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ROLLING STOCK PPP MAINTENANCE FACILITY

REFERENCE DESIGN REPORT

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Reference 17261/
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Note: This Report has been prepared by Connell Wagner Pty Limited in support of the RailCorp Maintenance Facility Reference Design.

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Document Control

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07	10 October 06	Reference Design Issue – Change Clause 7.1	SP	SP	PR	PR
08	21 November 06	Change paragraph 5, Section 1	SP	SP	PR	PR

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1. Introduction

The Rolling Stock Public Private Partnership (PPP) Project incorporates the design, construction, maintenance and finance of new passenger rail cars to replace existing R, S & L rolling stock and associated maintenance facilities for the rail cars, and other cars. The site is located between Auburn and Clyde stations on the southern side of the western Mainline. The PPP Co. will operate the facility for minimum 35 years before it is handed back to RailCorp.

The capacity of the PPP Maintenance Facility is to maintain a fleet of 1000 cars comprising the PPP Sets and Other Sets.

Connell Wagner was appointed by RailCorp in April 2006 to develop the initial stages of the design of the Site Works component of the PPP Maintenance Facility. The design of other components of the Facility including the Maintenance Building, Washplant, and Underfloor Wheel Profiling Plant (UWPP) were not part of the Connell Wagner scope of service. The Site Works design has been developed as a reference design for the tender of the PPP Maintenance Facility Works. Connell Wagner's scope of service includes the following disciplines:

1. Permanent way
2. Civil/Structural design
3. Bridge design
4. Traction power
5. Overhead wiring
6. Signalling
7. Communications
8. Earthworks
9. Stormwater, water and wastewater design
10. HV Power
11. LV Power
12. Security Design
13. Architecture (excluding PPP Maintenance Facility)
14. Landscaping

Connell Wagner reference design documentation consists of this report and drawings that document the proposed design solutions derived from the interpretation of RailCorp requirements.

Outlined below, by each discipline, are the functional requirements, design assumptions and scope of works identified as part of the Reference Design. Assumptions described in this document form the basis of Connell Wagner's design. This report and the Reference Design drawings are in no way intended to detract from the significance of the Maintenance Facility Specification.

This document refers to a Future RailCorp Facility adjacent to the proposed PPP Maintenance Facility. Based on preliminary planning for the site it is expected that this facility will be a Stabling Yard, however no decision has been made at this time.

It is noted that this reference design is not exhaustive and is provided as a general description only. The PPP Co is to undertake its own investigations, liaisons and design. In particular, all references to scope of work in this report are indicative only. PPP Co is responsible for the provision of all plant, materials, labour and other resources necessary to design, supply, build/construct, test, commission and maintain all things necessary for thee subject Maintenance Facility with the capacity for 1,000 cars..

2. The Site and Interfaces

2.1 Site Boundaries

Outlined below is a description of the project boundaries.

1. The boundaries of the PPP site are fixed where the site abuts the following locations:
   - Down Relief.
   - MainTrain.
   - RailCorp Central Warehouse.
2. The boundaries of the Site abutting the Future RailCorp Facility can accommodate some minor adjustment with RailCorp approval.

2.2 Interfaces

The following interfaces need to be incorporated into the PPP Maintenance Facility as necessary.

MainTrain

1. The principle access to MainTrain and Manildra (flour store) is to be maintained.
2. Access to MainTrain Sidings from the new Bypass Road must be provided and connected/realigned.
3. Disruption to MainTrain must be minimised and must be agreed by RailCorp.

Down Relief

1. The Down Relief is to be upgraded by RailCorp. Signalled mainline access to the PPP Co Maintenance Facility from the Auburn Corridor via the Down Relief (Commissioning Track) will be provided, using the existing 53 crossover at the Auburn end and 705 crossover at the Granville end. Train operations on the Down Relief during this period will be in accordance with Network Rules and Procedures for Yard Working in Sidings.

2. RailCorp will design the Down Relief upgrade to cater for two new turnouts into the PPP Site at the Granville end and one turnout at Access Road 1. PPP Co will be required to construct those three (3) turnouts in accordance with the RailCorp design for the Down Relief. RailCorp will provide the turnouts, point motors and associated rods free supply.
3. A 5mx10m level platform for the placement of Down Relief signal cabinets and canopy at chainage 20.055 km is to be placed 5.5m clear of the Down Relief track. Refer to Section 8 for requirements.
4. A 200m long inspection hardstand area is to be provided by RailCorp on the Down Relief.

Existing turnouts #49 and #52 at the Auburn end of the site are to remain and be used as key entry points to the PPP Maintenance Facility.

Future RailCorp Facility

1. Coordination with and provision for the Future RailCorp Facility is required as specified on the Reference Design drawings.

3. Site Operational Requirements

This section describes the operational intent and assumptions on which the design has been based.

3.1 Functional Intent

The key operational requirements are outlined below:

1. Accommodate and maintain RailCorp electric sets of 163m length with provision for 192m sets at nominated locations.
2. Provide train access to:
   - PPP Maintenance Facility.
   - Underfloor Wheel Profiling Plant (UWPP) Facility.
   - Train Washplant Facility.
3. At least 6 no. Maintenance Roads at level grade suitable for sets of 163m length are required through the Maintenance Building.
4. 8 no. Storage Roads to store new Sets and Other Sets of 163m length (including ability to hold at least two 192m long sets) plus clearances for signalling, catchpoints and any other operational requirements etc.
5. Storage Roads to be suitable for:
   - Hand over and pick up of sets by RailCorp.
   - Storage of sets by the PPP Company
   - Inspection of sets prior to entering into service.
6. Minimum 6 no. Standing Roads East on the Auburn side of the PPP Maintenance Building suitable for standing 163m sets.
7. Ability to shunt between all Storage Roads and all Standing Roads East.
8. Minimum 6 no. Standing Roads West on the Granville side of the PPP Maintenance Building suitable for standing 163m sets.
9. Standing Roads West to be suitable for hand over and pick up of sets by RailCorp.
10. Standing zones each side of the train Washplant suitable for a 163m set and is to be clear of the truck access level crossing.
11. Capability for RailCorp crew to deliver sets to, initiate operation and drive sets from the Washplant.
12. Standing zones each side of the UWPP suitable for a 163m long set on the Auburn side and at least a 163m set on the Granville side and are to be clear of the truck access road.
13. All storage and standing roads or zones are to be provided with clearances for signalling, catchpoints and any other operational requirements to prevent fouling points etc.
14. Capability for RailCorp crew to deliver sets to, and pick up sets from, the UWPP.
15. A Bypass road around the PPP Maintenance, UWPP and Washplant facilities.
16. Ability to directly access the UWPP and train Washplant facilities from any of the Storage Roads.
17. Secondary access (Access Road 1) to the Down Relief from Storage Roads 1-4 for additional operational flexibility.
18. Connection to the Down Relief (with catchpoints and associated areas for train runoff) at:
    - 2no. turnouts at the Auburn end utilising existing turnouts numbers #49 and #52.
    - 2no. new turnouts at the Granville end.
    - 1no. new turnout for Access Road 1.
19. Provision for accommodation of the Mobile Version Simulator close to the Crew Room comprising:
    - a dedicated hardstand area of appropriate dimensions,
    - all necessary services and suitable connections to / for the Mobile Version Simulator
20. The "in ground" works associated with a decanting and tanking facility are to be provided between two Storage Roads for the purpose of emptying effluent and filling water tanks on interurban trains that are fitted with controlled emission toilet systems. Features include:
    - Effluent is to be connected to local sewer systems.
    - The decanting and tanking facility is to be able to accommodate both 192m and 163m long trains.
    - The provision of facilities associated with a decanting pump house and associated equipment

to be provided at the western end of the Storage Roads to host the pumping mechanism.
- Access for maintenance will be required.

21. Provision is to be made to restrict facilities being constructed within the train run-off areas from the Catchpoints to provide both a safe run-off area and limit damage should trains run-off into these areas.
22. The design of the Down Relief (Commissioning Track) at the Granville end is to allow for the later incorporation by RailCorp of a turnout to provide access to the Future RailCorp Facility.
23. PPP Co is to provide a yard control facility in accordance with the Maintenance Facility Specification to manage the safe movement of trains and vehicles on the site and to/from the site.
24. PPP Co is to maintain the interfaces with MainTrain and Manildra including coordination of train movements for the purpose of maintaining continuity. The communication network needs to manage the internal movement of trains.

3.2 Assumptions

The following assumptions were made during development of the reference design:

1. The Down Relief west of the Auburn end turnout #49 and #53 will be used as a test track by PPP Co during Stage 1 Operations. For Stage 2 Operations, ie following completion of testing activities by PPP Co upon the Commissioning Track, the Down Relief line will be managed as a master siding and be controlled by PPP Co. For Stage 3 Operations, signalling will be controlled from the Strathfield Signal Box (superseding the Auburn, Clyde and Granville Signal Boxes) and the Down Relief line will be controlled by RailCorp.
2. RailCorp has addressed the safe movement of trains on and off the Down Relief line in this Reference Design. Refer to Section 5 – Signalling.
3. Train movement speed within the PPP Maintenance Facility will be 8 km/h.
4. The purposes of the rail roads are to include:
   - Storage Roads and Standing Roads West - storage of sets, drivers' preparation (inspection to enter service) and minor repairs arising from preparation (tool box repairs and including possible window replacement)
   - Standing Roads East – queuing of trains entering/departing the Maintenance Building, cleaning if not done in Building (internal cleaning and cleaning normally carried out at RailCorp depots or RailCorp washplants), Graffiti removal (using long handles), minor repairs which may involve mobile equipment (if Maintenance Building too busy), drivers' preparation.
   - Maintenance Building - General inspections, scheduled maintenance, CCO, out of course maintenance; refurbishment; modifications, cleaning etc.

4. Permanent Way

This section discusses the design of the permanent way, includes assumptions on which the design has been based, and lists key scope of work elements to be constructed. The operational functional intent for the permanent way is outlined in Section 3 - Site Operational Requirements.

4.1 Functional Intent

Key Permanent Way functional requirements include:

1. Maximum track grade:
   - Storage - 1:150.
   - Standing Roads - 1:150.
   - Maintenance Roads – level.
2. Minimum track radius - 160m
3. Diamond cross over type - 1:3.5 (as agreed by RailCorp)
4. Vertical curves through turnouts to have minimum radius of 3000m.
5. Track design to allow full signalling in the future.
6. Coordination with:
   - The Down Relief upgrade project (design and construction by RailCorp).
   - MainTrain facility development.
   - Future RailCorp Facility
7. The track has been designed to accommodate full signalling at the interfaces with the Down Relief and to accommodate the potential for full signalling elsewhere on the site in the future.
8. Regular access points from the PPP Maintenance Facility to the Down Relief were required for maintenance vehicles at a number of locations. Five locations have been provided through the boundary fences. In additional a down relief inspection area (200m long) is to be incorporated adjacent to the Down Relief on the northern side of the PPP Maintenance Facility fence line.
9. Coordinate the landing area for catchpoints on Down Relief, preceding turnout #52 and the western-most turnouts with other infrastructure provided by the PPP Co.
10. All essential services to be relocated outside catchpoint landing zones shown on Reference Design drawings.
11. Fences to be terminated or diverted around catchpoint landing zones as required.
12. Track generated noise is to comply with the authority requirements.

4.2 Assumptions

The following assumptions were made during the Reference Design:

1. Longitudinal grades for the Storage Roads as well as for the Standing Roads on both sides of the PPP Maintenance Facility should comply with the draft Design Guidelines for the Upgrade and Construction of New and Existing Train Stabling Yards and Turnback Sidings requirements (maximum grade of 1:150).
2. The track in this Reference Design has been prepared in accordance with the RailCorp Maintenance Facility Specification that includes:
   - Minimum 53kg/m rail
   - Minimum medium duty concrete sleepers
   - Minimum 150mm standard ballast.
3. The PPP Co. is to make its own assessment of subgrade, capping layer, ballast and track design. Varying depth of ballast may be required, in particular at track elements such as the diamond cross over and in areas of poor ground.
4. Flexibility for shunting between the storage and access roads has been provided with the incorporation of a diamond crossover. A 1:3.5 Diamond is proposed. This non-standard RailCorp component of infrastructure has been agreed by RailCorp.
5. The Car Turning Loop was designed with a minimum radius of 160m. This radius does not comply with the RailCorp Standard TS 3202 requirement for the minimum radius of 200m. However, the proposed minimum radius of 160m complies with the RailCorp Draft Standard ESC 210 (Track Geometry and Stability) requirement applying maximum (or minimum) Design Limits

6. Track layout for Storage and Standing Roads is based on the draft Design Guidelines for the Upgrade and Construction of New and Existing Train Stabling Yards and Turnback Sidings with 5.2m and 5.9m centres.
7. The original design for Storage Roads and Bypass Road 1 design was amended to accommodate the crossover between Bypass Road 1 and MainTrain Siding. Non-standard changes were made to accommodate this requirement including:
   - The catch points and turnout at the Auburn end of the Storage Roads are on vertical curves (radii more than 3000m) and vertical gradients around of 2%.
   - The Car Turning Loop turnout on Bypass Road 1 is on a vertical gradient of around 2%.

   At the time of writing, these geometric proposals had been discussed with RailCorp wherein it has been indicated that a minimum 3000 m radius was required for the vertical curves.

8. The track layout through the PPP Maintenance Facility provides a mainline length of straight between reverse curves which in places is less than the desirable straight quoted in the RailCorp Standard TS3202 Basic Siding Track Design Standards. In developing the design PPP Co shall to seek to increase the available straight between curves, ensure long vehicles can be accommodated without the need for separate shunting and gain the necessary RailCorp acceptance of the design in this respect.
9. Catchpoints at the eastern and western end of the Down Relief between turnout #52 and the western turnouts respectively are to be provided by RailCorp.
10. A non-conforming clearance of 5.8m between Storage Roads 1 and 2 track centres has been documented but is to be resolved by PPP Co in further design development.
11. Clearance between the Bypass Road 1 and Storage Road 8 is currently documented at 5.6m centres. The Bypass Road 1 is several hundred millimetres lower than Storage Road 8 and will have trains passing by the inspection walkway adjacent to Storage Road 8. A safety assessment is expected to be undertaken by PPP Co during design development to assess the risk of the lower track with trains passing-by staff with their backs turned while inspecting trains on Storage Road 8.
12. PPP Co is to ensure that track-generated noise complies with the authority requirements, in particular knocking at the diamond crossover and squeal on tight radii tracks.
13. The Reference Design has been further modified to accommodate anticipated operational requirements pertaining to the crossover connecting Bypass Road 1 to the MainTrain siding, the relocation of the siding described as MainTrain 1, the amended connection for the MainTrain Siding, the correction to the boundary line shown on the drawings for the MainTrain Lease Area and the amended point of connection for the Car Turning Loop with the Bypass Road 1.

4.3 Scope of Works

Permanent way scope of work includes:

1. Rail roads
   - Storage sidings – 8 no.
   - Standing roads either side of the PPP Maintenance Facility (163m min.) – 2 x minimum 6 no.
   - Bypass Road 1 (around the PPP Maintenance Facility, Washplant and Underfloor Wheel profiling Plant (UWPP)).
   - UWPP Road.
   - Washplant Road
   - Car Turning Loop around part of the MainTrain Facility.
   - Track crossover to new MainTrain Siding – 1 no.
   - Connection of MainTrain Siding to Auburn end main line – 1 no.
   - Realignment/connection to MainTrain 1 siding
   - Access Road 1
2. Turnouts and Catchpoints
   - Tie in to existing turnouts from the Down Relief to the PPP Maintenance Facility at Auburn end – 2 no. (including new catchpoints).
   - New turnouts from Down Relief to PPP Maintenance Facility at Granville end – 2 no. RailCorp

will provide these turnouts, points motors and associated rods free supply.

- New turnout from Down Relief to the Access Road 1 -1 no. RailCorp will provide these turnouts, points motors and associated rods free supply.
- New turnout between the Bypass Road 1 and MainTrain Siding.
- New turnout to MainTrain 1 Siding.
- Entry/exit to the Storage Roads, Standing Roads West, Access Road 1, Car Turning Loop and Bypass Road 1
- Catchpoints at:
  - 2 no. associated with turnouts at Auburn end of the site.
  - 2 no. associated with turnouts at Granville end of the site.
  - 1 no. associated with turnout at midpoint (Access Road 1).
- Derailers at:
  - 1 no. associated with MainTrain Siding
  - 1 no. associated with MainTrain 1

3. Diamond crossover between Storage Roads and Standing Roads East.
4. Vehicle and pedestrian track crossings.
5. Removal of existing tracks and turnouts as necessary.
6. Decanting facility "in ground works" between two storage roads to accommodate 192m interurban trains.
7. Maintenance access points through fence including ramps as necessary to Down Relief (Commissioning Track) line.
8. Track signage.
9. Block joints in tracks

5. Signalling

This section describes the functional intent with respect to signalling, assumptions on which the design has been based, and lists key scope of works elements to be constructed.

5.1 Functional Intent

Signalling functional requirements for track around the facilities include:

1. Providing certainty to RailCorp that a set can be removed clear of the Rail Corridor and delivered to the Maintenance Facility at any time.
2. Power operated signals and points at:
   - The Auburn entries/exits from the Down Relief (RailCorp control from the Auburn Signal box).
   - All eastern turnouts to the MainTrain Siding, Bypass Road 1 and Storage Roads.
   - The Bypass Road 1 and Washplant Road under normal running.
   - The western turnout to the Standing Roads West, including those on the Down Relief.
   - The turnout to the Access Road 1 from the Down Relief (Commissioning Track).
3. Track circuits to be provided for:
   - Storage Roads.
   - Standing Roads West.
   - MainTrain Siding.
   - Bypass Road 1.
   - Access Road 1.
   - Washplant Road.
   - Underfloor Wheel Profiling Plant Road
   - Down Relief (Commissioning Track) line.
4. Minimal modification to the Auburn signal box control and indications by using existing control switches only, under Stages 1 and 2 Operations (to be undertaken by RailCorp).
5. Yard Control is to be provided by the PPP Co. that includes:
   - Ability for visual identification (by CCTV and/or track circuits) of all roads under its control.
   - 24 hour operation.
   - Provision of suitable LCD Visual Display Unit/s for Auburn signal box to provide track circuit vision of the Storage Roads (to be installed by RailCorp but commissioned by PPP Co).
   - The extent of PPP Co. Yard Control is described in the Signalling Functional Specification that forms part of the RailCorp Maintenance Facility Reference Design.
6. Coordination of train movements between the PPP Maintenance Facility and the Down Relief to be made safe and in a manner consistent with all current RailCorp safeworking requirements for Master Sidings.
7. Preparation of a Safety Interface Agreement (SIA), including associated risk assessments, for the anticipated operations.
8. Provision of protection at the vehicle level crossing on the access road(s) within the PPP Maintenance Building.
9. Provision of sufficient signal sighting to meet standards.

5.2 Assumptions

1. It is assumed that the condition of the existing equipment and wiring inside the Auburn signal box will accommodate the limited, necessary activities associated with RailCorp's proposed modifications.
2. The Down Relief west of turnout #49 and #53 will be used for testing by the PPP Co during Stage 1 Operations with speeds up to 25kph, and will be controlled by the PPP Co. RailCorp will provide protection on the Down Relief including catchpoints with containment rails. Use of the Down Relief line during Stage 2 Operations will be controlled by PPP Co. Use of the Down Relief line in Stage 3 Operations will be controlled by RailCorp.
3. RailCorp has prepared a Signalling Functional Specification that includes the Down Relief and the turnouts and catchpoints into the PPP Maintenance Facility.

4. RailCorp will provide a suitable buffer stop at the western end of the Down Relief (Commissioning Track) line.
5. PPP Co is responsible for the provision of power required for the signalling to be provided by PPP Co.
6. Power for signalling to be provided by RailCorp, will be provided separately from RailCorp supply.
7. The vehicle level crossing will be protected by PPP Co with Type F flasher and boom gates interconnected with the signalling.

5.3 Scope of Works

Refer to the RailCorp Maintenance Facility Reference Design Signalling Functional Specification.

6. Traction Power

This section describes the traction power supply intent, assumptions on which the traction power supply design has been based and lists key scope of works elements to be constructed.

6.1 Functional Intent

Traction power requirements include:

1. Traction power feed will be provided by RailCorp from a new substation to be constructed north of the main lines adjacent to the Auburn Corridor.
2. The source of traction power supply to be in accordance with RailCorp's Proposed Sectioning Diagram (Drawing Number EL0237967)
3. The 1500 V DC feeder route from the new RailCorp traction substation DC Circuit Breakers to overhead traction feeder structure(s) is to be underground.
4. The 1500 V DC negative connections to the rail are underground via ULX and trackside negative bars.
5. The crossing beneath the main lines from the traction substation to the isolating switch is to be a ULX.
6. PPP Co shall connect the traction power supply from the isolation station to the PPP Co overhead.
7. The traction power is to tie-in with RailCorp, MainTrain and Manildra roads.
8. Power system to allow for 1500 V DC Overhead Traction power for the car turning loop.
9. Within the PPP Maintenance Facility site, a further pit and conduits will be provided for the traction power supply to the Down Relief (Commissioning Track) line (from a separate ULX supply to the above).
10. 3 no. x 150mm dia. UPVC HD underground ducts are required to traverse the PPP Maintenance Facility site for later extension of the 1500 V traction power supply to the Future RailCorp Facility.
11. PPP Co will advise its power draw requirements for the 1500 V DC overhead traction power system in order to meet RailCorp's operational requirements with regard to design of the RailCorp substation.

6.2 Assumptions

The following assumptions were made during the design:

1. The substation design has provided space for normal and back up 1500 V DC CBs (circuit breakers) to supply the required electrical sectioning to the PPP Maintenance Facility.

6.3 Scope of Works

Traction power supply scope of work for PPP Co includes:

1. Extension of the feeder from the isolation switch and construction of the connection pit within the site of the PPP Maintenance Facility.
2. Provision of 1500 V DC link area isolating switches.
3. For electrolysis protection discussion refer to Section 15 of this document.

7. Overhead Wiring

This section describes the overhead wiring (OHW) and structures functional intent, assumptions on which the overhead wiring and structures design has been based, and lists key scope of work elements to be constructed.

7.1 Functional Intent

OHW requirements for the Maintenance Facility to be in accordance with RailCorp standards and include:

1. 1500 V DC overhead wiring of all tracks associated with the PPP Maintenance Facility including:
   - Storage sidings – 8 no.
   - Standing Roads either side of the PPP Maintenance Building – 2 x minimum 6 no.
   - Access Road 1
   - Bypass Road 1.
   - Underfloor Wheel Profiling Plant (UWPP) Road including overhead traction termination.
   - One train length of the Car Turning Loop around the MainTrain Facility (approx 200m).
   - Washplant Road
   - MainTrain Siding and crossover
   - Turnouts including those to be installed in the Down Relief (Commissioning Track) line
   - Catchpoints, and
   - Diamond crossover between Storage Roads and Standing Roads East.
2. Removal of existing redundant overhead traction fittings, wiring and structures.
3. Overhead wiring interfaces with the existing overhead traction wiring, including:
   - Interface with the proposed overhead traction wiring on the Down Relief line (overhead wiring design of Down Relief by RailCorp). PPP Co is to liaise with RailCorp with regard to optimum overhead structure placement at interfaces with the Down Relief (Commissioning Track) design.
   - Interfaces with MainTrain overhead traction on the MainTrain Siding.
   - Connection with/over existing trackwork at the Auburn end.
4. Maintaining minimum overhead wiring and structure clearances with assets / infrastructure including Structure Gauge, HV Cables, LV Cables and High Vehicle clearances (level crossing).
5. Independent registration to be provided to all new overhead wiring support points as per RailCorp Specification EP 08000016SP
6. Design of 1500 V DC switchgear, control including safety isolation arrangements as per the proposed Sectionalising Diagram (Drawing Number EL0405239), and including switching to allow individual isolation of sections.
7. Design of all overhead support structures including associated foundations.
8. Bonding of overhead wiring structures where required.
9. Coordination with the Down Relief (Commissioning Track) line design being carried out by RailCorp.
10. Safe connection of power to the Maintenance Roads within the Maintenance Buildings.
11. Coordination of the design of the overhead wiring structures and their locations with the Future RailCorp Facility.
12. Overhead wiring design to make provision for the proposed level crossings including use of over-height vehicle detection and warning devices.
13. Safe incorporation of yard and perimeter lighting poles.

7.2 Assumptions

The following assumptions were made during the design:

1. Overhead suspension system and associated support systems within the Maintenance Building, the Washplant Building and the Underfloor Wheel Profiling Plant Building were not part of the scope of the Connell Wagner concept design service to which the Reference Design and this report refer. PPP Co is responsible for ensuring the overhead wiring interfaces with the

Maintenance Building, the Washplant Building and the Underfloor Wheel Profiling Plant Building comply with RailCorp standards.

2. Where the distance between track centre lines is 5.7 metres or greater there is sufficient space to install overhead traction masts.
3. Maximum overhead structure spacing is 65 metres including a 2 metre construction tolerance.
4. The overhead wiring system for the proposed PPP Maintenance Facility is as per OHW Conductor System 9 – (ie single 270 sq mm catenary @ 23.10kN and single 193 sq mm @ 18.0kN) PPP Co is responsible for finalisation of this matter.
5. The overhead wiring system for the existing main lines on the country side of MS20+006 (Down Sub)/ MS19+221 (Up and Down Mains) is as per OHW Conductor System 2 – (refer to RailCorp Standard EP08000016SP for details).
6. The overhead wiring for the existing main lines on the Sydney side of Structures MS20+006 and MS19+221 is fixed anchored.
7. The future overhead wiring system of the Down Relief (by RailCorp) is proposed to be per OHW Conductor System 12 – (refer to RailCorp Standard EP08000016SP for details).
8. Portal structures will be selected in preference to planted masts to reduce the number of obstacles in the yard.
9. Where practical, to reduce the number of structures, turnouts will be wired via twin drop verticals on portal structures.
10. Structural design for the PPP Maintenance Facility to cater for OHW System 9.
11. Over-height vehicle detectors are necessary at vehicle level crossings.

7.3 Scope of Works

Overhead traction and structures scope of work during construction is to be in accordance with RailCorp standards and includes:

1. Supply and installation of overhead gantries and masts.
2. Supply and installation of overhead wiring fittings and insulators
3. Supply and installation of overhead catenary, contact and dropper wire.
4. Supply and installation of 1500 V DC feeder connections and associated switches.
5. Removal of existing overhead wiring, fittings and structures
6. Overhead wiring structures bonding to be in accordance with the RailCorp standards.
7. Supply and installation of over-height vehicle detectors and warning devices at all level crossings.

8. Civil/Structural

This section describes the functional intent with respect to civil / structural site works. It discusses issues identified in the design, and lists key scope of work elements to be constructed.

8.1 Functional Intent

Civil / Structural functional requirements for the facilities include the following:

1. Access to Maintenance Building including:
   - 19m long truck access.
   - Safe pedestrian flow paths on designated minimum 1.5m wide concrete footpaths and grade separated track crossing with equitable access (2 person lifts). (If a bridge is adopted it shall have adequate vertical clearance over rail at RL10.0.)
   - Appropriate means of egress and access compliant with the current Building Code of Australia (BCA) requirements. It should be noted that the current building layout has not been checked against the BCA requirements.
2. Provision of train impact capacity (or associated deflection walls) if the building is within 10m of the Down Relief (Commissioning Track) line (ESC 360).
3. Down Relief maintenance access noting:
   - Access is required by RailCorp through the PPP Maintenance Facility to the Down Relief at the locations proposed, for the purposes of upgrading the Auburn Corridor and maintaining the main lines.
   - Access for heavy vehicles and arrangements must be in place for ready, 24 hour access by RailCorp.
   - Access to the Down Relief signals platform.
4. Vehicular access to the PPP Maintenance Facility noting:
   - The access point from Manchester Road North is fixed due to limits associated with the Planning Consent.
   - The truck access is proposed at grade from Manchester Road North via a security gatehouse to the PPP Maintenance Facility including the Maintenance Building, UWPP and other buildings. The road is to cross the minimum number of tracks, and must not hinder typical facility operations. Sets standing on the Bypass Road 1, UWPP Road and Washplant Road must be clear of the truck access.
   - A controlled level crossing is required for the truck access at the Granville end. The extent of protection associated with this is subject to a risk assessment by the PPP Co.
   - The road width is to accommodate 19m articulated semi-trailers. Turning bays for these vehicles are also to be provided.
5. Car parking for PPP Staff and RailCorp train crews and staff.
6. Allowance of sufficient space for the potential, future development of a grade separated vehicular crossing over tracks for vehicles accessing the PPP Maintenance Facility, should the Future RailCorp Facility proceed.
7. 2.5m wide asphalt footpath from Clyde Station.
8. Safe pedestrian flow around the Maintenance Facility site on designated footpaths. Note that footpaths to signals and lever points are not shown on the drawing.
9. Vehicle and pedestrian access to and around the Washplant and UWPP Facilities.
10. All vehicle track crossings are to be assessed by PPP Co for safety.
11. Safe demarcation and/or protection between vehicles, trains, pedestrians and infrastructure; in particular between the vehicle access roads and inspection footpaths at Standing Road West 6.
12. Provision in the alignment of the fencing around a 5 m x 10 m level platform for the placement of the Down Relief signal cabinets and canopy at 20.055 km placed 5.5m clear of the Down Relief track with a pedestrian gate access from the PPP Maintenance Facility and Down Relief.
13. Provision of a fence from the carpark to the Carlton United property with a suitable vehicle access gate.
14. Provision of gates over the siding roads into the MainTrain Facility.
15. Footpaths to be non-slip, particularly in areas where cleaning activities are to be undertaken.

8.2 Assumptions

The following assumptions were made during the Reference Design:

1. To carry out the pavement design certain assumptions about the traffic loading and sub-grade conditions were made:
   - Limited numbers of 19m semi-trailers will access the PPP Maintenance Facility per day.
   - 4 wheel drives or utilities (maintenance vehicles) will also be required to access the PPP Maintenance Facility.
   - No geotechnical information for the pavement design is available and as such the Reference Design pavements have been designed on a minimum sub-grade CBR of 5%. PPP Co is responsible for making its own assessment of the appropriate subgrade strength(s).
   - Garbage truck access will be required to collect rubbish from the site.
   - All vehicles are assumed to be fully laden to RTA legal load limits.
2. Pedestrian level crossing(s) will not be acceptable.
3. A safety assessment would conclude the application of w-beam barrier(s) between the access road and the footpath adjacent to the Standing Road West 1 to be appropriate.
4. Concrete footpaths are appropriate for the specified design life of the PPP Maintenance Facility.
5. It has been assumed that the gates into the MainTrain Facility will be sliding gates and installed such that they can be safely operated and will not foul the running lines.

8.3 Scope of Works

The scope of the civil and structural design for the Reference Design includes:

1. Replacement / new asphalt 2.5m wide footpath from Duck River to the gate house to access Clyde Station.
2. A pedestrian bridge (1.5m wide) over future and proposed trackwork to access the PPP Maintenance Facility. Piers to accommodate train impact loading. Bridge to have adequate vertical clearance over rail at RL10.0. Two person lifts are to be included. Bridge to be 1 x Super-T precast prestressed concrete girder with cast in-situ deck or similar. Bridge to be covered by a weatherproof canopy.
3. Rigid pavement on tight turning sections of the access road, namely at the entrance into the Maintenance Facility and the north-eastern corner / bend on the access road to the PPP Maintenance Building. Other sections of the access road to the PPP Maintenance Facility to be flexible pavement with kerbs and gutters.
4. Rigid pavement around the PPP Maintenance Building as shown on the civil drawings.
5. A car park up to a maximum of 220 car spaces for PPP Maintenance Facility and RailCorp personnel using a flexible pavement.
6. 2-coat seal pavement around the site for maintenance vehicle access as shown on civil plans and the Simulator Area.
7. Reinforced concrete retaining walls (maximum height approximately 2.0m) including but not limited to the following locations:
   - Down Relief and Storage Road 1 (maximum height approximately 2.0m).
   - Down Relief and PPP Maintenance Building (maximum height approximately 2.0m).
   - The Bypass Road 1 and Presentation Roads (maximum height approximately 2.0m).
   - Access Road 1 and Standing Road East 1 (maximum height approximately 2.0m).
   - MainTrain Siding and Bypass Road 1, and
   - Any other structures as determined necessary by PPP Co.
8. Earthworks - cut and fill.
9. Barriers to provide protection between trains, vehicles, pedestrians, buildings and infrastructure.
10. Signage.

9. Traffic and Pedestrian

This section describes the functional intent for traffic and pedestrians, assumptions on which the design has been based, and lists key scope of work elements to be constructed.

9.1 Functional Intent

Traffic and pedestrian functional intent includes:

1. The carpark for the PPP Maintenance Facility is to accommodate the staff working within the facility and RailCorp crews / personnel accessing the Facility. The size of the carpark is to be determined based on PPP staff levels in the facility and additional RailCorp staff and crew. The maximum capacity of the carpark (220 car spaces) has been established in the REF.
2. The carpark is located in the Reference Design so that it is coordinated with, and can be expanded for, the Future RailCorp Facility adjacent to the PPP site.
3. The carpark is to be designed in accordance with AS2890.1:2004 User Class 2.
4. Safe pedestrian flow to PPP Maintenance Facility site from Clyde Station, with minimum footpath width of 2.5m. Secured gate access is to be provided by PPP Co to the RailCorp Central Warehouse site.
5. Safe pedestrian access is to be provided for the PPP Maintenance Facility site to all areas that are to be accessed by PPP Co and RailCorp staff with minimum width 1.0m including access to signals and points. (Note that footpaths to signals and points have not been shown on the drawings.)
6. Safe pedestrian access from the car park for the PPP Maintenance Facility is to be provided with minimum 1.5m wide footpaths.
7. A grade-separated track crossing is to be provided for pedestrians from the carpark to the PPP Maintenance Facility with equitable access (utilising 2 person lifts, with minimum width of 1.5m shown in the Reference Design).
8. The crossing must cater for the span over the Future RailCorp Facility as shown on the Reference Design drawings.
9. The grade-separated pedestrian access from the car park to the PPP Maintenance Facility is to span the Future RailCorp Facility with adequate clearance above a rail at RL 10.0m.
10. A controlled level crossing is required for the truck access at the Granville end. The extent of protection is subject to a risk assessment by the PPP Co.
11. Provision for vehicle and pedestrian movement around the UWPP facility and Washplant.
12. Spatial provision for the cost effective construction of a grade-separated vehicular crossing as a potential, future replacement to the current proposed level crossing if RailCorp's Future Facility is to be undertaken. This provision must be based upon planning by PPP Co fsuch that the construction of the grade-separated vehicle crossing may proceed in a manner that will not restrict PPP Co's access to the Maintenance Facility.

9.2 Assumptions

The following assumptions were made during the Reference Design:

1. The maximum number of car parking spaces for the PPP Maintenance Facility will be 220. This is during a shift changeover.
2. Equitable access is required for people to access the PPP Maintenance Facility.
3. Traffic and parking numbers are to be finalised by PPP Co.
4. Footpaths will include those:
    - around trains at:
        - Storage Roads.
        - Standing Roads.
        - Roads west of the UWPP facility.
    - to the train drivers cabin of trains standing west of the Washplant
    - Miscellaneous to signals and points.

9.3 Scope of Works

Included at Section 8.3.

10. Flooding, Stormwater, Water and Wastewater

This section describes the functional intent for the Reference Design in respect to flooding, stormwater, water and wastewater and discusses issues identified in the design, assumptions on which the design has been based, and lists key scope of work elements to be constructed.

10.1 Functional Intent

The functional intent for the flooding, stormwater, water and wastewater design(s) includes:

1. General
   - The supply of new services to the PPP Maintenance Facility is to be provided independent of existing services wherever practical.
   - The PPP Co is to confirm the capacity of existing services being connected to by new services for this project and arrange approval from the service owner for any such connection(s).
   - The PPP Co is to ensure that any alterations to existing services affected by this project will not compromise the supply of the services to existing users both during construction and / or during operation(s).

2. Flooding and Stormwater
   - A piped stormwater drainage system to accommodate 1 in 50 year ARI storm event is to be provided for the rail infrastructure and 1 in 20 year ARI storm event for the external roads and carpark.
   - A surface flow path for a 1 in 100 year ARI flood event is to be accommodated by PPP Co on the PPP Maintenance Facility site based on RailCorp standards.
   - Detention storage is to be provided on site to control the discharge into Duck River from both the PPP Maintenance Facility (including buildings) and the adjacent Future RailCorp Facility site. Storage will conform to Auburn Council's PSD Zone1 Duck River catchment criteria between Auburn Station and Duck Creek.
   - The additional volume for detention of drainage from the Future RailCorp Facility shall be based on an area within the Catchment Boundary shown on drawings CV0405154 to CV405162 with an allowance of 30% of the catchment being impervious.
   - Oil separators and stormwater treatment devices are to be provided prior to stormwater exiting into Duck River.
   - Drainage from the Down Relief is to be accommodated in the PPP Maintenance Facility stormwater system. The Maintenance Facility design is to incorporate and be coordinated with the Down Relief drainage design. The area addressed by the Down Relief drainage design is bounded at the north by the midpoint between the Down Suburban and the Up Suburban, at the east by Auburn Station, to the west by the Granville end of the site, and to the south by the fence line to be provided by PPP Co along the boundary between the PPP Co Maintenance Facility and the Down Relief (Commissioning Track) line. In addition the area between the Down Relief, South Parade and Auburn Station east of Alice Street Bridge is also to be accommodated.
   - The outlet drainage pipes to Duck River require capacity to accept flow from the detention storage which has a catchment that includes the Future RailCorp Facility.

3. Water and Wastewater
   - New water, wastewater and fire services are required to accommodate the PPP Maintenance Facility that includes:
     - Maintenance Building.
     - UWPP facility.
     - Washplant facility.

  - Miscellaneous needs, and
  - Include the adjacent Future RailCorp Facility.

- Reuse of Washplant water is required.
- New water, wastewater and fire services are required to accommodate the PPP Maintenance Facility requirements and the use of the adjacent Future RailCorp Facility.
- The sizing of the new water and fire services for the Future RailCorp Facility shall be determined based on the accommodation of a maximum 90 RailCorp staff and cleaning of 16 no. 8-car sets as required in the draft stabling guide.
- The new wastewater system pipe is to be sized to accommodate wastewater from the PPP Maintenance Facility and adjacent Future RailCorp Facility. The sizing for the Future RailCorp Facility shall be determined based on the accommodation of a maximum 90 RailCorp staff and cleaning of 16 no. 8-car sets as required in the draft stabling guide

10.2 Assumptions

The following assumptions were made during the Reference Design:

1. Stormwater
   - On site detention is required. It is expected to be below ground and could take the form of either:
     - A number of parallel buried galvanised corrugated iron pipes.
     - Oval storage chambers.
     - Plastic lattice void formers.
     - Concrete tanks.
   - Detention storage stormwater will be directed to Duck River.
   - Additional detention structures to those shown on the drawings, would need to be included by the PPP Co for the anticipated detention requirements arising out of the provisions specified in the Reference Design for the Future RailCorp Facility.
   - A proposed location for the detention storage is under the carpark.
   - Auburn Council requires:
     - A detention storage design value of 530 m3/ha of impervious area.
     - A maximum discharge from the detention storage of 80 l/s/ha.
   - Stormwater treatment devices could be precast baffle type oil arrestors before detention storage and Humeceptor or CDS units for stormwater lines connecting after detention storage.
   - If proposed works reduce cover to existing services to an unacceptable level, the pipes may require redirection or multiple smaller diameter pipes to obtain cover. Data regarding the depth of existing stormwater pipes crossing the tracks to Duck River is not available. PPP Co must inform itself as to the prevailing conditions.

2. Wastewater
   - The only existing sewer lines near the site are two large Sydney Water rising mains flowing north along Manchester Road North from a pump station near the corner with Manchester Road.
   - Direct connection to the existing rising mains was not contemplated as Sydney Water typically rejects connections to rising mains.
   - The proposed sewer pipe from the PPP Maintenance Facility can gravitate to the Sydney Water Pump station inlet in Manchester Road and will ultimately be sized in accordance with PPP Co's planned water reuse adopted for the site.
   - The Central Warehouse sewage is currently pumped via a 50mm rising main westward to an existing sewer. This rising main is impacted by the proposed works and therefore it has been assumed that it can be redirected to the proposed sewer in Manchester Road North.
   - An existing 600mm rising main travels around the Central Warehouse at an unknown depth. Sections of this rising main impacted by works will require protection or relocation/lowering.
   - There is insufficient spare capacity in the existing wastewater / sewerage system in

Manchester Road North for the PPP Maintenance Facility and Future RailCorp Facility. It is expected that any new wastewater system may drain to the Sydney Water pumping station at the corner of Manchester Road and Manchester Road North. The pipe is to be gravity fed and run along Manchester Road North to the pumping station collecting manhole. The pipe is to be sized to accommodate wastewater from the PPP Maintenance Facility and adjacent Future RailCorp Facility. PPP Co is responsible for finalising these details.

- A water storage tank will be required for reuse of wastewater from the Washplant and will be located adjacent to this facility.

4. Water
   - A 100mm water main servicing existing infrastructure connects to a 200mm private service main in the Central Warehouse yard (understood to be owned by RailCorp). This service connects to a 450mm Sydney Water watermain in Parramatta Rd.
   - New fire and potable water connections are proposed to be connected to the 200mm service. PPP Co will be expected to carry-out further discussions with the owner and Sydney Water to determine available capacity to meet fire fighting requirements.
   - The size of a new potable water service could be approximately 150mm dia. However, this will be dependent on the pressure available in the Sydney Water watermain and private watermains.
   - The size of the fire service might be in the order of 150 - 200mm dia. but will be dependent on the required flow rate to meet sprinkler and fire hydrant requirements. As for development of other details of the design, PPP Co is responsible for finalisation of the design(s).
   - An existing 150mm DICL fire service from Rawson Street has been previously capped at the meter. This service is reported to be in good condition. Depending on fire fighting demands, the proposed fire service could also connect to this service to provide a link main to improve fire fighting flows and pressures rather than providing boosting of flows if required. This would be a detailed design alternative for consideration by the PPP Co, which may not be required.
   - The need for fire booster pumps will depend on the water pressure available from the supply connection and the size of fire service pipe. A fire water storage tank may be necessary. A fire service water storage tank capable of supplying 4 hours storage (750 kL) will be required if flow rates cannot be met. This is dependent on a fire flow check from Sydney Water and is only a provisional requirement at this stage. Discussions with Sydney Water have indicated there is insufficient capacity in the water mains within Manchester Road where original water and fire service connections were proposed. It may be possible to connect to the existing 200mm private service in the Central Warehouse yard. PPP Co is responsible for finalising these details.

10.3 Scope of Works

The following potential key water, sewer and stormwater infrastructure works have been identified for the Reference Design of the PPP Maintenance Facility which include but are not limited to:

1. Water
   - Deletion or protection of existing water pipe lines impacted by the works including existing routes in and around the Central Warehouse.
   - Termination of an existing 200mm diameter water main in the Central Warehouse yard (subject to confirmation of capacity and owner approval) with connection of new potable and fire water supply lines for:
     - Diversion of existing pipes within the Central Warehouse yard.
     - PPP Maintenance Facility including:
       - Maintenance Building.
       - UWPP facility.
       - Washplant facility, and
       - Miscellaneous needs.
     - Future RailCorp Facility.
   - Pipes, ring mains and fittings including:
     - Stop valves.

- non-return valves.
- metering .
- booster connections.

- Backfilled and reinstated trenching and road crossings.
- Fire services including:
  - Ring main.
  - Hydrants.
  - Hose reels.
- Washplant water reuse infrastructure including:
  - Storage tanks.
  - Booster pump pressure vessel.
  - Screening and oil separator.

2. Wastewater
   - Deletion, redirection or protection of existing sewer pipe lines impacted on by the works.
   - Connection of sewer pipes to PPP Maintenance Facility.
   - Provision for the Future RailCorp Facility.
   - Pipes and manholes.
   - Backfilled and reinstated trenching and road crossings.

3. Stormwater
   - Deletion, redirection or protection of existing stormwater pits or pipes.
   - Stormwater for pits and pipes for:
     - Track cross drains,
     1. Roads,
     - Hardstand areas,
     - Buildings including:
       - Maintenance Building.
       - UWPP facility.
       - Washplant facility and
       - RailCorp Crew Amenities Area.
     - Down Relief drainage.
   - Connection with capacity for the Future RailCorp Facility.
   - Below ground detention system with capacity to support / accommodate the carpark above.
   - A headwall at Duck River.
   - Oil arrestors.
   - Humeceptor or CDS type for stormwater that drains directly to Duck River.

11. Security

This section describes the security functional intent, assumptions on which the design has been based, and lists key scope of work elements to be constructed.

11.1 Functional Intent

The PPP Maintenance Facility requires a 24 hour, 7 days a week security presence. The security measures shall meet the requirements set out in the relevant Standards for the Project including, but not limited to the following documents:

1. Security Components Functional Specifications and Standards for Train Services – Rolling Stock Division Maintenance Centres
2. Part A: Fencing Functional Standard for RailCorp Maintenance Centres and Stabling Locations
3. Part B: Exterior Lighting Functional Standard for RailCorp Maintenance Centres and Stabling Locations
4. Part C: CCTV Functional Standard for RailCorp Maintenance Centres and Stabling Locations
5. Part D: Access Control Functional Standards for RailCorp Maintenance Centres and Stabling Locations
6. Australian Standard AS4806 Closed Circuit Television (CCTV)

   The document presents a Code of Practice for the management and operation of closed circuit television (CCTV) systems for reference by users, manufacturers, tenants of premises with CCTV installations and regulators. The standard comprises four parts. The CCTV design at this site shall comply with Part 2: Application Guidelines, section 3.7 "Recommended Object Sizes".

The security components to be used include the following:

1. Fences
   a. The fence will be discontinuous where there are rail tracks. Wherever practical, gates are to be installed at these locations. These fence breaks will have CCTV coverage.
   b. Due to site constraints there is insufficient space around the perimeter to install a secondary fence as specified for green fields sites in Part A of RailCorp's Functional Security Standards.
2. CCTV
   a. The facility shall have a CCTV security system which provides:
      - All weather and day night capability.
      - An interface into both local and offsite monitoring.
      - Off-site digital recording and in excess of 14 days data storage.
   b. The system must cover the perimeter of the site in addition to key egress locations. It must be able to interface with the on-site electronic access control system and have provision for Video Motion Detection (VMD).
   c. The CCTV system shall use video analytics to generate an alarm when it detects a person entering through rail track openings. The alarm shall be generated for pedestrian access, however shall not be triggered with train movements.
   d. The CCTV shall be monitored 24 hours from the Gatehouse. The CCTV system shall also be interfaced to the security network and monitored at RailCorp's Group Remote Monitoring Location (GRML).
   e. The entry and exit points located at the site shall be covered by CCTV surveillance. The coverage requirements include:
      - Each pedestrian entry/exit point must have 100% coverage and meet identification image requirements detailed in AS4806.2 – Closed Circuit Television (CCTV) – Application Guidelines.
      - Each vehicle entry/exit point must have 100% coverage and must be able to identify the number plate of a stopped vehicle in the field of view and also meet identification image requirements in AS4806.2 – Closed Circuit Television (CCTV) – Application Guidelines.

- Not less than 95% of the perimeter shall be covered and shall meet the Intruder Detection image requirements in AS4806.2 – Closed Circuit Television (CCTV) – Application Guidelines.
- There shall be CCTV coverage between the sets standing sets within the PPP Maintenance Facility and shall meet the Crowd Control image requirements in AS4806.2 – Closed Circuit Television (CCTV) – Application Guidelines.

f. The locations at the site to be covered by CCTV include all pedestrian and vehicle entry/exit points, the fence breaks for rail car movements and the access points along the Down Relief perimeter fence.
g. The cameras shall be placed at a height to minimise vandalism and unauthorised adjustment or tampering. Two cameras are to be mounted facing opposite directions on poles with security lighting mounted above the cameras to enhance the CCTV in times of low natural lighting.
h. These poles shall be spaced at 80 metres centres along the perimeter fence and 160 metres in standing sets to provide adequate coverage of the site to meet the requirements in the CCTV Functional Standard.

3. Intruder Alarms
   a. There is no specified alarm detection system on the site. Intruder alarms will be generated by the CCTV analytics and electronic access control system.
4. Electronic Access Control (EAC)
   a. The EAC system shall perform the functions of improving the working condition of RailCorp employees by:
      - Maintaining a safe, secure area.
      - Providing assistance with administration of a working site.
      - Minimising the opportunities for unauthorised or accidental entry onto the PPP Maintenance Facility premises.
      - Minimising the risk of injury or death to trespassers on the PPP Maintenance Facility grounds.
      - Minimising the cost and disruption to PPP Co and other rolling stock through the reduction of damage from criminal activity.
   b. The EAC system shall have the functional capability to record access and egress of all authorised users and shall be compatible with existing "smart card" applications currently implemented by RailCorp. It shall operate in conjunction with barrier fencing and gates.
   c. The system shall be able to log movements of personnel in the event of an emergency.
   d. There will be a mix of PPP and RailCorp staff within the PPP Maintenance Facility when RailCorp staff deliver/drop off trains to the facility. Control of these user groups will be achieved through electronic access control measures at the pedestrian exit and entry points around the site.
5. Gatehouse
   a. A manned gatehouse is to be provided to monitor vehicle and pedestrian movement to and from the carpark and PPP Maintenance Facility.
   b. The gatehouse is to be suitable for both the PPP Maintenance Facility and the Future RailCorp Facility.
   c. Access beyond the carpark will be through secondary access points into separate facilities (see EAC above).
6. Lighting
   a. The lighting is to be designed so as to provide adequate illumination of the site to allow effective surveillance by PPP Co security personnel, CCTV systems and other PPP Maintenance Facility staff.
   b. Coordination with electrical services is required to design lighting to facilitate the CCTV system.

11.2 Assumptions

Assumptions made in the Reference Design for security include:

1. Video analytics will be used by PPP Co to raise people movement alarms in certain locations

throughout the PPP Maintenance Facility.
2. PPP Co will provide a video analytics package that is satisfactory to RailCorp.
3. The design of the gatehouse and carpark will enable the potential future sharing of those facilities by RailCorp (for the Future RailCorp Facility) and PPP Co (for the Maintenance Facility).
4. Security for the PPP Maintenance Facility is the sole responsibility of PPP Co.
5. Security for the Future RailCorp Facility is the responsibility of RailCorp. However, PPP Co is required to make provision for the integration of control and monitoring functions with the PPP Maintenance Facility security system(s).
6. Security control will be undertaken at the gatehouse with provision for 2 no. security monitoring stations.
7. A security risk assessment of the known Security Threats to be undertaken by the PPP Co.

11.3 Scope of Works

The Security scope of work falls into the following categories:
1. Perimeter Fencing
2. CCTV Surveillance
3. Electronic Access Control

A broad description of the scope of work is as follows;
1. Perimeter Fencing
   a. Perimeter fencing around the facility shall occur at the locations indicated on the security drawing.
   b. The perimeter fencing shall be located between the Down Relief and PPP Maintenance Facility, between the MainTrain facility and the PPP Maintenance Facility, between the Future RailCorp Facility and the PPP Maintenance Facility, between the RailCorp Central Warehouse property boundary and the PPP Maintenance Facility (both sides of the pedestrian walkway), around the carpark and from the carpark to the adjacent Carlton United boundary.
2. CCTV Surveillance
   a. CCTV surveillance will occur throughout the site and allow for coverage of all pedestrian and vehicle entry and exit points to the entire site. These points include the Gatehouse, any breaks in the fencing to allow for train movement, any gates across trackwork, the access gates along the Down Relief perimeter fence, pedestrian entries to the PPP Maintenance Facility and PPP access road.
   b. Alarms shall be generated via the CCTV analytics system when people are detected moving through the fence breaks. The fence break locations include the Gatehouse, between the Down Relief and the Storage siding, between the Down Relief and the PPP Maintenance Facility and between the PPP Maintenance Facility access road and the Future RailCorp Facility.
   c. Number plates shall be identified via the use of a dedicated camera mounted at approximately 1 metre in height at the Gatehouse entrance.
   d. General surveillance cameras shall be mounted under the eaves of the Gatehouse on both the entry and exit sides.
   e. Not less than 95% of the perimeter shall be covered by CCTV and the design shall comply with the identification requirements of AS4806 Closed Circuit Television (CCTV). The perimeter CCTV cameras shall be mounted on exterior camera poles. The poles shall be hinging ('break back'), 4.5 metre high, hot-dipped galvanised finish with hexagonal profile to permit rapid and safe maintenance. The cameras will be mounted at a height of 3.5 metre with the light being installed 1 metre above the camera at 4.5 metres. A lockable inspection hatch shall be incorporated into the pole for access to equipment.
3. Electronic Access Control (EAC)
   a. The EAC system to be implemented shall be compatible with the existing RailCorp system and will be used to control pedestrian and vehicle access to the facility.
   b. The areas to be controlled include the Gatehouse entry and exit points, the grade-separated crossing from the Carpark to the PPP Maintenance Facility and the pedestrian entrance to the PPP Maintenance Facility.

c. The system shall have the ability to indicate the status of each portal including locked, unlocked, controlled, door open too long and door forced open.
d. The system shall be monitored locally by the security guard located at the Gatehouse. Additionally, the system shall be interfaced with RailCorp's Group Remote Monitoring Location (GRML).

12. Communications

This section describes the operational intent, assumptions on which the design has been based, and lists key scope of work elements to be constructed.

12.1 Functional Intent

The functional intent for the communications includes:

1. Provision of fixed line voice and data communications to facilities within the PPP Maintenance Facility and associated buildings as described below.
2. Provision of wireless voice communications between the PPP Yard Controller and drivers of trains within the yard at the PPP Maintenance Facility.
3. Provision of wireless voice communications between the PPP Yard Controller and personnel within the yard at the PPP Maintenance Facility.
4. Provision of wireless voice communications between the PPP Yard Controller and drivers of trains on the Down Relief at signals installed by PPP Co.
5. Provision of PSTN connectivity to Emergency Phones within lifts.
6. Provision of cable pathways for Future RailCorp Facility under the PPP Maintenance Facility site including pit and duct provisions. Number of ducts and approximate service route is given in Reference Design.
7. Maintenance of existing communications cables identified as being required to remain, to be modified or to be protected during the works. These include:
   - An existing communication cable running across the proposed site from the Down Relief to the MainTrain canteen.
   - A new communications cable from Down Relief to the Clyde Substation (in MainTrain) that has been recently installed.

12.2 Assumptions

Assumptions made in the communications design include:

1. Active network equipment and patch leads associated with RailCorp Voice, RailCorp Intranet LAN and RailCorp security LAN to be provided, installed and commissioned by RailCorp. (All associated conduit requirements are to be satisfied by PPP Co)
2. Signal Post / yard telephones located on or adjacent to yard / running line signals / stop boards are to be provided by PPP Co under the signalling requirements.
3. Signal Post / telephones located on or adjacent to Down Relief signals / stop boards are to be provided by PPP Co under the signalling requirements.
4. There are no particular hazards identified that warrant an extension of the Government Radio Network (GRN) into the PPP Maintenance Facility yard.
5. The Long Line PA requirements identified in the guidelines covering stabling yards and turnbacks do not apply to the PPP Maintenance Facility yard.
6. RailCorp Fibre Backbone
   PPP Co is required to determine whether any section of the RailCorp fibre backbone will be impacted by the PPP Maintenance facility work.
7. MetroNet
   PPP Co is required to provide MetroNet radio connectivity. Whilst MetroNet is normally provided to facilitate wireless communications between the driver's cab and the controlling signal box, for this project PPP Co is to provide a Yard Controller to co-ordinate train movements within the PPP Maintenance Facility yard. For such an arrangement, PPP Co should give consideration to creating a new MetroNet zone such that communications from trains entering the yard at the PPP Maintenance Facility are directed towards the PPP Yard Controller.
8. Yard Phones
   PPP Co is required to provide yard telephones. Whilst yard 'phones are normally sited at pre-defined locations within a stabling yard to line up with block and set stopping positions in order to facilitate communications with the responsible signal box, for this project, it is expected that a

wireless communication system capable of supporting private person-to-person communication will be recommended by PPP Co to augment yard 'phones. This may be trunk mobile radio, DECT telephones or regular mobile telephones. In addition, a number of strategically placed fixed line telephones should be provided by PPP Co to facilitate communication with the PPP Yard Controller in the event that wireless communication becomes impossible (eg mobile phone system failure, handset failure etc.).

A shared open channel wireless system is not recommended to support PPP Yard Control operations as such a system could, without rigorous protocols being adhered to, increase the probability of staff responding to messages not intended for them (eg two trains given a verbal 'go' at the same time).

Scope of Works

The scope of work for the communications includes the items summarised below.

1. RailCorp Fixed Line Data and Communication Connections
   - RailCorp Intranet LAN, RailCorp voice services and RailCorp security LAN connectivity to be provided by PPP Co in accordance with the Summary of Provisions table below.
   - The scope for PPP Co includes the provision of pit and duct, cables, cable containment, terminations, associated cable testing and documentation of the required cable infrastructure.
   - RailCorp fixed line services to be picked up by PPP Co from existing RailCorp works, from an adjacent station or from a trackside communication hut, depending on the appropriateness of cable routes. A detailed survey of existing facilities is to be carried out by PPP Co in consultation with RailCorp.
   - PPP Co shall terminate copper and fibre services on the PPP Co Building Distributor Frame in each building.
   - Install, test and document cabling in accordance with AS/ACIF S008 AS/ACIF S009, AS 3080, AS3084.

   A registered cabler must undertake all telecommunication installations.
   1. Telstra Telephone Connection
      - Telstra PSTN connectivity to be provided by PPP Co in accordance with the Summary of Provisions table below.
      - Telstra lines to be purchased by PPP Co directly from Telstra.
      - Pit and duct requirements to be provided by PPP Co as agreed with Telstra.
      - With the exception of lift emergency phones, PPP Co shall ensure that Telstra lines terminate on building distribution frame within the Building Distribution Room in each building. The building distribution frame to provide copper and or fibre terminations as required.
      - Telstra to install cabling on behalf of PPP Co to the Building Distributor Frames and lift emergency phone junction box.
   2. MetroNet
      - PPP Co will supply, install, test, commission and document a RailCorp MetroNet zone providing communication between trains within the PPP Maintenance Facility yard and the PPP Yard Controller.
   3. PPP Wireless Voice Communications
      PPP Co will supply, install, test, commission and document a wireless voice communication system as follows:
      - 100% trackside coverage within PPP Maintenance Facility yard irrespective of train position
      - Ability to originate handset to handset call
      - Ability to originate group handset broadcast and broadcast to all handsets from PPP Yard Controller position
      - Rugged rechargeable handsets

Refer to Assumptions section above.

Summary of Provisions to be made by PPP Co

Service	PPP Maintenance Facility Yard & License Areas	RailCorp Site Construction Office	PPP Maintenance Building	Footbridge Lift Phone	Gatehouse
RailCorp Intranet LAN		Yes	Yes		Yes
RailCorp Security LAN			Yes		Yes
RailCorp Voice Network		Yes	Yes		
Telstra Voice Network			Yes	Yes	Yes
Signal Post Phones	PPP Maintenance Facility Yard Entry and Exit with Running Lines				
Yard Phones	Communicating to PPP Yard Controller				
RailCorp MetroNet	PPP Maintenance Yard Zone				
PPP Wireless Voice Communications	Yes		Yes		

13. HV Power

This section describes the High Voltage functional intent, assumptions on which the design has been based, and lists key scope of work elements to be constructed. Supply of HV power during the construction period has not been considered as part of the Reference Design, and is a separate matter to be addressed by PPP Co.

13.1 Functional Intent

Two aspects relating to the functional intent of HV supply are:

1. Supplying the load of the PPP Maintenance Facility.
2. Dealing with the existing services on the site.

13.1.1 HV Supply for the PPP Maintenance Facility

The HV supply is required to have redundancy such that the failure of one transformer or feeder does not disrupt supply to the facility.

In this Reference Design, the HV supply to the PPP Maintenance Facility is to be acquired from external suppliers i.e. not from RailCorp's power supply infrastructure. The implications and practicality of this requirement will have to be assessed by the PPP Co during development of its design. Issues, which must be addressed by PPP Co in detailed design, with the use of an Energy Australia supply for the PPP 11kV/415V substation are:

- the separation of earths and the danger of stray traction current, in the case where the EA supply is from a cable feeder;
- neutral connection to rail for shore supply, and
- supply of other RailCorp loads, (if any), not the responsibility of the PPP, via the PPP 11kV/415V substation.

Initial discussions with Energy Australia indicate that

- they will not have the capacity to supply the estimated 6 MVA load until approximately 2008 (at the completion of the proposed Auburn zone substation)
- the customer (PPP Co) will have to pay the cost of construction of the feeders from the zone substation(s) to the 11kV/415V substation on site.
- Energy Australia requires access to the PPP Maintenance Facility Substation, ie. it must be located at the edge of the property, alongside public roads
- Energy Australia will perform annual maintenance at the substation, implying a scheduled outage for the PPP Maintenance Facility each year
- The double insulated isolation transformer arrangement, used by RailCorp at Penshurst station, will not be acceptable to Energy Australia at this site, due to the much larger load involved.

The proposed point of supply is on Manchester Rd North in the area between the proposed carpark and the property boundary to the south. At the detailed design stage, such a supply must be designed by PPP Co in accordance with Energy Australia's and RailCorp's requirements, with special attention given to earth potential rise, stray traction currents, and earthing.

In the event that the PPP Maintenance Facility is supplied from RailCorp's network, PPP Co must design a HV supply which is to the satisfaction of RailCorp. Modifications to RailCorp's HV network must be carried out by a construction company acceptable to RailCorp.

13.1.2 HV Supply to the East of the Facility

Power supply to the east of the site have not been determined for this Reference Design. It may be possible to supply the lighting loads at the extreme eastern end of the site from the

Auburn substation (presently being upgraded as part of the RailCorp Easy Access project). Alternatively, the poletop transformer at pole 104GA off RailCorp 11kV feeder 695 could be upgraded to supply the required load (estimated 100 kVA). The PPP Co is responsible for the investigation of any such options.

13.1.3 Existing HV Services

The existing RailCorp HV services supplying loads at or crossing the site are detailed in Table 1 below.

Table 1 Existing RailCorp HV Services

Existing Infrastructure	Location	Drawings
RailCorp 33 kV Feeder 721 Granville to Strathfield	The wood pole line crosses the site from MainTrain in the south in a north westerly direction to exit the site at Duck River.	EL0045688 K80897 / EL0016177 sheets 9, 8, 8A, 3
RailCorp 33 kV Feeder 722 Granville to Clyde	The wood pole line crosses the site from the decommissioned Clyburn station platform southwards to supply the Clyde 33kV/11kV substation	EL0045688
RailCorp 11 kV Feeder 623/1 Clyde substation to RSA Central Warehouse substation	Crosses the site from Clyde substation in a north westerly direction sharing the same poles as 33 kV feeder 721. Supplies Clyde Maintenance Depot SS and Clyde District Depot SS. Also crosses the site in a northerly direction from Clyde substation sharing some of the same poles as 33 kV feeder 722, to supply Clyde Telephone Exchange SS, Clyde Aux Supply SS.	EL0042634 K80897 / EL0016177 sheets 9, 8, 8A, 3, 4
RailCorp 11 kV Feeder 623/2 RSA Central Warehouse substation to 133GA	Located in the north western corner of the site sharing the same poles as 33 kV feeder 721 and also teeing off under the main line northwards.	EL0042634
RailCorp 11 kV Feeder 695/4 106GA to Clyde substation	Located to the south of the site on the other side of MainTrain. Supplies Sig Loc S11.77	EL0042634
RailCorp 33kV/11kV Clyde substation	Located to the south of the site	
RailCorp 11kV/415V RSA Central Warehouse substation	Located to the west of the site near wood poles 117GA and 118GA	
RailCorp 11kV/415V Clyde Maintenance Depot SS	Located to the south west of the site off wood pole 116GB	
RailCorp 11kV/415V Clyde District Depot SS	A poletop transformer at the west of the site on wood pole 117GB	
RailCorp 11kV/415V Clyde Telephone Exchange SS	A poletop transformer (pole B1) located to the south of the central part of the site off to the east of wood pole C3	
RailCorp 11kV/415V Clyde Aux Supply SS	A poletop transformer to the south of the site on wood pole C6	
RailCorp 11kV/415V Sig Loc S11.77	A poletop transformer south of the eastern end of the site within the MainTrain facility	

HV infrastructure requiring relocation due to proposed new rail tracks and other facilities includes but is not limited to:

1. Wood poles 117GA, 117GB, J118G, 118GA and 118GB supporting 33 kV Feeder 721 and 11 kV feeders 623/1 and 623/2.
2. Wood pole 116G supporting 33 kV Feeder 721 and 11 kV feeder 623/1 (it is in the way of the proposed carpark).
3. 11kV/415V Clyde District Depot SS poletop transformer at 117GB.
4. Underground cabling 11kV feeders 623/1 and 623/2 in and out at RailCorp Central Warehouse substation.
5. Wood poles C2 and C3 supporting 33 kV feeder 722.
6. Wood pole B1 and poletop substation Clyburn Telephone Exchange.

The scope of works below describes:

1. Relocation of 722 feeder.
2. Relocation of 721 and 623 feeders at the western end of the site.
3. Re-routing of the 11 kV supplies to RailCorp Central Warehouse.

Modifications to RailCorp's HV network must be approved by RailCorp and carried out by an approved construction company.

The design by PPP Co should enable a minimum of disruption of supply. Disruption of supply of power to the MainTrain facility via feeders 645 and 646 and Clyde substation, to RailCorp Central Warehouse substation, to Clyde Maintenance Depot substation, and to Clyde Aux Supply SS is to be minimised. The extent and timing of all disruption to RailCorp owned facilities and MainTrain to be agreed by RailCorp. The extent and timing of all disruption to any properties other than those owned by RailCorp to be agreed by the owner of those properties and RailCorp.

13.1.4 RailCorp and Other Standards

Key requirements of relevant RailCorp HV aerial and underground standards are:

1. Overhead 33 kV conductors shall not pass over structures.
2. Overhead 11 kV conductors shall preferably not pass over structures, or where they do, shall be aerial bundled conductor.
3. Overhead HV conductors crossing rail tracks are preferably to be perpendicular to the track and cross a maximum of two tracks with one span.
4. Clearances to ground and clearances to overhead wiring are to comply with ESAA C(b) 1. Clearance B (vertical) and C (horizontal) for OHW portal structures, and clearance D (vertical) and C (horizontal) to OHW masts.
5. Height limitation on wood poles: RailCorp prefers poles longer than 18.5 m are not used. New parts of the route will have 11 kV, 33 kV and overhead earthwire and will cross roads and pass by storage areas accessed by forklifts etc. A balance will need to be struck between the total quantity of new poles and the number of new poles which need to be 20 m or longer.

13.2 Provisions Required for the Future RailCorp Facility

PPP Co is not required to include for a HV supply to the site for the Future RailCorp Facility. The site is afforded direct frontage access to Manchester Road North..

13.3 Assumptions

Assumptions made in the HV design include those listed below. .

1. 11kV/415V Clyde Telephone Exchange SS is to be decommissioned and removed by PPP Co.
2. 11kV/415V Clyde District Depot substation is to be decommissioned by PPP Co.
3. Energy Australia supplies 11 kV to the PPP Maintenance Facility Substation.
4. Power supply to signal locations S12.14 and S12.43 and signals within the PPP Maintenance

Facility is to be supplied from the RailCorp network. Presently, S12.14 is supplied from 11kV/415V Clyde Telephone Exchange substation and S12.43 is normally supplied from S12.14. The PPP Co is not responsible for this supply, and it will be designed and constructed by RailCorp.

5. An external provider supplies shore power.
6. Correspondence with RailCorp indicates other future plans for 722 feeder. The compatibility of those plans with the reference design described here needs to be investigated. We have assumed here that the related project will be compatible with this reference design.

13.4 Scope of Works

The HV scope of work is likely to include but may not be limited to:

1. Construction of new PPP Maintenance Facility 11kV/415V substation (refer to LV scope of works).
2. Remove 623 feeder 11 kV conductors from the former route on poles C3 to C6. This work is to be co-ordinated with RailCorp such that supply to signal location S12.14 is maintained via 623 until an alternative supply is provided by RailCorp.
3. Relocation of 722 feeder. Construct an under track crossing under the PPP Maintenance Facility site to a location as shown in drawing EL0405233. Stay as required or replace poles C1 and C4A in order that they can handle full termination of 33 kV conductors. Construct a cable route from C1, underground through the Clyburn platform, through the under track crossing, and underground to pole C4A.
4. Remove 722 feeder 33 kV conductors from the former route on poles C1 to C4A. Remove and recover poles C2 and C3.
5. Install lightning protection, including surge arresters at underground cable to overhead transitions, in accordance with RailCorp standard EP21000001SP.
6. Ensure that the overhead earth wire on 722 towards Granville extends the full 800 m from C1.
7. Construct new alternative wood pole overhead route for 721 feeder and 623 feeder between poles 116GA and 119G, as shown on drawing SV016 and SV013. Wood poles 116GA and 119G may require replacing or staying.
8. Relocate the supply to the Clyde Maintenance Depot Substation from pole 116GB to either 115GA or one of the new poles in the route, such that the 11 kV feed to the substation does not pass over the gatehouse.
9. Construct new underground in-out cabling for 623 feeder at the RailCorp Central Warehouse substation.
10. Cut 721 feeder and 623 feeder over to the new route, reconnect RailCorp Central Warehouse substation.
11. Take down 11kV and 33 kV conductors on the old route between poles 116GA and 119G.
12. Remove and recover poletop Clyde District Depot substation. Remove and recover poles 117G, 117GA, 117GB, 118GA and 118GB, and stay poles associated with J118G.

14. LV Power

This section describes the operational intent, assumptions on which the design has been based, and lists key scope of work elements to be constructed.

14.1 Functional Intent

The functional intent of the LV Power portion of the works is to provide safe and reliable LV power distribution and lighting to the new facility. Supply during the construction period has not been considered as part of the Reference Design, and is a separate matter to be addressed by PPP Co. .

The power distribution design criteria will include the requirement to provide adequate capacity to meet the PPP Maintenance Facility's projected needs (including provision for spare capacity). Reliability and flexibility are other key design criteria to be met by PPP Co.

The LV power portion of the works is to provide safe and reliable LV power distribution and lighting to the new PPP Maintenance Facility and, insofar as is specified within the Reference Design, the provisions required for the Future RailCorp Facility. Distribution will include but not be limited to:

- Signalling (dedicated circuits).
- Lighting for tracks, area, perimeter, carpark, buildings, and access roads including level crossings.
- The PPP Maintenance Building and plant within.
- The underfloor wheel profile facility.
- The gatehouse.
- Washplant facility.
- Simulator Area (3 phase power).
- Shore power outlets
- RailCorp to relocate the existing power supply to the Signalling huts north of the new PPP Maintenance Building for provision of temporary power during the removal of the existing Clyburn Exchange Substation.
- Lighting and power for the 200m inspection area on the Down Relief (Commissioning Track) to be used during testing activities.
- Miscellaneous loads.
- Lightning protection including surge protection of sensitive and / or critical circuits (note that the area is subject to high frequency of lightning strikes).
- Earthing and Bonding.

Power supplies to RailCorp signalling facilities are to be on dedicated circuits sourced from RailCorp supply (not sub circuits of Industrial loads in order to avoid unnecessary interruptions).

Lighting design considerations will include the need for light attenuation to minimise light pollution, light spill to adjoining neighbours and glare that could affect adjoining running lines. Illuminance levels for respective areas or tasks shall be to Australian Standards' recommendations for the respective tasks or otherwise to RailCorp's specific requirements where applicable (e.g. lux levels specified in the "Design Guidelines for the upgrade and construction of new and existing train stabling yards and turnback sidings"). The Storage Roads lighting design criteria shall include the need for RailCorp train Crews / staff to be able to perform top and bottom train preparations at any time.

14.2 Assumptions

Assumptions made in the low voltage concept design include:

1. PPP Co is to provide a detailed power demand estimate based on the plant and equipment that they propose for the facility. The demand for the PPP Maintenance Facility has been estimated to be in the order of 6.2 MVA (see Appendix A). However this estimate has been prepared based on the Reference Design and without knowledge of the plant and equipment that the PPP Co propose for the facility.

2. Electrical services cabling can be run in the same trenches with traction cabling, provided recommended respective depths and separation are maintained.
3. The applicable maintained luminance requirement across all lit areas of the site is between 50 and 85 lux (as per the draft stabling standard). This is inconsistent with the security External Lighting Functional Standard for RailCorp Maintenance Centres and Stabling. In its most conservative interpretation the security standard would result in the application of lighting levels of a minimum 150 lux which are considered to be impractical. PPP Co is to consider the hazards relevant to this design task, as well as the associated risk assessment(s) and develop its own design to respect the relevant standards and codes, and seek agreement from RailCorp if non-conforming lighting levels are to be applied.
4. The car park Reference Design does not comply with the draft stabling standard requiring a minimum 20 lux. It has been designed to 'AS1158.3.1:2005 - Lighting for Roads and Public Spaces' with a minimum 3 lux (Category P11b) which does still provide a maintained illuminance of between 50 and 85 lux. Additional lighting may be required for footpaths in the car park during design development. PPP Co is to consider the hazards relevant to this design task, as well as the associated risk assessment(s) and develop its own design to respect the relevant standards and codes, and seek agreement from RailCorp if non-conforming lighting levels are to be applied.
5. Additional lighting will need to be considered by PPP Co during further design development including at stairs, building entry exists, and other confined spaces.
6. In the Reference Design, requirements for top and bottom train preparations have been addressed by using light fittings on poles. These poles have been placed at carriage coupling points to maximise illumination. Bollard lighting (as noted in the draft stabling standard) has been deemed unnecessary.
7. RailCorp's lighting requirements that include light glare minimisation and safe maintenance have been met (in the Reference Design) by generally using 4.5m tilting poles and building mounted luminaires accessible from the roof. The primary concern is the maintenance access to these poles in proximity to live overhead wires. The proposed arrangement is one of several options that include medium high poles 8-9m or very high masts approximately 30m. There are a range of maintenance methods available in the market that include lowering systems. All lighting options are subject to a safety assessment by PPP Co as part of its further development of the design. In particular it is noted that wall-mounted poles, including those between the Down Relief and Storage Roads, will require further consideration.
8. The Reference Design for lighting has only covered the following areas (a detailed design needs to be developed by the PPP Co to provide lighting throughout the PPP Maintenance Facility to satisfy RailCorp's requirements.):
   - Facility perimeter fence.
   - Facility entry and exit points.
   - Car park.
   - Facility walkways, access paths and roads.
   - Parallel and in-between stationary trains.
9. Provision of LV power is not required for the RailCorp Future Development.
10. Shore power outlets from dedicated supply and with earthing and neutral connections to RailCorp Standards.

14.3 Scope of Works

Low voltage scope of work includes but is not limited to:

1. New 11kV/415V substations (refer to HV Section for HV requirements)
2. Distribution via cables, conduits and pits including ULXs to distribution boards and circuits for:
   - Signalling (dedicated circuits).
   - Lighting.
   - The PPP Maintenance Building and plant within.
   - The Underfloor wheel profile facility.
   - The gatehouse.
   - Washplant facility.
   - Simulator Area.

- Shore power outlets (dedicated supplies with appropriate earthing to RailCorp Standards)
- Down Relief hardstand area lighting.
- Miscellaneous loads.

3. Lighting for tracks, area, perimeter, carpark, buildings, and access roads including level crossings.
4. Earthing and Lightning Protection for the facility including:
   - Lightning and Surge Protection.
   - Earthing and Bonding.

15. Electrolysis Protection

Outlined below is a discussion of good practice for electrolysis protection. The most suitable system of electrolysis protection should be assessed for all services, utilities and structures as part of detailed design.

15.1 Functional Intent

Corrosion control design criteria are to encompass all engineering disciplines involved in the project. The objectives of the corrosion control design criteria and their implementation should include the following:

- Maximising the probability of achieving the design life of system facilities by avoiding unexpected failure caused by corrosion.
- Minimising the operating and maintenance costs associated with material deterioration.
- Providing continuity of operations by minimising the risk of corrosion related failures of systems and sub-systems.
- Minimising the detrimental effects to facilities belonging to others.
- The corrosion control design requires coordination with other disciplines including mechanical, utility, electrical, civil & structural, trackwork, electrification, signalling and communication designs.

The scope of work for electrolysis protection design should consist of the following items:

- Establish a comprehensive list of 'buried structures", their correlation to the rails, associated materials and construction details.
- Establish ground and ground water characteristics and their aggressiveness toward relevant construction materials
- Reviewing existing electrolysis protection measures and issues
- Liase with all stakeholders to obtain relevant requirements.
- Perform measurements of potentials between existing structures to soil to evaluate the potential risk of electrolysis.
- Evaluate the design of new 'buried structure' with respect to susceptibility to soil corrosion and stray current corrosion.
- Establish control and protection criteria to counter soil corrosion and/or electrolysis with consideration of the required service life.

15.2 Design Considerations

15.2.1 Soil corrosion control

Determination of Aggressiveness

- Soil and groundwater testing should be performed in conjunction with geotechnical testing, particularly in areas of extensive below grade construction.
- Data on concentrations of the aggressive nature of soil and/or ground water should be obtained. As a minimum, soil resistivity, moisture content, pH, chloride ion concentration, sulphate concentration, presence of sulphide (acid sulphate soil) and organic materials should be obtained.

Materials of Construction

- Materials of construction should be selected based on the determined aggressiveness of the soil/groundwater and required design life.
- Any non-native backfill materials should, as a minimum, conform to the limits indicated in Australian Standard AS 2159 for non-aggressive soils.

Safety and Continuity of Operations

- Corrosion control and protection will be required for any facilities where corrosion related failure may affect safety or interruption of continuity of operations.

Monitoring

- When corrosion control provisions are implemented, permanent and accessible test facilities should be installed with allowance for periodic maintenance and monitoring.

Special Considerations

- The selection of corrosion control measures should be designed as an integral part of the project to minimise any possible construction conflicts and impacts on other systems.

Materials and Methods for Soil Corrosion Control

Unless specified otherwise, materials and methods for soil corrosion control should comply with the following requirements:

- Coatings
    - Minimum volume resistivity 10^{10} ohm-centimetres.
    - Minimum thickness as recommended by manufacturer but not less than 400 microns.
    - Bonding strength to substrate should be tested for approval.
    - Resistance to handling, earth pressure, abrasion should be evaluated for approval.
- Electrical insulation of piping - All devices used as electrical insulators for corrosion controls should meet relevant Australian standards and other specific requirements by Rail Infrastructure Corporation. The selected devices should have similar mechanical and temperature ratings to the structure to which they are installed.
- Electrical continuity - Electrical continuity shall be provided for all non-welded metallic pipe joints.
- Cathodic protection - Unless considered not technically and/or economically feasible, cathodic protection should be accomplished by sacrificial galvanic anodes to minimise the risk of interaction. Cathodic protection must not be connected to a negative return system.

Structures and Facilities

- Ferrous pressure piping - All new buried ferrous piping should be catholically protected.
- Copper piping -All buried copper pipes should be electrically isolated from other piping and non-buried piping.
- Non pressure piping - Ferrous piping should be internally and externally coated with a sacrificial coating and an organic protective coating. Dielectric encasement should be considered.
- Electrical conduits - Buried metallic conduits should include galvanised steel with PVC or other acceptable coating.
- Reinforced concrete structures - Reinforced concrete structures should comply to relevant requirements given AS 2159, AS 3600, AS 5100 to suit the requirement on design life.
- A review of the electrolysis should be undertaken in the vicinity of the tracks/sub-stations where prestressed or post tensioned concrete elements are used.

15.2.2 Stray Current/Electrolysis Control

All recommendations given in Rail Infrastructure Corporation Standard EP 12 30 00 01 SP should be considered and implemented. In addition to these, the following items are recommended:

Traction Power Substations

- Implementation of recommendations provided in BS EN 50122-2.
- Substation should provide a remote monitoring system to record bus-to-earth potential, track-to-earth potential and stray current return.
- Space should be provided for future installation of stray current mitigation drainage devices.

Positive Distribution Systems

- Maximum current leakage of 1.5 mA per km.
- Discrete grounding of support poles.
- Establish electrical continuity of reinforcing steel and a common ground electrode system.

Ballasted Track Construction

- Use of hard, non-porous, low absorption and well drained ballast.
- Clearance between ballast materials to all metallic surface of rail should be kept at 25 mm minimum.

Maintenance Building

- Shop track should be electrically connected to shop building and shop grounding system.
- Other electrically grounded track should be electrically insulated from yard tracks and powered from the shop traction power supply.

Water Drainage

- Design to prevent water running onto rails and accumulation of water.

Track Structures

- Column and bearing assemblies
  - Provide electrical continuity of top layer of reinforcing steel.
  - Provide interconnection of all top layers longitudinal reinforcing steel to transverse collector bars.
  - Provide a ground electrode system at each end of structures and at intermediate locations with maximum spacing of not more than 500m.
  - Provide test facilities at each end of structures and at intermediate locations with maximum spacing of 150m.
  - Provide electrical isolation of reinforcing steel in deck from columns, abutments and other grounded elements.
  - If a membrane system is used it should have a minimum volume resistivity of not less than 10^{10} ohm-cm.

Overhead Contact System Pole Foundation Grounding

- Sacrificial coating shall be applied to the entire component.
- Barrier coating should extend a minimum of 250 mm into concrete and 100 mm above surface of concrete.
- Electrical continuity of reinforcing steel with the pole must be established.

Utility Structures

- Unless required otherwise, all piping and conduits should be non-metallic.
- All reinforcing steel, structural steel and steel rails within the shop building should be electrically connected to a common grounding grid.

Existing Structures

Install test facilities at selected locations for evaluation of stray earth current effects. As a minimum, this is required for structures within 100m of the system traction power station, any utility crossing the system within 100m.

Testing

- Electrical continuity of reinforcement and utility structures is required and should be tested as part of the quality control scheme.
- Design and implementation of cathodic protection when required should be designed according to relevant Australian standards and subjected to verification as noted previously.
- Testing of Track-to-earth resistance of running rail should be formalised in term of testing procedures, acceptance criteria and reporting procedures.

15.3 Reference documents

The following reference documents should be consulted in corrosion control design

- Rail Infrastructure Corporation Electrical Engineering Standards in category Earthing, Bonding and Electrolysis, Particularly Electrical Engineering Standard EP 12 30 00 01 SP – Electrolysis from Stray DC current.
- British/European Standard BS EN 50162:2004 – Protection against corrosion by stray current from direct current systems
- British/European Standard BS EN 50122-1: 1998 – Railway applications – Fixed installations – Part 1: Protective provision relating to electrical safety and earthing
- British/European Standard BS EN 50122-2: 1999 - Railway applications – Fixed installations – Part 2: Protective provision against the effects of stray current caused by D.C. traction systems
- Australian Standard AS 4799-2000- Installation of underground utility services and pipelines within railway boundaries
- Australian Standard AS 2832.1 –2004- Cathodic protection of metals – Pipes and cables
- Australian Standard AS 2832.2 –2003- Cathodic protection of metals – Compact buried structures
- Australian Standard AS 2832.4 –2004- Cathodic protection of metals – Internal surfaces
- Australian Standard AS 2832.5 –2004- Cathodic protection of metals – steel in concrete structures
- Australian Standard AS 1674.2 – 2003 – Safety in welding and allied processes – Electrical

16. Architectural and Landscaping

This section outlines architectural and landscaping elements of the PPP Maintenance Facility, assumptions, and the scope of work on which the design has been based.

These works do not include the PPP Maintenance Building, Under Floor Wheel Profile Facility or the Washplant facility.

16.1 Functional Intent

The functional intent for architecture and landscaping elements include:

Gatehouse

1. Monitor and control vehicular and pedestrian access into the site.
2. Accommodate 2-3 security personnel including security control systems for the site.
3. Provision of weatherproof undercover area at interface of gatehouse attendant and visitors.
4. Height of protective awning to accommodate 5.3m vehicles.
5. Air conditioning.
6. Good visibility from within the gatehouse.
7. Separate gate control mechanisms for both vehicles and pedestrians entering and exiting.
8. Internal thermal comfort.

RailCorp Crew Amenities Area

1. Accommodate 2 male or female workers in the eastern workplace far away from other facilities.
2. Provide visual lock.
3. Two sets of toilet pan and basin.
4. Robust constructed to suit outside situation.

Landscaping

1. Ground covers to carpark perimeter providing visual pleasure screen between working yard and carpark.
2. Large canopy trees in the carpark for shade.
3. Palms and canopy shade trees to the facility entrance.
4. Ballast, turf, stone and ground covers at the facility entrance forming railway related concept.
5. Small hedge (to 1.5m high) with ground covers to eastern, centre and western zones of the sidings in between tracks that provides visual pleasure screens within the working yard.
6. Replace the landscaping planted as part of the Olympic greening project removed as part of the PPP Site Works and associated Down Relief works.

Note landscaping documented on drawings is indicative only and subject to the design of the PPP Maintenance Facility functional layout.

Assumptions

Gatehouse

1. Provision of toilet and kitchenette.
2. Location of gatehouse in centre of road.
3. Provision of fencing and swing gates for security control.
4. Can accommodate 2-3 persons.

RailCorp Crew Amenities Area

1. Accommodate 2 persons at the same time.
2. Security gate provided.
3. Naturally ventilated.

Landscaping

1. Minimal irrigation will be applied.

2. Native species are to be used.
3. Big trees are not to be provided between tracks.
4. No branches in the car park lower than 2m.
5. Water detention structures in the carpark will support proposed trees.

Appendix A

Preliminary Power Demand Estimation

Preliminary Power Demand Estimate

Electrical loads listed below are preliminary estimates only.
Proponents are to provide detailed estimate based on their proposal.
Comments marked * are based on information current at time of writing-Refer Specification requirements for full details

Load Description	Estimated Demand (kW)	Comments
Traction Power	3200	assumed power for 8 sets @ 400 kW each *
Shore Power	20	assumed power for 20 cars stabled *
Area Lighting -Track, Car Parks	160	
Down Relief Lighting	20	200m*
Maintenance Facility - Lighting & Gen Power	350	200m x 70 m
Maintenance Facility - Machinery	750	Final loads will depend on equipment proposed for the facility
Maintenance Facility - Miscellaneous Loads	300	including: PPP Co Office, Training Room, Stores, Amenities, Crew Amenities, RailCorp Office*
Wheel Profiling	150	loads include: Underfloor Wheel Profiling Plant M/C (4000 wheel sets pa plus sets requirements)*
Washplant	150	20 x 8 car sets per day*
RailCorp Loads	500	PPP Proponent to liaise with RailCorp to confirm extent of requirement
Contingency	600	25%
TOTAL	**6200**	

Note: The estimates are based on preliminary design work using the information available at the time. Suggested contingency allowances have been defined in the estimates. These contingencies allow for inaccuracy in quantity estimates, minor omissions, and unforeseen loads. These contingencies are not intended to cover significant changes in the project scope.
A more definitive estimate will only be possible after detailed design is well advanced and when details of PPP Maintenance Facility equipment are known. These further steps / actions are the responsibility of PPP Co.