

Railway

Master Specification

RW-SE-D1 Signalling

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RW-SE-D1 Signalling

1 General

1.1 This Part specifies the Requirements for the Railway Signalling System.

2 Engineering Standards

2.1 The Contractor shall comply with the following, minimum, relevant engineering standards for any signalling work on the Adelaide Metropolitan Passenger Rail Network (AMPRN):

- | | | |
|-----|---------------------------|--|
| a) | PTS-AR-10-SG-STD-00000068 | Signalling Principles and Practices. |
| b) | SG1-DOC-000928 | Automatic Train Protection: Signalling Principles. |
| c) | PTS-MS-10-SG-STD-00000033 | Signal Sighting Standard. |
| d) | PTS-MS-10-SG-STD-00000094 | Pit and Conduit Standard for Signalling and Communication Cables. |
| e) | SG4-DOC-000455 | Engineering Standard for Railway Signalling Cables. |
| f) | PTS-AR-10-CN-SPE-00200400 | Communications Network Principles and Practices for Public Transport. |
| g) | SG2-DOC-002021 | Tramline Signalling Requirement. |
| h) | SG1-DOC-000375 | Signalling Design Process and Design Production Standard for Contractors. |
| i) | PR-AM-GE-1170 | Assessment of Engineering Competence for Rail Safety Workers. |
| j) | SG4-DOC-002026 | Rail Safety Worker Competency Assessment for Signalling Contractors Staff. |
| k) | AS 1742.7 | Manual of uniform traffic control devices; Part 7: Railway crossings. |
| l) | AS 7658 | Level Crossings. |
| m) | AS 7715 | Train Detection. |
| n) | AS 7718 | Signal Design Process Management. |
| o) | AS 7717 | Signal Testing & Commissioning. |
| p) | AS 7716 | Signal Testing Process. |
| q) | AS 7702 | Type Approval. |
| r) | AS 7720 | Signalling Equipment Enclosure and Wiring. |
| s) | AS 7708 | Signalling Earthing and Surge Protection. |
| t) | AS 7722 | EMC Management. |
| u) | AS 7663 | Signal Cables. |
| v) | AS 7664 | Railway Signalling Cable Routes, Cable Pits & Foundations. |
| w) | AS 7631 | Railway Infrastructure Sighting. |
| x) | AS 7721 | Lineside Signals, Indicators and Signal Signage. |
| y) | AS 7632 | Railway Infrastructure Signage. |
| z) | AS 7706 | Interface with Points. |
| aa) | AS 7660 | Railway Network Control Mobile Communication Systems Standard. |

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|-----|--|---|
| bb) | AS 7666 TPC | Interoperability. |
| cc) | AS 7450 | Interoperability. |
| dd) | Guideline – Rail Systems interoperability. | |
| ee) | PTS-AR-10-TK-SPE-00000035 | "In Bearer" Point Machines. |
| ff) | PTS-AR-10-TK-SPE-00000062 | Technical Specification for Train Points & Crossings. |
| gg) | PTS-AR-10-TK-SPE-00000093 | Technical Specification for BW-Type Tram Points & Crossings. |
| hh) | PR-AM-GE-807 | Development and Approval of Engineering Waivers. |
| ii) | PTS-MU-10-EG-PRC-00000016 | Design Decision Records Procedure. |
| jj) | AM4-DOC-000466 | Type Approval for Railway Products. |
| kk) | PTS-MS-05-AM-PRS-00000091 | Asset Management Technical Data Requirements Specification. |
| ll) | FR-AM-GE-806 | Identification and Numbering of Public Transport Technical Documents, Records and Drawings. |
| mm) | PL-AM-GE-865 | Rail Drawings Acceptance Procedure. |
| nn) | AM4-DOC-000364 | Drafting requirements for Rail AutoCAD Drawings. |
| oo) | PR-AM-GE-847 | Engineering Notices Procedure. |
| pp) | PR-AM-GE-1270 | Issue of Keys to Access Signals Infrastructure. |
| qq) | PR-AM-GE-762 | Punch List Management Procedure for Public Transport Projects. |
- 2.2 The hierarchy of the identified standards in clause 2.1 above in order of precedence as follows:
- DIT Policies, Procedures, Processes and Engineering Standards.
 - DIT Directives, Guidelines and Specifications
 - Australian Standards issued by the RISSB
 - Other Australian Standards not identified above
 - Utility Authority standards, procedures and guidelines
 - International Standards.
- 2.3 An advice must be sought from the Principal's or Rail Signal Engineering's representative for any clarification or conflict regarding the standards listed in the above clause.
- 2.4 The Contractor must develop, implement and comply with a standards register.

3 Design Reports and Concept Plans

- As a minimum, the Design Reports provided at the following stages (4, 5, 6 7 & 8) for the Signalling System shall include the documentation listed in the relevant phase's and comply with the requirements of DIT standard SG1-DOC-000375 clause 11.
- Concept Signalling Scheme Plans shall be submitted for operational and engineering input prior to commencement of initial design phase.

4 Requirements Definition (Notionally 15% Complete) Phase

- The following shall constitute **Hold Points** for this stage:
 - initial Programme and Schedule of Works – Including WBS;
 - Detailed Site Survey Drawings containing:
 - major monuments (e.g. Railway Stations, Side Roads, over bridges, etc.);

- ii) existing Master Signalling Plan and trackside signalling equipment including asset numbers and descriptions;
 - iii) existing railway services;
 - iv) existing Utility Services;
 - v) track and civil plan;
 - vi) existing OHW infrastructure; and
 - vii) existing railway corridor access points.
- c) Initial Master Signalling Plan:
- i) initial Bill of Materials;
 - ii) initial Braking and Signal Spacing Calculations;
 - iii) initial Headway Calculations and Time / Distance Graph; and
 - iv) initial Level Crossing Approach Calculations.
- d) Initial Bonding and Cable Running.
- e) initial Signalling Power Calculations.
- f) Initial Systems Architecture:
- i) Fibre Backbone and Redundancy;
 - ii) Train Control System Interface with Signalling Interlocking; and
 - iii) Communications Infrastructure.
- g) Initial Design for Primary Cable Containment Route:
- i) proposed location of the Primary Cable Containment (Up / Down track side) and Under Track Crossings;
 - ii) number of conduits where the preferred Primary Cable Conduit consists of pit and conduit system [PTS-MS-10-SG-STD-00000094]; and
 - iii) where make-up of the non-preferred Primary Cable Containment consists of Ground Level Trough or Galvanized Steel Trunking.
- h) identification of signalling assets requiring connection via a Secondary Cable Containment Route;
- i) basic Signalling Functional Specification; and
 - j) Design Basis Report.

5 Preliminary Design (Notionally 30% Complete) Phase

5.1 The following shall constitute **Hold Points** for this stage:

- a) updated Programme and Schedule of Works – Including WBS;
- b) Master Signalling Plan:
 - i) updated Bill of Materials;
 - ii) updated Braking and Signal Spacing Calculations;
 - iii) updated Headway Calculations and Time / Distance Graph;
 - iv) Safety in Design Report and Risk Assessment;
 - v) preliminary signal sighting [Forms]
 - vi) updated Level Crossing Approach Calculations; and
 - vii) preliminary Risk Assessment for Level Crossings [LX and PedX].
- c) Track Bonding and Signal Apparatus Plans:

- i) typical details of cable pits;
- ii) preliminary cable running plans; and
- iii) provisional Signalling Cable Route.
- iv) identification of location case, Up / Down track, preliminary chainage;
- d) Impedance and Cross bonding plans;
- e) Signalling Power Supply:
 - i) updated Power Calculations;
 - ii) Preliminary power schematic;
 - iii) Preliminary power distribution; and
 - iv) Preliminary power control panel layout(s).
- f) Systems Architecture:
 - i) Fibre Backbone and Redundancy;
 - ii) Train Control System (TCS) Interface with Signalling Interlocking;
 - iii) Communications Infrastructure;
 - iv) Systems Diagnostics;
 - v) Cyber security design plan;
 - vi) ATP system; and
 - vii) Axle Counter system network (where applicable)
- g) Location, Equipment and Generator Room layouts;
- h) Level Crossing Layout Plan [LX & PedX]:
 - i) Preliminary Risk Assessment for Level Crossings [LX and/or PedX]
 - ii) level crossing focussing plans; and
 - iii) sighting distance [pedestrian].
- i) Control Tables:
 - i) Signal Controls and Lighting;
 - ii) Point Controls and Detection;
 - iii) Axle Counter Controls;
 - iv) Level Crossing Controls
 - v) Pedestrian Crossing Controls;
 - vi) Interface Controls; and
 - vii) Aspect Sequence Chart.
- j) Application Logic and Systems Data:
 - i) Computer Based Interlocking;
 - ii) Signalling Communications;
 - iii) Train Control System and Interfaces;
 - iv) ATP Systems; and
 - v) Axle Counter System.
- k) Combined Services Plan (aerial photograph) overlaid with:
 - i) Master Signalling Plan;
 - ii) trackside signalling equipment including asset numbers and descriptions;
 - iii) major monuments: Railway Stations, Side Roads, over bridges, etc.;

- iv) existing railway services;
 - v) existing Utility Services and indicative clashes;
 - vi) track and civil plan (including drainage);
 - vii) existing railway corridor access points; and
 - viii) OHW mast locations & booster transformers; traction power cable containment.
- l) Preliminary Primary Cable Containment Route, including:
- i) location of the Primary Cable Containment;
 - ii) containment type: Conduit, Ground Level Trough, Galvanised Steel Trunking;
 - iii) number of conduits;
 - iv) location of pits; and
 - v) review identifying potential clashes of the Primary Cable Containment with other services including drainage infrastructure.
- m) Preliminary Secondary Cable Containment Route, including:
- i) identification of signalling assets requiring connection via a Secondary Cable Containment Route;
 - ii) location of trackside signalling equipment;
 - iii) location of under track crossings; and
 - iv) location of pits.
 - v) review identifying potential clashes of the Secondary Cable Containment with other services including drainage infrastructure;
- n) Preliminary arrangements for special Cable Containment:
- i) on gantries;
 - ii) across creeks;
 - iii) across waterways;
 - iv) over bridges;
 - v) on or over embankments;
 - vi) through cuttings;
 - vii) over or through subways;
 - viii) through station platforms; and
 - ix) through tunnels.
- o) updated Signalling Functional Specification:
- i) providing overall system requirements;
 - ii) Novel systems & equipment to be introduced; and
 - iii) Instigation of Type Approval process (where required).
- p) updated Design Development Report:
- i) detailed position of location case (within 10m of the final position);
 - ii) concept of safe construction and maintenance access.
 - iii) preliminary RAMs assessment.
 - iv) list of Engineering waivers to be sought;
 - v) design issues list; and
 - vi) design decisions log.
 - vii) Asset List skeleton;

- viii) a list of construction specifications; and
- ix) a list of Inspection and Test Plans.

6 Detailed Design (Notionally 70% Complete) Phase

6.1 The following shall constitute **Hold Points** for this stage:

- a) updated Programme and Schedule of Works – Including WBS, Final & Stagework Construction, Commissioning;
- b) Master Signalling Plan:
 - i) updated Bill of Materials (final);
 - ii) updated Headway Calculations and Time / Distance Graph (final);
 - iii) updated Braking and Signal Spacing Calculations (final);
 - iv) Safety in Design Report and Risk Assessment (final);
 - v) updated Level Crossing Approach Calculations (final); and
 - vi) Risk Assessment for Level Crossings [LX and PedX] (final)
 - vii) updated Signal Sighting Forms (final).
- c) Track Bonding and Signal Apparatus Plans:
 - i) final details of cable pits;
 - ii) final cable running plans; and
 - iii) final Signalling Cable Route.
 - iv) final position of location case, Up / Down track, chainage.
- d) Impedance and Cross bonding plans;
- e) Signalling Power Supply:
 - i) final Power Calculations;
 - ii) final power schematic;
 - iii) final power distribution; and
 - iv) final power control panel layout(s).
- f) Systems Architecture:
 - i) Fibre Backbone and Redundancy (final);
 - ii) Train Control System (TCS) and Interfaces (final);
 - iii) Communications Infrastructure;
 - iv) ATP Systems; and
 - v) Axle Counter System.
- g) Location, Equipment and Generator Room final layouts;
- h) Level Crossing Layout Plan [LX & PedX]:
 - i) Final level crossing focussing plans; and
 - ii) Final sighting distance [pedestrian].
- i) Control Tables:
 - i) Signal Controls and lighting (final);
 - ii) Point Controls and detection (final);
 - iii) Axle Counter Controls and Resets (final);
 - iv) ATP Controls (final);

- v) Level Crossing Controls (final);
 - vi) Pedestrian Crossing Controls (final)
 - vii) Interface Controls (final); and
 - viii) Aspect Sequence Chart (final).
- j) Final Application Logic and System Data:
- i) Computer Based Interlocking;
 - ii) Signalling Communications;
 - iii) Train Control System;
 - iv) ATP System; and
 - v) Axle Counter System.
- k) Combined Services Plan (final):
- i) Chainage;
 - ii) major monuments (e.g. Railway Stations, Side Roads, over bridges, etc.);
 - iii) existing Master Signalling Plan and trackside signalling equipment including asset numbers and descriptions;
 - iv) existing railway services;
 - v) existing Utility Services and detailed design of Utility Services to be relocated;
 - vi) track and civil plan (including drainage);
 - vii) OHW mast locations, booster transformers, etc.;
 - viii) traction power cable containment;
 - ix) existing railway corridor access points; and
 - x) the combined services plan overlaid on aerial photography.
- l) Final Primary Cable Containment Route including:
- i) location of the Primary Cable Containment (Up / Down track side), Under Track Crossings and Under Road Crossings;
 - ii) Primary Cable Containment detailing sections of Conduit, Ground Level Trough, Galvanised Steel Trunking;
 - iii) closed out clash review of all previously identified Primary Cable Conduit clashes;
 - iv) typical trench, Ground Level Trough, Galvanised Steel Trunking cross sections;
 - v) number of conduits where the preferred Primary Cable Containment consists of a pit and conduit system;
 - vi) number of conduits where the non-preferred Primary Cable Containment consists of Ground Level Trough and/or Galvanised Steel Trunking;
 - vii) location of Primary Cable Containment Route Under Track and Under Road Crossings;
 - viii) detailed construction methodology for conduits (open trench, directional bore, etc.) including Under Track and Under Road Crossings;
- m) final Secondary Cable Containment Route including:
- i) detailed location of trackside signalling equipment;
 - ii) location of Secondary Cable Containment Route Under Track and Under Road Crossings;
 - iii) detailed construction methodology of each conduits (open trench, directional bore, etc.) including Under Track and Under Road Crossings;
 - iv) Secondary Cable Route connections to trackside signalling equipment;

- v) closed out clash review of all previously identified Secondary Cable Conduit clashes with other services, including drainage;
 - vi) details of cable pits;
 - vii) pits detailed on Drawings:
 - Primary cable / UTX pit;
 - Secondary cable / UTX pit;
 - Location Case Pits;
 - Under Road Crossing pit;
 - Secondary cable break out pit;
 - Fibre optic joint pits; and
 - Fibre optic make-off loop pit.
 - viii) pit Schedule for all pits on Secondary Cable Route;
 - ix) detailed design of all pits to be used. Where proprietary pits are to be used Product Technical File of pits; and
 - x) final details of cable containment (pit and conduit, Ground Level Trough, Galvanised Steel Trunking) pit entry details.
- n) Final detailed arrangement for special Cable Containment;
- i) on gantries;
 - ii) across creeks;
 - iii) across waterways;
 - iv) over bridges;
 - v) on or over embankments;
 - vi) through cuttings;
 - vii) over or through subways;
 - viii) through station platforms; and
 - ix) through tunnels.
- o) Final Signalling Functional Specification:
- i) final overall system requirements;
 - ii) Novel systems & equipment to be introduced; and
 - iii) Type Approvals implemented.
- p) updated Design Development Report:
- i) detailed position of location case;
 - ii) safe construction access methodology;
 - iii) maintenance access methodology.
 - iv) waivers sought; and
 - v) design issues list.
- q) design decisions log and Stagework designs:
- i) Signalling Arrangement:
 - Safety in Design Report; and
 - Level Crossing Approach Calculations.
 - ii) Bonding and Cable Running:

- details of cable pits;
 - cable running plans;
 - Signalling Cable Route; and
 - Traction Return, Impedance and Cross Bonds.
- iii) location case position:
- identification of location case, Up / Down track chainage; and
 - concept of safe construction and maintenance access.
- iv) Systems Architecture:
- Fibre Backbone and Redundancy;
 - Train Control System Interface with Signalling Interlocking; and
 - Communications Infrastructure;
 - Systems Diagnostics;
 - Cyber security design;
 - ATP System; and
 - Axle Counter system network.
- v) Location, Equipment and Generator Room layouts;
- vi) Level Crossing Layout Plan [LX & PedX]:
- level crossing focussing plans; and
 - sighting distance [pedestrian]
- vii) Control Tables:
- Signal Controls and lighting;
 - Point Controls and detection;
 - Axle Counter Controls and Resets;
 - ATP Controls
 - Level Crossing Controls;
 - Pedestrian Crossing Controls
 - Interface Controls; and
 - Aspect Sequence Chart.
- viii) Final Application Logic and System Data:
- Computer Based Interlocking;
 - Signalling Communications;
 - Train Control System;
 - ATP System; and
 - Axle Counter System.
 - Each tester shall be registered with RIW and hold the relevant DIT competency in accordance with SG4-DOC-002026, please provide evidence. Detailed strategy for implementation of the works;
 - Updated RAMs assessment;
 - completed Engineering Waivers;

- a summary of any additional Engineering Waivers sought due to development of the Detailed Stagework Design.
 - Preliminary Safety Case/Argument; and
 - final Asset List in accordance with PTS-MS-05-AM-PRC-00000091;
- r) 70% developed Construction Specifications;
- s) 70% developed Inspection and Test Plans; and
- t) test certificates for the final commissioning and any stageworks.

7 Final Design (Notionally 95% Complete) Phase - For Comment Close Out

7.1 The following shall constitute **Hold Points** for this stage:

- a) design decisions log;
- b) final design documentation, plans and data release certification;
- c) stagework designs (where applicable);
- d) final Asset List in accordance with PTS-MS-05-AM-PRC-00000091;
- e) Final RAMs assessment;
- f) Final Safety Case/Argument;
- g) Construction Specifications;
- h) Factory Acceptance Test Certification;
- i) Inspection and Test Plans;
- j) test certificates for the final commissioning and any stageworks.
- k) level crossing focussing plans;
- l) Equipment and Generator room layouts;
- m) Signalling Diagram;
- n) bills of materials;
- o) Signal Sighting Forms;
- p) Design Report;
- q) Construction Specifications.

8 Issued for Construction (IFC) Design (Notionally 100% Complete) Stage

8.1 The following shall constitute **Hold Points** for this stage:

- a) Closure List;
- b) Issue For Construction Plans;
- c) Inspection and Test Plans;
- d) Commissioning Plans;
- e) Interim Maintenance Copy Plans.

9 Construction or Installation

9.1 The following shall constitute **Hold Points** for the construction or installation of signalling system on the AMPRN:

- a) signal design and issued for construction site plans must be accepted by Rail Signal Engineering's Representative before the start of construction or installation work;
- b) signal sighting desk top design and modelling approval or sign off by Rail Signal Engineering's Representative must be completed before the start of installation of signal foundations and gantries. Track Engineering sign off must be required for any structural clearance conflicts;
- c) Rail Signal Engineering Inspector or representative is required to pass all signalling installation work before burying of conduits / cables and earth grid;
- d) software FAT, signed certificates and close out reports shall be submitted for review at least 15 business days prior to coming out on site;
- e) track side installation of location case must be inspected and accepted by Rail Signal Engineering's and Track Engineering's representative;
- f) Signalling power distribution must be certified with Certificate of Compliance for all cable runs before energisation. Rail Signal Engineering's Representative shall accept all documentation before energising acceptance is given;
- g) installation hold points for the below must require a certificate to be signed off by Rail Signal Engineering's Representative before hold points will be released:
 - i) Signal base;
 - ii) Location base;
 - iii) Level Crossing base;
 - iv) Conduit routes, depth, back filling, warning tape between location cases, pits and equipment; and
 - v) Axle counter disconnection post, Controlled Balise disconnection bootleg, Automatic Warning System transformer boxes.
- h) Signal Engineering and Maintenance's representative along with Track Engineering's representative must inspect the installation of point machine for the quality and accept the set up and adjustments of points.

10 Inspection, Testing and Commissioning

- 10.1 The Contractor must comply with PC-RW50 "Inspection, Testing and Commissioning", AS 7717 "Signal Testing & Commissioning", and AS 7716 "Signal Testing Process".
- 10.2 "As Built" alterations to circuit plans and application and systems data as required to be completed after each level of stagework.
- 10.3 Final "As Built" plans must be provided after the test copies have been returned and the commissioning is complete.

11 Asset Handover

- 11.1 The Contractor must comply with PC-RW60 "Asset Management Handover".

12 Hold Points

- 12.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
4.1	Provision of Requirements Definition Documents and Drawings Comments close out	Minimum 10 Working days for Rail Signal Engineering
5.1	Provision of Preliminary Design Documents and Drawings Comments close out	Minimum 10 Working days for Rail Signal Engineering

Document Ref.	Hold Point	Response Time
6.1	Provision of Detailed Design Documents and Drawings Comments close out	Minimum 10 Working days for Rail Signal Engineering
7.1	Provision of Final Design Documents and Drawings Comments close out	Minimum 10 Working days for Rail Signal Engineering
8.1	IFC / Final drawings / software shall be provided with version summary sheet Comments close out	Minimum 10 Working days for Rail Signal Engineering
9.1	Provision of construction / installation documentation with all commissioning modification complete.	Minimum 25 working days for Rail Engineering