2, the potential traffic generation for the construction period has been based on a worst case scenario and involves the removal of spoil from site, other construction truck movements and construction worker traffic.

The expected period for the generation of construction traffic associated with spoil removal at the Rouse Hill Stabling Yards is approximately seven months.

Table 6.10 Construction Period Traffic Movements at Rouse Hill Stabling Yards

Activity	Daily traffic movements (vtpd)	AM and PM construction traffic movements (vtph)
Spoil Truck Movements	168	17
Construction Truck Movements	18	2
Light Vehicles	100	50
Total	**268**	**60**

The movement of spoil and construction equipment is likely to generate in the order of

93 heavy vehicles per day. Based on the assumed worst-case scenario, the heavy vehicle traffic generation during the peak period for construction vehicle activity is in the order of 186 vehicle trips per day, comprising 93 In/ 93 Out movements. The proportion of these movements occurring during the AM and PM peak periods has been conservatively estimated at approximately 10%, with a split between arrivals and departures of 50/ 50.

Based on the above assumptions, heavy vehicle traffic generation during the AM and PM peak periods is 19 vehicle trips per hour, comprising 9.5 In and 9.5 Out movements.

It is assumed that traffic generated by construction workers will be similar to that described under section 6.2.2.

6.9.3 Haulage routes

Similar to principles set in sections 6.2.4 and 6.3.4, the following haulage route options have been identified for truck movements to and from the site:

» Right onto Windsor Road;

» Straight onto Old Windsor Road;

» Right onto Sunnyholt Road; and

» Right or Left onto the M7 at the Sunnyholt Road Interchange.

All routes except for a section of Old Windsor Road between Windsor Road and Sunnyholt Road are designated B-Double Routes. Old Windsor Road was approved by the RTA as a construction route during the construction of the M7 and considered acceptable to provide the most direct access for construction vehicles from the Rouse Hill Station site to the M7.

6.9.4 Site access

The proposed location of the stabling yards is north and south of Rouse Road. Rouse Road has a signalised intersection with Windsor Road and this intersection has been selected as the preferred access route to the construction site. Direct access to Windsor Road is to be avoided.

6.9.5 Parking

Parking spaces for employees could potentially be accommodated on site or include an arrangement with local property owners.

6.9.6 Impacts on surrounding land use

The area surrounding the proposed stabling yards site is low density rural residential with some commercial uses on Rouse Road. There is a small neighbourhood shopping centre on the opposite side of Windsor Road. The Rouse Hill Regional Park is to the north of the stabling yards site.

Traffic generation from the construction of the stabling yards is unlikely to impact on

any of the above land uses.

6.9.7 Intersection assessments

Rouse Road and Windsor Road ids likely to be impacted by construction vehicles. This intersection is currently controlled by traffic signals.

Further investigation into the future projected traffic volumes and performance operation of this intersection during the planned construction period will be required.

6.9.8 Recommended mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» Rouse Road is the preferred access route to the construction site;

» Avoid providing direct access for construction traffic to Windsor Road;

» Undertake further investigation into the future projected traffic volumes and likely operation in the future of the Rouse Road and Schofield Road during the planned construction period; and

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

6.10 Construction of Road Crossings

The construction of the overbridges and cut and cover tunnels are required at the following locations:

» Windsor Road – north of Schofields Road;

» Windsor Road – east of Old Windsor Road;

» Samantha Riley Drive – east of Old Windsor Road;

» Burns Road – east of Old Windsor Road; and

» Balmoral Road – east of Old Windsor Road.

This construction would result in modifications to the road network surrounding the above sites.

The key traffic impacts associated with these works are described below.

6.10.1 Windsor Road (North of Schofields Road) cut and cover tunnel

It is proposed to provide a rail tunnel under Windsor Road, north of Schofields Road, using a cut and cover construction techniques.

Staged construction of this tunnel would be required, which would be confirmed at detailed design stage in the Construction Management Plan. The work could be expected to include the following impacts:

» Temporary lane closures; and

» A temporary road diversion around the area of tunnel construction.

It is expected that a temporary deviation of Windsor Road would be required to allow the cut and cover tunnel to be constructed

Recommended mitigation measures and further studies

Further assessment of peak hour traffic volumes would need to be investigated to determine the timing of any lane closures in order to minimise the impact on the surrounding road network.

6.10.2 Windsor Road (East of Old Windsor Road) overbridge

It is proposed to provide a rail bridge over Windsor Road, east of the intersection with Old Windsor Road.

Staged construction of this bridge would be required, which would be confirmed at detailed design stage in the Construction Management Plan. The work could be expected to include the following impacts:

» Temporary lane closures; and

» Temporary road diversions around the areas of construction.

It is expected that a temporary closure or deviations of Windsor Road would be required to allow the new bridge structure to be lowered into place. Closures would be likely to cover a short time period and is likely to occur at night or during a weekend.

Recommended mitigation measures and further studies

Further assessment of peak hour traffic volumes would need to be investigated to determine the timing for the road closures in order to minimise the impact on the surrounding road network.

During any temporary road closures, Samantha Riley Drive could be used as an alternative route.

6.10.3 Samantha Riley Drive (East of Old Windsor Road) overbridge

It is proposed to provide a rail bridge over Samantha Riley Drive, east of the intersection with Old Windsor Road.

Staged construction of this bridge would be required, which would be confirmed at detailed design stage in the Construction Management Plan. The work could be expected to include the following impacts:

» Temporary lane closures; and

» Temporary road diversions around the areas of construction.

Temporary closure of Samantha Riley Drive may be required to allow the new bridge structure to be lowered into place. This is likely to cover a short time period and is likely to occur at night or during a weekend.

Recommended mitigation measures and further studies

Further assessment of peak hour traffic volumes would need to be investigated to determine the timing for the road closures in order to minimise the impact on the

surrounding road network.

During any temporary road closures Windsor Road could be used as an alternative route.

6.10.4 Burns Road (East of Old Windsor Road) cut and cover tunnel

It is proposed to provide a rail tunnel under Burns Road, east of Old Windsor Road, using a cut and cover construction technique.

Staged construction of this tunnel would be required, which would be confirmed at detailed design stage in the Construction Management Plan. The work could be expected to include the following impacts:

» Temporary lane closures; and

» Temporary road diversions around the areas of construction.

Temporary closure of Burns Road may be required to allow the cut and cover tunnel to be constructed. This is likely to cover a short time period and is likely to occur at night or during a weekend.

Recommended mitigation measures and further studies

Further assessment of peak hour traffic volumes would need to be investigated to determine the timing for the road closures in order to minimise the impact on the surrounding road network.

During any temporary road closures Samantha Riley Drive could be used as an alternative route.

6.10.5 Balmoral Road (East of Old Windsor Road) cut and cover tunnel

It is proposed to provide a rail tunnel under Balmoral Road, east of Old Windsor Road, using a cut and cover construction technique.

Staged construction of this tunnel would be required, which would be confirmed at detailed design stage in the Construction Management Plan. The work could be expected to include the following impacts:

» Temporary lane closures;

» Temporary Transitway diversion; and

» Temporary road diversions around the areas of construction.

It is expected that a temporary closure of Balmoral Road would be required to allow the cut and cover tunnel to be constructed. This is likely to cover a short time period and is likely to occur at night or during a weekend. Balmoral Road is currently lightly trafficked, however as development progresses this will become heavily used.

Recommended mitigation measures and further studies

Further assessment of peak hour traffic volumes would need to be investigated to determine the timing for the road closures in order to minimise the impact on the surrounding road network.

During any temporary road closures Burns Road could be used as an alternative route.

6.11 Summary of Recommendations

The following recommendations have been developed in order to control, manage and minimise the potential impacts on road network operations, bus services and the movement of pedestrians and cyclists and access to properties surrounding the rail network during the construction period.

6.11.1 Traffic impacts

Mitigation measures to minimise any adverse traffic impacts would include:

» Prior to and during construction, consultation with the community would ensure that the local community, including road users, are informed regularly on changed conditions including likely disruptions to access. Specific access measures to minimise disruption to access and parking would be detailed in the Construction Management Plan;

» A community liaison group, information hotline and complaints register would be set up for the duration of the detailed design and construction period to address community issues and provide updates on project status and progress;

» Appropriate traffic management, including temporary speed restrictions, precautionary signs, illuminated warning devices, manual and/or electronic traffic control and provision of temporary barriers and markers, to control these work areas and minimise delays would be implemented. Managed traffic control arrangements would also be necessary during periods of reduced lane flow;

» Establishment of safe access points to work areas from the adjacent road network including safety measures such as barriers, maintaining sight distance requirements and signage and the provision of traffic management measures such as those identified above;

» Construction hours would be between 7am to 6pm Monday to Friday and 8am to 1pm Saturdays. No construction work would be undertaken on Sundays or Public Holidays. The Balmoral Road site associated with tunnelling activities is proposed to operate 24 hours a day Night work construction would be undertaken in locations where construction of bridges and underpasses could significantly impact on traffic flow in order to minimise the disruption. Prior advice would be given to the community of any works outside normal construction hours;

» During construction, temporary speed restrictions would be imposed in the vicinity of construction activities taking place on or near roads. The procedures for installation and operation of road traffic devices, as established in Australian Standard 1742.3-1996 Traffic Control Devices for Works on Roads, would be followed;

» Disruptive works would be scheduled to take place generally outside peak commuting hours and peak weekend times;

» If some side streets are required to be closed temporarily during construction then

alternative access would be provided via other local roads;

» Temporary deviations may be required to allow traffic to pass the work-site while roadworks are taking place. Establishment and operation of deviations would be in accordance with Australian Standard 1742.3-1996 Traffic Control Devices for Works on Roads as a minimum; and

» Any additional measures for traffic management should be undertaken in accordance with AS 1742.3 1996, Manual of Uniform Traffic Control Devices, Part 3: Traffic control devices for works on roads.

The Environmental Management Plan for construction would include traffic management and safety procedures that further address these issues.

6.11.2 Parking impacts

Mitigation measures to minimise any adverse impacts with respect to increased parking demand during construction would include:

» Provision of suitable parking facilities within high parking demand areas such as at Castle Hill, Rouse Hill and also at the Balmoral Construction Site;

» A suitable number of parking spaces for employees within close proximity to the site, this could potentially include an arrangement with local property owners.

6.11.3 Property access impacts

Mitigation measures to minimise any adverse impacts with respect to property access would include:

» Property access would be maintained at all times where feasible. This may require the temporary relocation of property access while permanent improvement works are made. Where changes to access arrangements are necessary it would be necessary to advise owners and tenants and consult with them on alternate access arrangements; and

» Property access points would be separated from work areas (through the installation of fencing for example) to ensure safety.

6.11.4 Bus service impacts

Mitigation measures to minimise adverse impacts with respect to the operation of bus services would include:

» Bus service routes and frequencies would be maintained at all times where feasible. Where changes to bus timetables are necessary then agreement with bus operators, NSW Ministry of Transport and the appropriate Council, and the public and bus passengers would be notified of any changes;

» Diversions to the Transitway will be undertaken only where necessary and by consultation with bus operators, NSW Ministry of Transport and the RTA, and the public and bus passengers would be notified of any changes; and

» Bus stops and associated footpaths would be separated from work areas (through

the installation of fencing for example) to ensure safety.

6.11.5 Footpath and bicycle route impacts

Mitigation measures to minimise adverse impacts with respect to walking and cycling would include:

- Existing footpaths and bicycle facilities would be maintained at all times where feasible. This may require the temporary relocation of footpaths and bicycle facilities whilst construction works occur. Where modifications to footpaths and bicycle facilities are necessary then the appropriate Council would advise the general public and provide alternative facilities; and
- Temporary footpaths and bicycle facilities would be separated from work areas (through the installation of fencing for example) to ensure safety.

7. Conclusions

Previous studies have indicated that the population in this region is currently predominantly car orientated due to the lack of transport choices. Road network benefits have been identified in areas around the existing Northern Line as a result of delivering a North West Rail Link. Residential areas surrounding stations such as Beecroft, Thornleigh and Pennant Hills currently experience high levels of on-street parking, which results in localised congestion due to people driving to these areas from areas to the west and northwest of the line. The North West Rail Link would reduce the need for commuters from the North West area to park at these rail stations by providing a direct rail service from many of these areas.

It is proposed that services from the North West Rail Link would proceed to the CBD via the Epping-Chatswood Rail Link. In this corridor, an additional eight services per hour would therefore travel via new stations at Epping, Macquarie University, Macquarie Park, Delhi road and Chatswood before travelling down the North Shore Line. Rail passengers travelling to or from these areas would benefit from an increased service frequency of up to 12 services per hour, or one service every 5 minutes.

The broad benefits that the North West Rail Link is expected to deliver are as follows:

» Improved access to rail services and a reduction in travel times;

» Improved transport choice to help reduce the high car dependence characteristics in this region;

» Capacity relief on the Richmond, Western and Northern railway lines;

» Reduced demand on the region's arterial road network; and

» Improved integration at transport interchanges and stations to help encourage travel by public transport, walking and cycling in the region.

As part of station precinct planning, pedestrian and cyclist facilities would be provided to provide for safe and convenient access to the railway, these facilities would also provide an improvement to the surrounding community.

Operational impacts

After the North West Rail Link is constructed, a number of operational impacts could be expected at and around each rail station. These impacts and benefits may include:

» An increase in the number of local traffic movements leading to potential delays and conflict, the extent of this will be largely dependent on the design and the planned access arrangements to the rail station including the provision of park and ride facilities;

» An improved pedestrian environment and integration with other transport modes around rail stations with new road crossings, footpaths and interchange areas encouraged as part of the design; and

» Improved accessibility to Sydney's public transport network, providing improved

travel choice and potential for travel time savings.

It is recommended that future investigations be undertaken for station precinct designs in order to provide adequate priority for pedestrians, cyclists and public transport services with appropriate traffic management for kiss and ride and park and ride movements.

Recommended operational mitigation measures

The following recommendations have been developed in order to control, manage and minimise the potential impacts on road network operations, bus services and the movement of pedestrians and cyclists and access to properties surrounding the rail network during the operation of the project.

» At each station, further studies should be undertaken to determine:
  – local connectivity requirements to enable efficient pedestrian, cyclist and vehicular access to the station, particularly to nearby pedestrian generators and surrounding residential areas;
  – the potential impacts of traffic accessing the station from the surrounding road network, with particular attention given to the location and access to the park and ride facilities, minimising delay to bus services, potential impacts on local residential streets and operation of intersections on nearby arterial roads;
  – optimised integration of Transitway and other bus services with the new rail station;
» Design and delivery of each station should provide for:
  – well-lit and covered pedestrian paths between the bus stops, car parking and station entrances;
  – pedestrian crossing facilities across nearby roads;
  – bicycle parking and access routes to enable convenient access to the station.

Furthermore, further investigation is required on the following specific issues:

» User requirements, parking demand and potential impacts resulting from the upgrade of Cheltenham Station;
» The potential for shared use of an existing or future parking facility for use by rail commuters at Norwest and Hills Centre Stations; and
» Effective integration of the proposed Balmoral Road Release Area with regard to efficient local access to the rail station and planning for development that will place trip generators within close proximity of the rail station to develop as a local centre.

Construction impacts

The proposed stations associated with the delivery of the project are located in areas surrounded by existing development and land zoned for future development. As a result, management strategies for construction should be developed in order to minimise impacts, particularly when the site is in close proximity to existing residential and commercial areas. In the case of future land releases, co-ordination of development and construction works is required to minimise any potential impacts.

Intersections surrounding the proposed station locations will need to be investigated

further to ensure that acceptable levels of services can be achieved and there is adequate space to accommodate heavy vehicle movements.

In general, the following impacts have been identified to be associated with all construction sites along the alignment:

» Increased volumes of light and heavy vehicles on local roads surrounding work sites and arterial roads, potentially leading to some delays at intersections due to increased traffic volumes;

» Temporary deviations to roads, property accesses, footpaths, bicycle routes and bus services, which would be minimised and designed to provide safe and appropriate access throughout construction; and

» Potential temporary increase in parking demand on local streets as stations are constructed.

Recommended construction mitigation measures

The following mitigation measures are recommended in order to minimise impact on the surrounding area during the construction period:

» Ensure the following:

  – that further investigation into the impacts on land uses surrounding proposed stations during construction period and as a result develops mitigation measures that form part of the Construction Management Plan;

  – that construction management plans that minimise delays to Transitway services, where applicable are developed;

  – that adequate temporary facilities to replace services that are lost temporarily during staged construction period are provided;

  – suitable parking arrangements within close proximity to the site for all on-site employees are provided; and

  – pedestrian paths to the key facilities and public transport interchanges are retained.

» Undertake further investigation into the future projected traffic volumes and the operation of key intersections during the planned construction period; and

» Limit the route used by heavy vehicle traffic during the construction period to appropriately designed roads and RTA designated B-Double routes.

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