



**RailCorp**



**Transport Infrastructure**  
*Development Corporation*

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# **EPPING CHATSWOOD RAIL LINE**

## **BRIEF OVERVIEW**

**Version 2.0**

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# 1. Introduction

## 1.1 Background

The Epping Chatswood Rail Line (ECRL) is a new dual track electrified commuter railway across the north of Sydney, linking the Main Northern Line at Epping with the North Shore Line at Chatswood. The line includes three new stations at Delhi Road, Macquarie Park and Macquarie University, providing improved public transport access to education, retail and employment locations. In addition, new underground platforms are being provided at Epping and the existing surface station is being upgraded, and a new Chatswood Transport Interchange is being constructed.

These facilities are being constructed and commissioned by the Transport Infrastructure Development Corporation for the NSW Government. Upon commissioning, these facilities will be operated and maintained by RailCorp, with private sector involvement in the operation and maintenance of the non-rail component of the Chatswood Transport Interchange.

## 1.2 Document Purpose and Development

The purpose of this document is to provide a baseline description of the operations and maintenance of ECRL. The operations and maintenance are described under different operating modes, covering normal, degraded, emergency and possessions modes.

This document is an abridged version of the 'ECRL - Description and Operational Configuration Manual'.

**Note: The Final 'ECRL-Description & Operational Configuration Manual' will be issued prior to contract mobilisation.**

# 2 General Configuration

## 2.1 Route

The ECRL, with its junctions at Chatswood and Epping, is configured to provide a new train route from Hornsby, to the lower North Shore, and the Sydney CBD via the North Ryde/Macquarie corridor, i.e.

Up: Hornsby - Epping - Chatswood - Sydney CBD

Down: Sydney CBD - Chatswood - Epping - Hornsby

The new route is in addition to existing routes between Hornsby and the Sydney CBD via the Main Northern Line and North Shore Line. The ECRL and North Shore Lines connect directly through the Sydney CBD to the Northern and Western Lines to provide continuous "through" timetabled services.



Figure 2-1 Epping Chatswood Rail Line

## 2.2 Stations

Between Chatswood and Epping, new underground stations are provided at Delhi Road, Macquarie Park and Macquarie University. Additional platforms are provided at Epping and Chatswood Stations, to cater for increased passenger interchange and to ensure adequate and reliable train capacity at the new Epping and Chatswood Junctions.

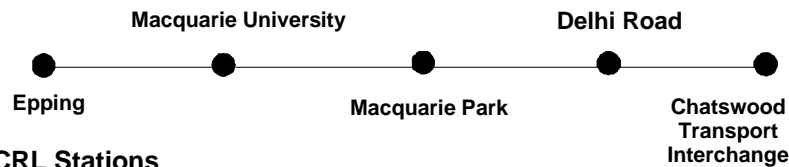


Figure 2-2 ECRL Stations

**Chatswood Transport Interchange (CTI)** is located centrally to the Chatswood CBD. CTI has been rebuilt to incorporate the rail station, bus interchange, pedestrian, taxi and drop off facilities.

**Delhi Road Station** – is located underground near the intersection of Epping Road, the M2 Motorway and Delhi Road at North Ryde.

**Macquarie Park Station** – is located underground near the intersection of Lane Cove Road and Waterloo Road at Macquarie Park

**Macquarie University Station** – is located underground near the entrance to Macquarie University at the intersection of Waterloo and Talavera Roads. It is also adjacent to the Macquarie Centre retail facilities.

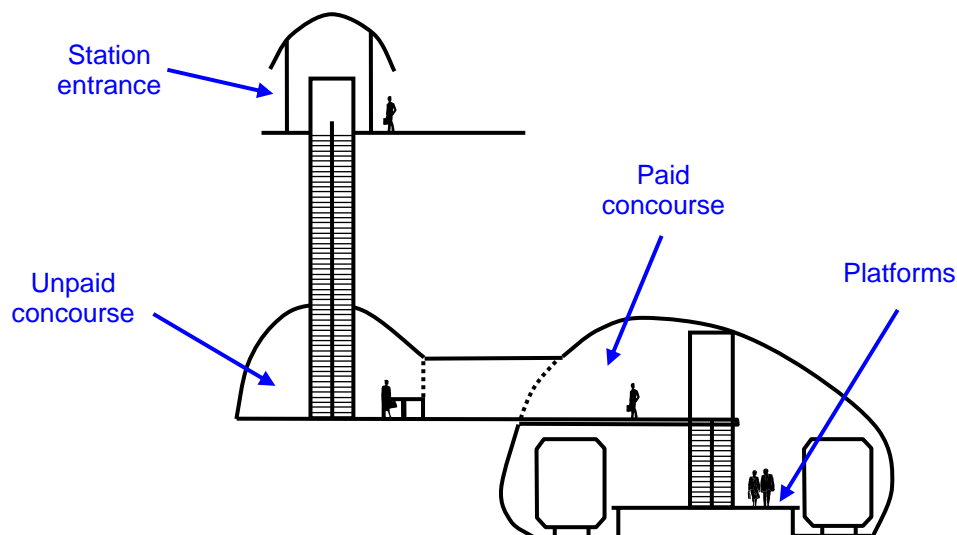
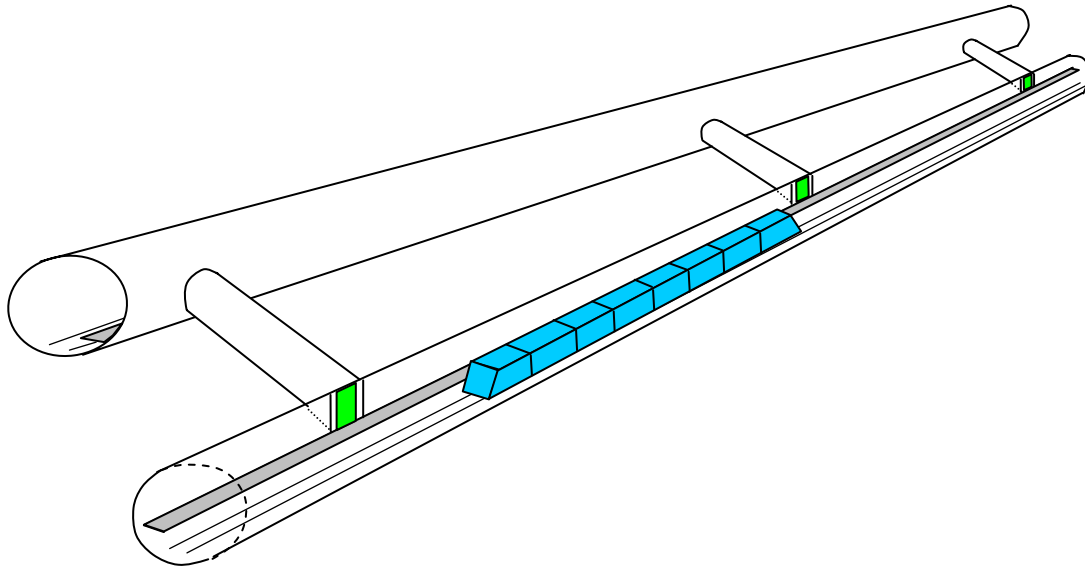


Figure 2-3 General Layout – Delhi Rd, Macquarie University, Macquarie Park

**Epping Station** is extensively redeveloped to improve platforms on the existing Northern Line and to provide new underground platforms on the ECRL. The existing surface station is completely refurbished with a new above track concourse and platforms have been widened and re-configured. Escalators, lifts and stairs provide access between the concourse, surface platforms and underground platforms.

## 2.3 Tunnel Configuration

The majority of the ECRL is contained within two tunnels approximately 12km long between portals on the northern side of Epping Station and portals on the northern side of Chatswood Station. The twin circular tunnels are approximately 14m apart. Each tunnel has an internal diameter of 6.5m and carries a single track. In addition to the circular tunnels there are short sections of box tunnel constructed by cut and cover methods. These are located near the portals and under the Lane Cover River. The tunnels are joined every 240m (minimum) by cross passages for pedestrian emergency evacuation.



**Figure 2-4 Tunnel Configuration**

## **2.4 Track and Signalling Configuration**

The rail systems are compatible with the rest of the Sydney rail network and the line is fully integrated into the network systems. The entire length of track in tunnel comprises concrete trackform with treatments to mitigate noise and vibration.

The ECRL includes underground crossovers at Epping, Macquarie Park and Lane Cove River. These crossovers are remotely operated. Dual directional signalling throughout the length of the line provides for bypassing any line blockage within the ECRL, and the clearing of trains under signals against the normal running direction. Signal control is integrated into the wider network systems with control of the whole line (including Epping and Chatswood junctions) from Strathfield Signal Box.

The maximum operating speed of the ECRL is 80 km/h. There are numerous extended grades on the ECRL at a maximum 2.9% (around 1 in 34) and the minimum curve radius is 585m around 1km east of Epping station.

## **2.5 Lady Game Drive Service Facility ( LGDSF )**

The Lady Game Drive Service Drive Facility (LGDSF) is located above the tunnels near the intersection of Lady Game Drive and Millwood Ave at North Ryde. The facility is located in the 5.5 km long tunnel section between Chatswood portals and Delhi Road Station. LGDSF effectively provides a tunnel section break that is otherwise provided at stations over shorter lengths of tunnel.

The functions of the facility are to:

- provide a tunnel evacuation and access location;
- contain equipment such as substations and signalling equipment rooms;
- provide ventilation shaft, fans, and associated equipment;
- house a water treatment plant (with discharge to the Lane Cove River);

## 3 Description of Rail Systems

### 3.1 Tunnel Ventilation and Fire Systems

#### 3.1.1 Overview

The purpose of the tunnel ventilation system is to maintain comfortable temperatures in the tunnels and station caverns, and to control smoke and heat in the event of a fire in the tunnel.

The tunnel ventilation system comprises two main subsystems:

- a) Tunnel Ventilation System and b) Trackway Exhaust System.

The operation of the two subsystems is integrated during all modes of operation. The three operating modes for the ventilation system are:

- Normal mode, during everyday free running of trains to timetable requirements.
- Congested mode, when trains are operating more slowly than their timetabled speed or have stopped within the tunnel.
- Emergency mode, when there is a fire incident in the tunnel network and operation of the Tunnel Ventilation System is required for safe passenger evacuation and fire fighting.

Each of the two tunnels is divided into 'Ventilation Sections' or Zones. There are total 10 sections in each tunnel. Each ventilation section can have maximum of **two** trains under all operating scenarios.

Some shorter tunnel sections only require one train in each tunnel bore to maintain the design headway of 3 minutes.

#### 3.1.2 Tunnel Ventilation System and Trackway Exhaust System

The Tunnel Ventilation System (TVS) includes two types of fans:

- Reversible axial fans in each of the station service buildings. These fans take air from outside and blow it into the tunnel, or expel air from the tunnel to the outside.
- Reversible jet fans in the tunnels near the stations and tunnel portals which assist the axial fans in providing sufficient air flow.

In combination, the fans operate in a 'push-pull' mode – pushing air in one end of a ventilated section and pulling out of the other end.

The TVS operates in a fully automatic mode of operation to cater for the normal, congested and emergency modes of operation as necessary. The automatic escalation of modes occurs as and when required.

The Trackway Exhaust System (TES), in the immediate vicinity of the station caverns, aids in the removal of train generated heat and in smoke management. It consists of under-platform and over-track exhaust ducts and associated fans. The TES operates automatically and in conjunction with the TVS. The TES removes around 50% of the heat generated by a train in the platform.

In fire mode operation, the under platform exhaust is closed off and the total system flow diverted to the over track exhaust system which extracts smoke from the station air space. All fans, dampers, actuators, components and cabling are designed to continue to operate for at least two hours while moving air at a temperature of 250°C.

#### 3.1.3 Fire Protection Systems

The Tunnel Fire Protection System for the ECRL consists of the following subsystems:

##### Fire Detection System

This consists of smoke detectors monitored by fire indicator panel(s). The system interfaces with the Central Control System (CCS) and, on detection of a fire, will activate other ECRL systems, including emergency lighting and ventilation, and the station fire alarm systems.



### Tunnel Hydrant System

A wet pipe tunnel hydrant system is installed in the ECRL tunnels and stations. The tunnel and station systems are connected to each other in a ring main set up and are fed from mains connection points located at each of the stations and at the tunnel portals at Epping and Chatswood. The system consists of nine separate ring main systems, each connected to a Grade II water supply at the respective stations and portals. Each ring main services half a tunnel length between stations and covers both up and down tracks.

### LGDSF Hydrant System

A hydrant & hose reel system to the requirements of the NSWFB is installed at the LGDSF. The system includes outlets at the ground floor external to the building, outlets at tunnel walkway level internal to the stairwell lobby area, and hose reels located in a central area at each level of the building.

### Gas Fire Suppression System

Gas fire suppression systems are in tunnel equipment rooms and station service buildings. The systems incorporate warning devices with a time delay prior to gas discharge. The gas suppression exhaust ventilation system can be used to ventilate the room prior to entry.

### Portable Fire Extinguishers

Carbon Dioxide portable fire extinguishers are installed in LGDSF, substations, sectioning huts, communications and signalling huts and tunnel cross passage equipment rooms.

## **3.2 Tunnel Access and Evacuation**

### **3.2.1 Tunnel Cross Passages**

The tunnels are connected at intervals not exceeding 240m by cross passages. The cross passages provide emergency evacuation access between tunnels. The tunnels are also connected at the three underground crossovers, at the platforms of each underground station, and at the LGDSF. Cross passages provide a pedestrian path.

The main purpose of the cross passages is to allow passengers and train crew to move from one tunnel to the other during an underground incident such as a train breakdown or a fire. Cross passage entrances are protected by fire rated doors that are normally closed, but not locked. The end of each cross passage, i.e. entry and exit from tunnel, has a 1m wide sliding, self-closing door. An amber strobe light will be fitted on the top of the illuminated exit sign. The strobe light will operate when a fire alarm is activated to guide people going through the cross passage.

Cross passage doors are alarmed and indicated via the CCS the position of persons in the tunnel (whether authorised or not).

Emergency phones are located at 80m intervals through the tunnels and are placed to coincide with each cross passage entrance.

Some cross passages also contain equipment rooms for railway signalling, communications and electrical distribution equipment and some contain sumps and pumps for the tunnel drainage system. They do not prevent the cross passages from being used for evacuation purposes.

### **3.2.2 Walkways**

Elevated walkways are provided in the tunnels for the emergency evacuation of crew and passengers. The walkways run along each tunnel, on the right side in the normal direction of train running. Hence the walkways are on the side of the tunnel adjacent to the other tunnel, with direct access to the cross-passages. The walkways are at approximately the same height above rail level as a standard access station platform (1.2m). At each track crossover the walkways drop to track level, via a ramp, pass through the crossover cavern (at approximately the same height as the rail head) and then rise again to the walkway on the other side of the crossover cavern.

As the elevated walkways approach the stations, they connect via a fire door and corridor to the station platform and the emergency fire stairs (to surface). The walkways do not directly adjoin the station platform.

The elevated walkway allows evacuation of trains through the carriage side doors (i.e. the normal passenger egress route) as opposed to end detrainment. In addition to the elevated walkway the track bed (4 foot) provides a smooth path as an alternate route.

### **3.2.3 Communication and Signage**

There are multiple redundant modes of communication in the tunnel allowing train crew to communicate with signallers and train control.

### **3.2.4 Tunnel Access and Egress**

The tunnel system provides for the use of the non-incident tunnel as a point of safety in the event of fire and /or smoke in one tunnel. In a non-fire scenario access and egress can be via either of the tunnels. Egress from trains to the other tunnel, stations, or to LGDSF, is facilitated by the tunnel cross passages and the raised walkway. Access and egress between the underground system and the surface is via each station, LGDSF, or the tunnel portals at Epping and Chatswood. Hi-rail access is provided at Epping and Chatswood. Access to the outside of trains within the tunnels is severely restricted due to the tunnel size and infrastructure such as the emergency walkway and drainage channels.

### **3.2.5 Tunnel Portal CCTV and Intruder Detection**

Fixed position closed circuit television cameras are provided at the Epping and Chatswood tunnel portals to provide additional information to operators to manage evacuation through these points. The station platforms and track areas are also covered by the station CCTV systems. The portal cameras will be compatible with the station CCTV cameras and will integrate into the station CCTV system. Images are stored locally at the stations and transmitted on demand to remote site at GRML and RMC via the communications backbone.

## **3.3 Rail Systems**

### **3.3.1 Track Structure**

All of the underground railway and sections of railway in dives has a concrete track structure. Two types of track are used:

- Rail supported on Delkor Egg baseplates which are directly fixed to the tunnel invert slab
- Rail supported on Delkor Alternative 1 baseplates fixed to a floating slab, which is held off the tunnel invert slab by elastomeric bearings.

There are three crossovers located underground. The sections of above ground railway at Chatswood (between the Chatswood dives and the station) have a concrete track structure.

### **3.3.2 Track Speeds**

Various speed boards will be posted along the line as required.

### **3.3.3 Signalling System**

The signals are double light colour light (4 aspect) LED similar to other signals in the metropolitan network. All signals are protected by train stops. Signal control is through the ATRICS system in Strathfield Signal Box.

The signalling system permits trains to operate in either direction in either tunnel. Under normal timetable operation, up and down trains will operate in their own tunnels – one designated Up and the other Down. On occasions, trains may operate in the “wrong” tunnel for all or part of their journey. The signalling system allows switching the direction of travel through the ATRICS panel.

The absolute signals protecting the crossovers have a refuge platform in front of and behind the signal for the protection of the safe working personnel. The platform is designed to protect personnel during train operations, allowing a flagman to stand in a prominent position at the signal and to allow safe working staff to communicate with the train driver. The platform is approximately five metres long and does not obstruct signal sighting. Access to and from the safe working platform is only allowed if strict emergency operating procedures are in place to protect the safety of personnel.

Guards indicators are provided on platforms to advise the guard of whether the departure signal has cleared.

Warning lights are provided in the tunnel areas at the ends of the platforms and linked to the signalling system to warn of approaching trains. The lights are fail safe and while the time taken for the light to extinguish prior to train travelling varies at each station, the minimum warning provided is 30 seconds. At platform areas, there are no warning lights through the tunnels.

### **3.3.4 Signalling / Ventilation System Interface**

A tunnel ventilation section is a single tunnel section between adjacent stations, portals or LGDSF. The ventilation system is only designed to be effective with a maximum of two trains in any one ventilation section. The signalling system ensures that under normal operations, no more than two trains are allowed to occupy a ventilation section.

The process for counting trains and the holding signal aspects is automatic and carried out within the signalling computer interlocking. In addition to counting trains in and out, software continually monitors track occupation within each tunnel ventilation section. The signaller is responsible for implementing any restrictions on train movements due to restrictions imposed by the ventilation system and the mode of operation.

The signalling system controls tunnel entrance signals and other signals preceding a ventilation section to ensure that the maximum number of trains in a ventilation section is

### **3.3.5 Train Control System**

The control system for ECRL is ATRICS. ATRICS is a modern duplicated computerised control system that allows the operator to monitor and control the movements of trains in the area of control. This system is already working in various areas of Metropolitan Network.

### **3.3.6 High Voltage, Low Voltage, and Electrical SCADA Systems**

#### **High Voltage System**

The High Voltage system for the Epping to Chatswood Railway consists 33kV and 11kV distribution subsystems that work together to provide a stable and reliable power system.

#### 33kV System

The 33kV system comprises bulk electricity supply points, feeders, substations and sectioning huts. Feeders come from bulk supply points at St.Leonards and Hornsby. The Hornsby feeder supplies 33kV equipment at the Devlin's Creek sectioning hut at Epping and the St. Leonards feeder supplies the Chatswood North substation. The ECRL network requires only one of the two supplies to be operational for normal system operation.

#### 11kV System

Station power is supplied through 33/11kV transformers located at Chatswood Traction substation, Lady Game Drive Traction substation and Devlin's Creek sectioning hut. The transformers are sized so that the loss of any one of the transformers will not result in a loss of power to the 11kV network operating in the ECRL system. Each of the transformers feed an 11kV switchboard.

#### **Low Voltage System**

The Low Voltage system at each station distributes the station loads as evenly as possible over the low voltage main switchboards/motor control centres. Each LV switchboard has two transformers on an "Up Ring" and a "Down Ring" which provide system redundancy. A UPS system is used to provide up to fifteen minutes of uninterruptible power to critical equipment during the change over process that takes place when changing from "Up Ring" supply to "Down Ring" supply or vice versa. The equipment backed up by UPS includes the Central Control System, the communications system and certain station loads. The split in supplies is such that failure of a switchboard will not result in a total loss of power to a tunnel section. This ensures that 50% of the tunnel will have power in the event of a catastrophic failure to a LV switchboard.

### **Electrical SCADA System**

The Electrical SCADA System is a system within the ECRL for the control and monitoring of 33kV, 11kV High Voltage Power Distribution System, 1500V DC Traction Power System, Low Voltage Switchgear such as main incomer circuit breakers and monitoring of the status of signalling power supply. The Electrical SCADA system is capable of remote site control and monitoring of the status of dual supply, high voltage circuit breakers, recording maximum demand of the network and alarms.

The ECRL Electrical SCADA system is fully compatible with the existing RailCorp Electrical SCADA System, located at the Electrical Operations Centres at Central and backup at Newcastle.

### **3.3.7 Tunnel Lighting**

The tunnels are supplied with three separate lighting systems: a normal lighting system, an emergency lighting system and a crossover inspection lighting system.

#### Normal Lighting System

The normal lighting system consists of fluorescent lights mounted above head height over the emergency walkway, of which one in three are always on while trains are running. This system provides a level of lighting at the elevated walkway surface suitable for evacuation and general inspection and maintenance activities. However for evacuation or maintenance the lighting can be remotely switched to make the tunnel brighter

#### Emergency Lighting System

In case the normal lighting has completely failed, an emergency lighting system is provided. These fluorescent lights are always on. In the event of a complete loss of lighting, these lights will automatically switch to battery power and will provide sufficient light at the walkway surface for evacuation. The batteries will maintain emergency lighting for a period of two hours after failure of the normal power supply.

#### Crossover Inspection Lighting System

Additional lighting is provided at each of the three underground crossovers to facilitate detailed inspection of the crossover geometry and components and for crossover maintenance.

### **3.3.8 Overhead Wiring System**

The tunnel OHW system is a fixed anchor, variable tension overhead wire system and is generally based on the Eastern Suburbs and New Southern Railway systems. This system has twin contact wires and single catenary.

#### Overhead Wiring System Operational Modes

For normal operation the OHW system is suitable for the ultimate capacity of the line (20 trains per hour) at a vehicle speed of 80 km/h. It is rated as per the DC traction power system and is compatible with the existing RailCorp electrified network.

In the congested and emergency operational modes, where there are more than two trains in an electrical section, trains will be stopped at signals and then moved off progressively one at a time as the overlaps clear. The emergency mode considers the scenario of when a 1500V dc trip out (blackout or brown out) occurs and four trains are in the one electrical section. Trains will not necessarily be at signals and theoretically could all be started within a short period of time once the power is returned.

### **3.3.9 Drainage and Water Treatment System**

#### Drainage

The drainage system on the ECRL incorporates a network of drains, pump stations, rising mains and a water treatment plant. The drainage network captures the following water sources:

- Seepage flow from tunnels and stations;
- Fire suppression system flows;
- Station and platform wash down water; and
- Rainwater ingress through openings, vents, portals and dive structures.

All tunnel flows originating between the Chatswood Portal and Epping Underground Station are discharged to the Lane Cove River via a single water treatment plant located at the Lady Game Drive Service Facility. Flows up to the portals are discharged locally from pump stations at each portal.

#### Water Treatment

The water treatment plant treats the inflow water to a quality that meets the requirements of the authorities for discharge to the receiving waters. The discharge point for the treated water is to the estuarine section of the Lane Cove River. There is redundancy in the plant to provide automatic back-up to the primary system.

### **3.4 Central Control System**

The Central Control System (CCS) manages the majority of station, service facility and tunnel systems to:

- Monitor the health status of various devices
- Monitor the operational status of various devices
- Operate certain devices e.g. ventilation and tunnel lighting

The CCS will also initiate several responses to a fire when an alarm signal is received from the Fire Indicator Panel. The CCS interfaces with the signalling system with the ventilation system.

The following is a list of systems for which the CCS has control and/or monitoring/reporting functions. The management of the control system functions is described in section 6.6.

#### **Rail Systems**

- Tunnel Ventilation
- Tunnel Lighting and Signage
- CCS Uninterrupted Power Supply
- Tunnel Drainage Systems
- Tunnel Fire Indication Panel (FIP)
- Distribution Boards / Switchboards
  
- Communications Backbone
- Communications and Control Equipment
- Tunnel Telecommunications
- Tunnel Radio Communications
  
- Tunnel Fire Detection and Protection
  
- Portal CCTV
- Equipment Room Environmental Monitoring and Temperature Indication
- CCS Interface – Security, Station Fire and Flood Alarms
- Signalling System
- DC Traction Power and Overhead Wiring (through Elec SCADA system)

#### **Station Systems**

- Station Ventilation
- Station Lighting and Signage
- CCS Uninterrupted Power Supply
- Station Drainage System
- Station Fire Indication Panel (FIP)
- Distribution Boards/ Switchboards (Station Electrical Supply)
- Communications and Control Equipment
- Station Telecommunications
  
- Individual Station Radio Communications
- Equipment Room Environmental Monitoring and Temperature Indication
- Station Fire Detection and Protection
- EWIS / PA
- Passenger Information and Display
  
- CCTV
- Vertical Transportation
- Ticketing System
  
- Station Security Systems

## Rail Systems

## Station Systems

- CCS Interface - Tunnel Intruder Detection Systems, Fire and Flood Alarms

### 3.5 ECRL Control Room

The 'ECRL Control Room' is a new facility located in the Strathfield Signal Complex. It is a room dedicated to the function of operating the ECRL :

- Three ATRICS workstations for Chatswood (North Shore), Epping (Main North) and North Sydney
- Three Station Passenger Information workstations (North Shore, Main North, ECRL)
- ECRL Central Control System operator workstation
- Overview screen/s

## 4 Description of Stations

### 4.1 Underground Station Configuration

#### 4.1.1 Delhi Road, Macquarie Park and Macquarie University Stations

The three new stations are designed to operate in a similar manner to existing RailCorp stations. They comprise entry structures, an unpaid passenger concourse, a paid passenger concourse, rail platforms and a "back of house" area for station staff and administration functions. These three stations have the same basic configuration with differences in the orientation of entrances and concourse configuration.

Each of the new underground stations incorporates two "service buildings", one at each end of the station. The service buildings contain:

- railway signalling/communications equipment, electrical power distribution equipment, traction power substations and sectioning switches;
- maintenance rooms;
- tunnel ventilation system axial fans and dampers;
- tunnel emergency exit stairways.

#### 4.1.2 Epping Station

The ECRL provides two additional underground platforms (i.e. one island) which connect vertically with the upgraded Epping surface station.

Access to the underground platforms is from the surface over-track concourse or from the surface platforms via an underground interchange concourse. Drop off, taxi stands and bus stops are located in Langston Place and Beecroft Road. As for the underground stations, way-finding signage is distributed throughout the station. There are service buildings at each end of the underground platforms.

### 4.2 Station Systems

#### 4.2.1 Overview

This section describes the functionality of the various station systems within the ECRL. The majority of systems are connected externally to the network by the ECRL communications backbone. The following systems are described below:

- Station ventilation

- Fire detection and protection
- Emergency warning and intercommunications system and public address
- Station security
- Closed circuit television and Help Points
- Integrated ticketing
- Station passenger information
- Lighting and signage
- Telephone and radio – refer section 5

#### **4.2.2 Station Air Conditioning and Ventilation System**

The Station Ventilation System provides controlled air to Station Service Buildings, facilities, platform and concourse areas and extracts air from specific service building rooms, stations facilities and concourse areas.

The system forms part of the overall ventilation system of the station and works in conjunction with the Station Trackway Exhaust System (TES) to maintain the required level of air supply and temperature range for the underground station areas.

##### **4.2.2.1 System Operation :**

Air is drawn from outside of the station by the 'Outside Air' system ( General Air Supply System, A/C Units Air Supply System, Platform Air Supply System and Toilet Air Supply System ) and supplied throughout the station to the concourse areas, underground platforms and Service Buildings. Rooms and areas supported with A/C systems are supplied with the fresh air by the Outside Air System.

Air is extracted from the concourse facilities areas and certain service building rooms by exhaust fans through Exhaust System ( General Exhaust Air System and Toilet Exhaust Air System ). The platform area and other service building rooms not supported by exhaust fans have the air extracted by the TES (Trackway Exhaust System) exhaust fans.

#### **4.2.3 Fire Detection and Protection System**

##### Fire Detection and Alarms

The Fire Detection and Alarm System consists of field detection devices such as smoke detectors and break glass units, alarm bells, door holder release contacts and a central Fire Indicator Panel (FIP). The FIP is located in the Emergency Control Centre at each station. This displays the status of each fire zone, identifies a predetermined evacuation route and initiates evacuation procedures.

The station is divided into zoned areas and each zone is a separate fire zone. The zoning for fire detection is the same as the zoning for other systems including the Emergency Warning and Intercommunications System (EWIS) and Public Address System, allowing a co-ordinated response to a fire in a particular section of the station.

The smoke detectors are located in the public and non-public areas of the station, and air ducts, for early detection of a fire. Break glass units are manual initiation devices located along evacuation routes where the front glass will have to be physically broken to initiate a fire alarm manually. The FIP will respond in a similar manner to an alert from smoke detectors or a discharge from the fire protection systems. When a fire alarm is initiated at the FIP, the FIP will interface to other systems

##### Fire Protection System

The Fire Protection System is installed to provide the means to suppress a fire. It is made up of a sprinkler system, hydrant system and gaseous system. Sprinkler systems are provided where required throughout the station. Hydrant systems are provided throughout the stations and along tunnels. The gaseous fire protection system is provided in rooms with electrical and electronic equipment.

Fire hydrants are provided to facilitate fire fighting and booster pumps are provided to maintain sufficient operable pressure.

#### **4.2.4 Emergency Warning and Intercommunications System and Public Address**

##### Emergency Warning and Intercommunication System (EWIS)

The Emergency Warning and Intercommunication System (EWIS), Public Address (PA) System and Remote Public Address System are all interconnected and share much of the same hardware, particularly the speaker system, throughout the station.

The EWIS provides audible communications to the patrons and staff to enable the orderly evacuation of the stations in the event of an emergency. In the event of a fire, the EWIS is automatically activated by the FIP and initiates audible alarms and broadcasts messages, which advise patrons and staff that the station is to be evacuated.

#### **4.2.5 Station Security System**

The station security system includes access control to the station and services building areas, intruder alarm of emergency exit doors and equipment rooms, movement detectors, personal duress alarms and a CCTV system.

The access control comprises card readers at entries to back of house area and station rooms. This is compatible with the current RailCorp centralised access control system.

Movement detector in stations detects illegal movements in staff areas after hours. Upon detection of people's movement in a secured area, an alarm will be sent to the security control panel of individual stations, GRML and RMC.

Personal Duress Alarm Buttons will be provided throughout the stations, particularly in the Ticket Offices and Station Manager's office. Upon manual activation of the duress alarm buttons, an audible alarm will be raised and alarm signal sent to GRML and RMC.

There are anti-tamper devices provided with ticket vending machines where cash is present. When the ticket issue machines are tampered with and the anti-tamper devices detect impacts such as vibration, an alarm will be sent to the station security system control panel.

#### **4.2.6 Closed Circuit Television System and Help Points**

Closed Circuit Television (CCTV) cameras are provided at entrances, platforms and lifts to monitor the passenger flow, and for security surveillance, to confirm emergency situations and monitor train movement in tunnels approaching stations.

The CCTV throughout the stations provide coverage to the requirements of a Category A station as detailed in the RailCorp "Passenger Security & Information Program Systems Concept Design for Station Per Category" document dated June 2002.

Station Help Points are provided as intercom units on a special purpose intercom network with a dedicated intercom exchange at each station. CCTV monitoring automatically reacts to activation of a Help Point. When a Help Point is activated, the CCTV allocated to the Help Point will focus on the point and the local and remote monitoring screens will switch to show images from the relevant camera, allowing rail staff in the Station Manager's Office and GRML to see who initiated the Help Point. GRML and RMC staff can talk to the patron using Help Point Intercom System, Public Address System or Remote Public Address System (external to the station).

#### **4.2.7 Integrated Ticketing System**

This comprises automatic fare collection ticket gates, which are operated by a central computer and automatic ticket vending machines. These are consistent with the facilities provided over the rest of the rail network.

Automatic ticket gates are located at entrances of the paid areas. Under normal revenue operation conditions they are closed and open upon detection of correct fare tickets, and generate alarms when an invalid ticket is detected. When a fire is detected, the ticket gates will open automatically.

Automatic ticket vending machines are located in the unpaid concourse where patrons can purchase tickets with cash.

When a ticket machine is tampered with, an alarm will be generated and a signal will be sent to the Station Security System.



#### 4.2.8 Station Passenger Information System

The Station Passenger Information System is used to provide passengers with train information such as destination, stopping pattern, due out time, departure platform designation and number of carriages due at the station. A 'Type 2' SPI system is provided. This includes electronic indicators on platforms and the unpaid concourse on each station. As interchange locations, Epping and Chatswood also have indicators in the paid concourse.

During emergency events, the it is used to display suitable visual messages on the appropriate display devices in the stations.

Digital 'Precise clocks' are located on each of the station platforms to show the exact time for the information of operational staff.

#### 4.2.9 Lighting and Signage

The Lighting System in the station comprises normal lighting, emergency lighting and signage.

The normal lighting provides efficient and functional lighting to provide a safe environment for patrons using the station. The normal lighting in the public area, such as concourse and platform, will be switched on and off in groups by the ECRL Control System via contactors with override switches for after hours maintenance and testing. As cleaning is usually carried out after hours and it does not require such high lighting level as the stations normal lighting, the public area lighting will be reduced to 50% after hours for this purpose and the 50% lighting will be rotated everyday to ensure the lamps throughout the station are running relatively evenly throughout their life.

For the back of house area, manual switching by local light switches will be provided. Again, cleaning will be carried out after hours using reduced lighting levels. This will be controlled locally.

The Emergency Lighting System is a backup lighting system to provide emergency lighting for evacuation purposes.

#### 4.2.10 Warning Lights

As described in Section 3.3.2, warning lights are provided in the tunnel areas at the end of platforms to advise rail workers of approaching trains.

### 4.3 Chatswood Transport Interchange (CTI)

Chatswood Transport Interchange is a new interchange that integrates a rail concourse and platforms with a bus interchange, taxi and drop off facilities, and retail/commercial facilities.

The rail station consists of two 170m island platforms each with two platform faces. The platforms are raised higher than the land surrounding the station. In normal operation ECRL trains use the inner two platform faces and NSL trains use the outer platform faces. This arrangement provides cross platform interchange between up ECRL and NSL trains, or between down ECRL and NSL trains. In general, station services and systems are as for the underground stations.

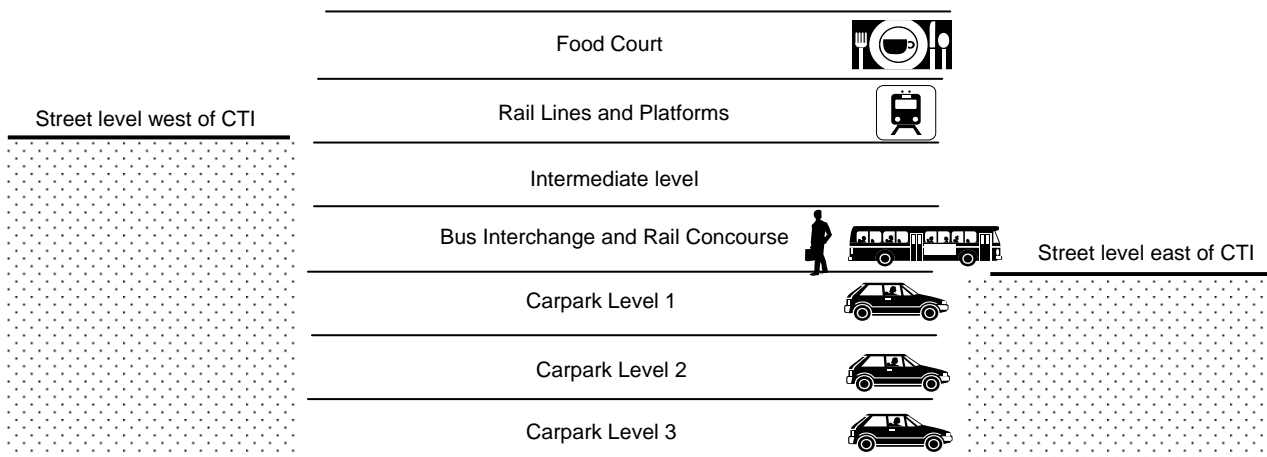


Figure 4-1 CTI Arrangement of Levels in Central Area

## **5 Tunnel/Station Phone and Radio Systems**

### **5.1 General**

Various telephone and radio systems are available in the tunnels and stations. Voice, video and data transfer is via a communications backbone, which is an extension of the existing rail communications backbone as provided by RailCorp. The radio communications system provides radio system coverage along the ECRL tunnel sections, stations and the LGDSF.

MetroNet Train Radio, GRN and Police Radio services are all provided as extensions of existing networks and are connected back to their respective control centres. RailCorp Station Operations Radio is a locally operated system, unique to each station.

### **5.2 Phone Systems**

#### **5.2.1 General Administration Phones**

This provides a general purpose telephone system for management, administration, operation and maintenance services for the ECRL. The system has the capability to interconnect with both the RailCorp private administrative telephone network and the public switched telephone network.

#### **5.2.2 Traction Phones**

Traction phones are provided at each traction substation, sectioning, hut, ring main unit and DC isolator rooms. A direct phone line is provided between all substations and sectioning huts to the Electrical Operations Centre PABX.

#### **5.2.3 Signal Post Phones**

For all signals, signal phones will be located on the walkway side of the track to aid access from a train to the phone. Controlled signals will have signal phones in a parallel arrangement on both the walkway side and at the signal. Rail staff at the signal post can use the signal phones to communicate with the ECRL Control Room at Strathfield.

#### **5.2.4 Emergency (Fire) Phones**

The station and tunnel emergency phones are provided on a special purpose phone network and stand-alone PABX. Emergency phones are located throughout the tunnels every 80m to 120m. The phones are connected directly to the RMC with 'pick up and talk' operation. The RMC operator can identify the specific emergency phone being used through a caller identification function. The RMC operator can connect two or more individuals in the tunnel using the voice communications systems (VCS).

#### **5.2.5 Mobile Phones**

Infrastructure has been provided to support 1800/2100MHz GSM and W-CDMA coverage.

#### **5.2.6 X-Ring Phones**

A party line service is provided from the signal box to the associated stations within the signalling area. The X-Ring phone system is an extension of the existing system where the telephone at the signal box has an open line to all the connected stations for signallers to communicate train running information to Station Managers.

#### **5.2.7 Public Pay Phones**

Public pay phones are located in the unpaid concourse and on platforms.

#### **5.2.8 Paging**

There is provision for the Link paging system used by station staff and guards at stations only i.e. not within the tunnels except in platform areas. A decision on the implementation of this system has been deferred.

### **5.3 Radio Systems**

#### **5.3.1 MetroNet**

The MetroNet Train Radio is provided for communication between train drivers and signallers/controllers. MetroNet communications can be broadcast to/from the tunnels and station

platform areas, but not elsewhere within the stations or LGDSF. The system is compatible with the existing MetroNet train radio installed in the City Rail network. Status, monitoring and alarms will be provided to the RailCorp Network Monitoring Centre and will also be provided to the ECRL Control System.

### **5.3.2 GRN and Police Radio Network**

The Government Radio Network (GRN), and Police Radio Network provides voice and data communications between dedicated hand held portable radios and Police Central Operations. The systems will be integrated with their existing Government Radio Network and Police Radio Network systems. These services will provide communication for NSW Police, Ambulance, Fire Brigade and State Emergency Services (SES). These systems operate throughout the tunnels, stations and service areas.

### **5.3.3 Station Operations Radio**

The station operations radio provides communication between portable hand held radios and/or the Station Managers office (or other appropriate station location). The radios are designed for security and operations communications and coverage is limited to each independent station, excluding the LGDSF.

## **6 Tunnel Access Restrictions**

Under normal operations, people will not be permitted in the tunnel, including using tunnel walkways and cross passages, when trains are operating. There may be circumstances when access is required during the operation of trains, for example flagging failed signals or manually switching points. In these circumstances existing safe-working procedures will apply.

## **7 Infrastructure Maintenance and Possessions**

### **7.1 Access During Operations**

There will be no refuges in either of the tunnels, and maintenance personnel will not be permitted to access the tunnels for normal maintenance activities while trains are operating. Access to attend to infrastructure faults during normal operating hours will be via standing train protection or other (existing) safe-working procedures.

Generally station maintenance activities will not be carried out during normal operating hours unless these can be carried out without significant impact to staff or customers (e.g. normally only back of house activities).

### **7.2 Nightly Possessions**

Maintenance in the tunnels will be restricted to a shutdown window between the hours when train services are not in operation. In general this will allow access windows of approximately 4 hrs. The nightly possessions, the ECRL intended to be Monday – Thursday nights with an additional night on Sunday if required.

NOTE: Monday night is access will actually fall in the early hours of Tuesday morning and so forth.

A 48-hour shutdown over one weekend may also be made available on an annual basis if required.

These shutdowns are listed in the Railcorp “Major Closedown Weekend Possessions Program”. These dates are subject to change and the latest version must always be used.

### **7.3 Station Maintenance**

The Station Maintenance Section of Infrastructure Group (Building & Sidings) is responsible for the routine and Major Periodic Maintenance of passenger facilities. These facilities include station platforms and buildings; car parks and bus interchanges and their access ways. A maintenance management structure exists that provides the full maintenance function by planning, organising and controlling tasks through a system of routine maintenance inspections, preventative and corrective maintenance tasks, emergency response and planned, cyclic maintenance.