

Project Controls

Master Specification

PC-RW30 Design

Document Information

K Net Number:	11821703
Document Version:	1
Document Date:	August 2020

DEPARTMENT FOR
INFRASTRUCTURE
AND TRANSPORT



Government of South Australia

Department for Infrastructure
and Transport

Document Amendment Record

Version	Change Description	Date
1	Initial issue (formerly RW30)	August 2020

Document Management

This document is the Property of the Department for Infrastructure and Transport and contains information that is confidential to the Department. It must not be copied or reproduced in any way without the written consent of the Department. This is a controlled document and it will be updated and reissued as approved changes are made.

Contents

Contents	2
PC-RW30 Design	4
1 General	4
2 Engineering and Design Management Plan	5
3 Contractor's Design Obligations	5
4 Design Program and Work Breakdown Structure	6
5 Design Coordination	6
6 Development of the Design and Design Documents	8
7 Design Verification and Validation / Requirements Management	9
8 Document Control	11
9 Document Controller	11
10 The Contractor's Documents	11
11 Provision of the Design Documents to the Principal	12
12 ICT and Software Systems Management	14
13 Human Factors	15
14 Reliability, Availability and Maintainability	16
15 Hold Points	17
16 Records	18

PC-RW30 Design

1 General

- 1.1 This Part specifies the Requirements for the design of Railway Infrastructure.
- 1.2 Refer to PC-RW10 "Railways Management Planning" for definitions and referenced documents.
- 1.3 Contractor must comply with:
- | | |
|-------------------|---|
| a) RSNL | Rail Safety National Law (South Australia) Act 2012 and Regulations. |
| b) WHS | Work Health and Safety (South Australia) Act 2012 and Regulations. |
| c) AS15288 | Systems and Software Engineering – System Life Cycle Processes. |
| d) AS10007 | Quality Management System – Guidelines for Configuration Management. |
| e) ISO/IEC 29148 | Systems and software engineering – life cycle processes – requirements engineering. |
| f) ISO/IEC 26702 | Systems engineering – application and management of the systems engineering process. |
| g) EN50126 Part 1 | Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability, and Safety (RAM) – Part 1: Basic Requirement and Generic Process. |
| h) EN50126 Part 2 | Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Guide to the application of EN 50126-1 for safety. |
| i) EN50128 | Railway applications. Communication, signalling and processing systems. Software for railway control and protection systems. |
| j) EN50129 | Railway Applications - Communication, Signalling and Processing Systems - Safety Related Electronic Systems for Signalling. |
| k) ISO/IEC 12207 | Systems and Software engineering - software life cycle processes. |
| l) AS 61508 | Functional safety of electrical / electronic / programmable electronic safety-related systems. |
| m) AS7470 | Human Factors Integration in Engineering Design – General Requirements. |
- 1.4 Where appropriate, the Contractor must comply with following Departmental documents:
- | | |
|------------------------------|--|
| a) FR-SR-GE-002 | Integrated Safety Management System. |
| b) AM4-DOC-001217 | Systems Engineering Standard. |
| c) PTS-MU-10-EG-PRC-00000023 | Design Lifecycle Management. |
| d) PTS-MU-10-EG-PRC-00000016 | Design Decision Records Procedure. |
| e) PR-AM-GE-1013 | Rail Drawings Acceptance Procedure. |
| f) AM4-DOC-000364 | Drafting Standard for AutoCAD Drawings |
| g) AM4-DOC-000466 | Type Approval for Railway Products. |
| h) PR-AM-GE-807 | Development and Approval of Engineering Waivers. |
| i) FR-AM-GE-806 | Identification and Numbering of Technical Documents and Drawing. |
| j) PTS-MS-05-AM-PRC-00000091 | Asset Management Technical Data Requirements for Projects. |
| k) PC-RW10 | Railways Management Planning. |

- l) PC-RW50 Inspection, Testing and Commissioning.
- m) PC-RW60 Asset Management Handover.

2 Engineering and Design Management Plan

- 2.1 The Contractor must develop, implement, and comply with the Contractor's Project Engineering and Design Management Plan (CEDMP) for the management of the engineering and design activities for Railway Infrastructure in accordance with AM4-DOC-001217 Systems Engineering Standard.
- 2.2 . The CEDMP must provide details including, but not limited, to:
 - a) proposed engineering lifecycle;
 - b) engineering competency management system and approach to assessing and maintaining competency within the project team;
 - c) the application of value management activities through each design stage;
 - d) managing all design activities, including:
 - i) management and organisation of design personnel;
 - ii) Design Stage Review requirements, deliverables and meetings;
 - iii) process to generate innovation; and
 - iv) coordination and integration between different design disciplines.
 - e) the approach to ensuring alignment with Principal's personnel and any external rail operators;
 - f) application of both technical and construction integration / interface management activities to engineering and design management;
 - g) processes for capture and recording of design decision Records;
 - h) methodology for the development and update of a technical deliverables register in accordance with PC-RW60 "Asset Management Handover";
 - i) procedures for reliability, availability, maintainability and safety;
 - j) procedures for EMC hazard identification and control (where applicable);
 - k) roles, skills and competencies of the personnel undertaking design work;
 - l) roles, skills and competencies of the personnel preparing the construction specification;
 - m) management of Design Verification;
 - n) interfaces with the Design Program and work breakdown structure ("WBS");
 - o) management of Design Documents (refer Clause 8 "Document Control");
 - p) identifying and managing Hold Points during design activities;
 - q) Verification and Validation;
 - r) Operation Concept; and
 - s) Maintenance Concept,
- 2.3 The CEDMP may be part of an integrated management plan. The CEDMP is a Controlled Document (refer PC-QA1 "Quality Management Requirements"). Provision of the CEDMP must constitute a **Hold Point**.

3 Contractor's Design Obligations

- 3.1 The Contractor acknowledges that the development of the design to meet the requirements of this Contract is the sole responsibility of the Contractor. The Principal or Principal's Authorised Person have no obligations in respect of the development of the design.
- 3.2 Work under the Contract must be designed to meet the requirements of:

- a) this contract, including all standards, guidelines and codes referenced therein; and
 - b) any clarifications or interpretations of standards, codes and guidelines contained within the Contract.
- 3.3 Subject to any changes made during the development of the design to ensure compliance with this contract, the design of the Works and any temporary works shall be:
- a) generally as shown in the design submitted with the Contractor's tender; and
 - b) developed in a manner such that each stage of the design is consistent with, and a logical development of, the preceding version(s) of the design.

4 Design Program and Work Breakdown Structure

Program

- 4.1 The Contractor's Program must include a "Design Program." At a minimum, the Design Program must provide details of the following:
- a) design activities, which are correlated with the Contractor's work breakdown structure ("WBS") for each discrete element of the Works and the Temporary Work;
 - b) design coordination meetings;
 - c) time for the provision (in electronic and hard copy format) of the draft and Final Design Documents specified in the Contract Specific Requirements to the Principal (and any independent verifier and Proof Engineer where relevant) for comment / release of applicable Hold Point;
 - d) the Designer's inspection of the Site and the stage of design that the inspection will take place (refer Clause 11 "Inspection of Site");
 - e) float and the critical path of all design packages;
 - f) Design Verification and Road Safety Audits (if applicable); and
 - g) the time allowed for comments from the Principal for the time for the release of Hold Points.
- 4.2 The Design Program is a Controlled Document (refer PC-QA1 "Quality Management Requirements"). The Contractor must provide the Principal with a copy of any revised Design Program within 4 days of the revised Design Program being approved by the Contractor for implementation.
- 4.3 Provision of the Design Program must constitute a **Hold Point**.

Work Breakdown Structure

- 4.4 The Contractor must prepare a WBS which identifies the design of individual elements of the Works and the design disciplines associated with each individual element. The WBS must be commensurate with the complexity of the Works and be integral with the Design Program. The WBS is a Controlled Document (refer PC-QA1 "Quality Management Requirements"). If the WBS is revised, the revised WBS must be provided to the Principal with the revised Design Program. Additional requirements for the WBS may be included in the Contract Specific Requirements.
- 4.5 Provision of a Work Breakdown Structure must constitute a **Hold Point**.

5 Design Coordination

Design and Engineering Coordination Meetings

- 5.1 The Contractor must convene Design and Engineering coordination meetings to be held throughout the design and testing phase at intervals not exceeding 2 weeks or whenever requested by the Principal. The design and engineering coordination meetings must review the status and progress of the design / testing and the meeting must involve, as a minimum, representatives of the Contractor and the Principal.

- 5.2 The Contractor must prepare progress reports for presentation at the meeting. These must summarise:
- a) the progress and status of the design / testing, including any modifications to the preceding versions of the Design / Engineering Documents, Testing Documents and Controlled Documents;
 - b) how any previous comments from the Principal have been addressed;
 - c) progress against the Design / Engineering / Testing Program and any revisions to the Design / Testing Program;
 - d) discussions and unresolved issues; and
 - e) report on Design Review, Testing Review, Design / Testing Verification, Proof Engineering (where applicable) and ISA audits.
- 5.3 At each meeting, the Contractor must present an updated Design and Engineering Program and register of Design / Test Documents (refer Clause 8 "Document Control"). These must identify:
- a) all Design / Engineering / Test Documents which will be delivered in the forthcoming 28 days; and
 - b) all Design / Engineering / Test Documents which are expected to be delivered between weeks 5 and 8 from the date of the design and Engineering coordination meeting ("Look Ahead Program").
- 5.4 The Contractor must record meeting minutes and forward the minutes to all parties not later than 7 days after each meeting. If a party does not accept any aspect of the minutes as being a reasonable record of the meeting, that party must advise the other parties of the proposed changes required to be made in order to achieve a reasonable record of the meeting.
- 5.5 The minutes of the meeting are for information only. If, at a design and engineering coordination meeting, the parties agree upon an amendment to the Agreement or the Principal issues a direction, these must be separately documented and clearly identified as such.
- 5.6 If requested by the Principal, the Contractor must convene additional meetings and make available relevant Designers, Testers, and other project personnel to explain the documentation or to report on specific matters which the Principal reasonably requests.

Design / Engineering / Test Gated Reviews

- 5.7 The Contractor must convene and host a review ("Design / Engineering / Test Gated Reviews") with the Principal's key personnel at Gates 4A, 4B, 4C, 4D and 4E (or as specified in the Contract Specific Requirements) in accordance with PTS-MU-10-EG-PRC-00000023 Design Lifecycle Management.
- 5.8 These reviews are formalised assessments during the development of the design to ensure that deficiencies in regard to design principles and practices and project requirements are identified and corrected. The Contractor must present the design at the workshop to sufficient detail to verify that it has achieved the design intent. Changes to the design, with particular attention to the integration and interaction of the different design elements, must also be identified. All necessary documentation (including the Design / Engineering / Inspection & Test Procedures / Reports) must be provided to the Principal prior to the applicable Gated Review. Without affecting the Contractor's Obligations under this Contract, at each Gated Review, the Principal may:
- a) permit work to proceed;
 - b) permit work to proceed, provided that specified changes are implemented by the Contractor; or
 - c) prohibit work from proceeding until the documentation is revised and resubmitted.
- 5.9 The conduct of each Gated Review constitutes a **Hold Point**.

Review Comments Register

- 5.10 The Contractor must plan and implement procedures to capture, process and close out comments received from stakeholders during Design Stage Review processes. These must be logged on a register, and the Contractor must ensure all comments are successfully closed out.

- 5.11 The register of comments must be updated fortnightly and submitted at design and engineering coordination meetings. The register must be submitted with the progress reports at each gated review.
- 5.12 The Contractor's Design and engineering Management Plan must detail the process for the capture, processing and closed out of stakeholder comments throughout the gated review process.

Design Decision Records

- 5.13 The Contractor must plan and implement procedures to capture design decisions, consistent with the requirements of PTS-MU-10-EG-PRC-00000016 Design Decision Records Procedure

Contractor Proposed Alternative Approach

- 5.14 The Contractor may propose an alternative systems engineering based approach outside the requirements specified in this Part, provided that it demonstrates that the proposed approach aligns with the requirements of AS 15288 and PTS-MU-10-EG-PRC-00000023 Design Lifecycle Management.
- 5.15 Submission of a proposal for an alternative approach by the Principal constitutes a **Hold Point**.

6 Development of the Design and Design Documents

No Relief from Contractor's Obligations

- 6.1 The Contractor acknowledges and agrees that:
 - a) the development of the design, engineering and testing to meet the requirements of the CSTR is the sole responsibility of the Contractor;
 - b) except where specified otherwise in the CSTR, the Principal has no obligations in respect of the development of the design, engineering and Testing;
 - c) receipt of the Contractor's Documents by (or on behalf of) the Principal is solely for the purpose of monitoring the performance and progress of the Contractor;
 - d) the Principal owes no duty to the Contractor to review or examine any of the Contractor's Documents submitted by the Contractor for compliance with the CSTR or any applicable legislation; and
 - e) notwithstanding any review, comment, release of Hold Point, request for change, endorsement, approval, acceptance or deemed acceptance regarding any Contractor's Documents by (or on behalf of) the Principal:
 - i) the Contractor is not relieved of its responsibilities and obligations under the Contract; and
 - ii) the Principal has no liability whatsoever to the Contractor by reason of any errors, deficiencies or defects or omissions in any Contractor's Document.

Standard of Design

- 6.2 Subject to any changes made during the development of the design to ensure compliance with the CSTR, the design of the Works and any Temporary Works must be:
 - a) generally as shown in the design submitted with the Contractor's tender; and
 - b) developed in a manner such that each stage of the design is consistent with, and a logical development of, the preceding version(s) of the design.
- 6.3 The IFC Design must not be of a lesser standard than any preceding version of the design with regard to any of the following:
 - a) capacity;
 - b) durability;
 - c) aesthetics and visible features;

- d) whole of life performance;
 - e) operational and maintenance performance;
 - f) work health and safety;
 - g) rail safety;
 - h) system assurance;
 - i) security;
 - j) community amenity;
 - k) community benefits; and
 - l) user benefits.
- 6.4 If the Contractor considers that a requirement specified in the CSTR cannot be achieved, it must promptly advise the Principal and provide details of why that requirement cannot be achieved and the proposed alternative design solution.
- 6.5 Where more than one Designer prepares the design, the Contractor must ensure that there is consistency in design assumptions, design methodology, design modelling and details.

Design Provided by the Principal

- 6.6 If a design has been prepared by the Principal (Reference Design), the Contractor acknowledges that the Reference Design:
- a) has been prepared solely for project planning purposes;
 - b) has not been reviewed, checked or optimised for constructability or functionality;
 - c) has not been reviewed, checked or optimised for constructability;
 - d) may not comply with the requirements of the CSTR;
 - e) is provided for information only; and
 - f) does not form part of the Contract.
- 6.7 The Contractor may not place any reliance on a Reference Design or any aspect of the Reference Design and the use of any aspect of the Reference Design is entirely at the Contractor's own risk.

7 Design Verification and Validation / Requirements Management

- 7.1 The Contractor must develop a Project requirements analysis, allocation and traceability management (RAATM) register to capture, record, analyse and prioritise requirements, and manage changes to requirements, and maintain traceability to any Project Document, verification and validation results, and any modifications made during Project Activities.
- 7.2 The Project RAATM register can be prepared in any best practice requirement management tool, but must be readily compatible with IBM® Rational® DOORS® (DOORS®).
- 7.3 Provision of a RAATM at Gate Reviews (4A, 4B, 4C, 4D, and 4E) shall constitute a **Hold Point**.
- 7.4 The Contractor must:
- a) prepare and maintain a System Requirements Specification (SRS) which incorporates the requirements of the Business Requirement Specification (BRS), the CSTR / PSTr, and addresses the system architecture;
 - b) develop and maintain a system architecture;
 - c) allocate requirements to subsystem elements as identified in the system architecture;
 - d) prepare and maintain an interface requirements specification identifying interface requirements for all major subsystems and external interfaces;

- e) maintain traceability between the BRS, the SRS, subsystem elements, safety requirements, design outputs, verification and validation activities, integration Tests and operational readiness activities and outcomes, and functional responsibilities;
 - f) maintain traceability between subsystem elements and work packages allocated to subcontractors; and
 - g) provide reporting on requirements performance in a format as agreed by the Rail Commissioner.
- 7.5 The RAATM register must include the requirements derived from section “Project Safety Requirements.”
- 7.6 The Contractor must produce, as a subset of the requirements and traceability register, an engineering assurance register.
- 7.7 The engineering assurance register must include as a minimum:
- a) unique identifiers for each system and interface requirement;
 - b) system requirements, including those requirements originating from safety controls identified by the Contractor in the project safety hazard log;
 - c) a reference to the source of the requirement;
 - d) other references as appropriate including project safety hazard log references;
 - e) an attribute identifying the type of requirement including:
 - i) safety requirements;
 - ii) interface requirements including human factors and systems; and
 - iii) RAM requirements.
 - f) systems assumptions, dependencies and constraints (ADCs) for integration;
 - g) obsolescence status as a requirement for software and equipment;
 - h) safety critical systems and components as identified by FMECA;
 - i) references to the justification of safety requirements, where these have been allocated;
 - j) subsystem elements that satisfy a particular system requirement, with a link to subsystem requirements or specification document reference, as appropriate;
 - k) a description of how each requirement will be verified;
 - l) work package reference;
 - m) design documentation reference;
 - n) independent professional review;
 - o) the Independent Reviewer's comments on design documentation;
 - p) the Contractor's response to Independent Reviewer's comments on design documentation;
 - q) accreditation reviews and comments;
 - r) inspection and test plan references; and
 - s) reference to verification and validation status including the assurance documentation management plan.
- 7.8 The Contractor must maintain traceability between safety requirements in the requirements and traceability register and the project safety hazard log.
- 7.9 The Contractor must demonstrate that system and interface requirements are known and implemented by all design and other groups on the Project including sub-contractor's systems and safety assurance of the Works.

8 Document Control

- 8.1 Further to Clause 8.3.4 "Design and development controls" of AS 9001, the Contractor's Quality Management System must effectively and efficiently manage and control all Design Documents to ensure, at a minimum:
- a) all Design Documents include the correct title information, revision, date of documentation and status;
 - b) all Design Documents to be included/incorporated within existing layout plans and cut lines
 - c) all personnel have access to, and are working from Design Documents that are the correct status and most recent revision; and
 - d) the Principal and any independent verifier are advised of design changes.
- 8.2 The Contractor must implement and maintain a register of Design Documents which;
- a) enables the Design Documents to be searched by title and other key attributes;
 - b) identifies all superseded, revised, current and planned Design Documents; and
 - c) is accessible by the Principal and any independent verifier.
- 8.3 All Design Documents must be numbered and identified in accordance with a numbering system provided by the Principal. In addition to the provision of hard copies, Design Documents must be transmitted electronically through any IMS provided by the Principal or otherwise agreed between the parties.

9 Document Controller

- 9.1 The Contractor must engage a lead document controller who:
- a) is appropriately qualified and possesses a demonstrated understanding of the principles and practices of document control on major construction projects;
 - b) has at least 5 years previous experience in document control on projects of similar nature, size and complexity using electronic IMS;
 - c) if required, lead and manage other document controllers;
 - d) audits the meta-data within the IMS at least monthly to ensure that the IMS meta-data is being entered accurately, consistently and in accordance with the Principal's requirements; and
 - e) remains dedicated to the role until all documents have been provided to the Principal in accordance with PC-RW60 "Asset Management Handover".

10 The Contractor's Documents

Design Reports

- 10.1 The Contractor must prepare a "Design Basis Report" which includes:
- a) any interpretations, clarifications or assumptions made in relation to the CSTR;
 - b) all technical standards, references, material properties, durability, performance requirements, design loadings and design lives used for the design; and
 - c) design methodology / rationale and design software.
- 10.2 The Contractor must prepare Design Report(s) for each technical discipline described in a Part of the CSTR. A Design Report is a summary of design work undertaken to date and at a minimum, each Design Report must provide details of the following:
- a) identification of the stage of completion that the report describes (e.g. Notional 70% Design);
 - b) identification of each construction package that the report relates to;
 - c) the applicable Part / Clauses / technical discipline in the CSTR that the work relates to;

- d) all relevant analysis and calculations for the Works and Temporary Work;
 - e) the information which has been specified in each applicable Part of the CSTR to be included in the reports (refer to the Clause "Records" in each Part);
 - f) summary of Hold Points released;
 - g) requirements for land acquisition, special access or clearance from property boundaries;
 - h) summary of any changes to the design since the previous issues of the design report;
 - i) evidence of any required approvals;
 - j) proposed maintenance regime;
 - k) outline of the documentation that will be prepared for the operation / maintenance of the Works;
 - l) any processes / procedures for commissioning of the Works; and
 - m) discussion regarding compatibility of the design with future expansion of the infrastructure.
- 10.3 The level of detail included in the draft Design Reports must be commensurate with the percentage completion of the design. The Design Basis Report may be included in the Design Report.

Inspection, Maintenance and Operations Documentation

- 10.4 The Contractor must prepare technical maintenance plans (TMPs), instructions / procedures describing the inspection and maintenance (and operations where appropriate) that the Principal will be required to undertake to ensure that the performance, functionality and durability of the Works do not deteriorate.

11 Provision of the Design Documents to the Principal

Submission of Design Documents

- 11.1 The Contractor must:
- a) forward the Design Documents to the Principal progressively and in a manner that does not result in an unreasonable number of Design Documents being submitted in any given week;
 - b) provide a Design Document to the Principal within 5 working days of a request from the Principal to view the current draft of that document; and
 - c) provide the Principal with a Design Document when that document reaches each stage specified in the Contract Specific Requirements "Provision of Design Documents" in the formats in accordance with PC-RW60 "Asset Management Handover".
- 11.2 If requested by the Principal, in addition to the electronic copies, the Contractor must provide paper copies of the drawings (One set at A1 and up to 4 sets at A3) and Design Reports (up to 4 bound copies).
- 11.3 The CSTR may specify other stages of completion, in addition to those specified in the Contract Specific Requirements, when a particular Design Document must be forwarded to the Principal.
- 11.4 Provision of the draft Design Documents at the stages specified in the Contract Specific Requirements must constitute a **Hold Point**.
- 11.5 The Contractor acknowledges that:
- a) receipt of Design Documents by (or on behalf of) the Principal is solely for the purpose of monitoring the performance and progress of the Contractor;
 - b) the Principal owes no duty to the Contractor to review or examine any of the Design Documents submitted by the Contractor for compliance with the Contract or any applicable legislation; and
 - c) notwithstanding any review, comment, release of Hold Point, request for change, endorsement, approval, acceptance or deemed acceptance regarding any Design Documents by (or on behalf of) the Principal:
 - i) the Contractor is not relieved of its responsibilities and obligations under the Contract; and

- ii) the Principal has no liability whatsoever to the Contractor by reason of any errors, deficiencies or defects or omissions in any Design Documents which has been prepared by the Contractor.

Notionally 70% Complete Design Documents

- 11.6 Notionally 70% complete Design Documents must be sufficiently detailed to demonstrate that the design will meet the requirements of the CSTR.

Final Design Documents

- 11.7 The Final Design Documents must be sufficiently detailed to enable construction to take place without further explanation or clarification from the Designer.
- 11.8 The Contractor must provide to the Principal copies of the Final Design Documents (and any applicable verification certificates required under the Contract) relevant to an element of work at least 10 working days prior to construction commencing on that element of work.
- 11.9 Provision of the Final Design Documents must constitute a **Hold Point** ("Final Design Hold Point").

Issued for Construction ("IFC") Documents

- 11.10 Following release of the Final Design Hold Point, the Contractor must:
- a) identify the relevant Design Documents as IFC Documents, Revision 0;
 - b) provide the Principal with the number of electronic and paper copies of the IFC Documents specified in Clause 10; and
 - c) construct the Works in accordance with the IFC Documents.

Changes to IFC Documents

- 11.11 After the release of the applicable Final Design Hold Point, any proposal by the Contractor to change the Works from that shown on an IFC Design Document or modify an IFC Document is deemed to be a request for a Variation for the Contractor's convenience and is subject to the prior approval of the Designer and the Principal.

As Built Drawings

- 11.12 The Contractor must prepare As Built Drawings for all of the Works, regardless of whether the actual construction varies from that shown on the IFC Drawings. As Built Drawings must be identified in the Amendment Block.
- 11.13 Whenever the Works are constructed at variance with the IFC drawings, within 3 working days of the varied work commencing the Contractor must notify the Principal of the extent of varied work and provide the relevant As Built Drawings within 4 weeks of the varied work being completed. All other As Built Drawings must be provided to the Principal in accordance with PC-RW60 "Asset Management Handover".

Inspection, Maintenance and Operations Documentation

- 11.14 Draft and final inspection, maintenance, and operations procedures must be submitted to the Principal in accordance with PC-RW60 "Asset Management Handover".

Traffic Control Drawings

- 11.15 This sub-clause only applies where traffic control devices will be installed.
- 11.16 At least 14 days prior to the installation of any permanent or semi-permanent Traffic Control Devices, the Contractor must provide the applicable Traffic Control Drawings to enable the Principal to obtain approval for the devices.
- 11.17 Provision of the Traffic Control Drawings shall constitute a **Hold Point**.

Inspection and Certification

Inspection of Site

- 11.18 As soon as practicable (and in no case after the completion of notionally 30% of the design), the Designer, or a competent representative of the Designer, must undertake a field inspection of the entire Site to verify that the design takes into account all physical features that would be reasonably apparent during a field inspection. The Designer must prepare a "Site Assessment Report" describing the scope of the inspection and any issues that require attention identified as a result of the inspection
- 11.19 Provision of the Site Assessment Report shall constitute a **Hold Point**.

Inspection of Works

- 11.20 The Contractor must ensure that the Designer inspects the Works or relevant parts thereof when so required by the Contractor or by the Principal. If requested by the Principal, whenever the Designer is requested to inspect the Works, the Contractor must obtain from the Designer a certificate stating that:
- a) the Designer has inspected the Works or relevant parts thereof; and
 - b) any relevant assumption relating to the actual site conditions that the design was based on (e.g. geotechnical conditions) remains valid.
- 11.21 The Contractor must provide the certificate to the Principal within 5 Business Days of the Designer inspecting the Works.

Design Certification

- 11.22 The Contractor must ensure that certificates of compliance for all of the Works are prepared and submitted to the Principal which:
- a) certify that the Design Documents comply with the requirements of this Contract;
 - b) are forwarded to the Principal within 5 Business Days of completion of the verification and at least 5 Business Days prior to the commencement of construction that part of the works which is the subject of the certificate;
 - c) are signed by authorised representatives of the Contractor and the Designer;
 - d) are in accordance with the form specified in the Contract Specific Requirements; and
 - e) unless agreed otherwise with the Principal, are not qualified in any way which would lessen the effect of the certificate.

12 ICT and Software Systems Management

- 12.1 The Contractor must develop, implement and maintain an ICT and Software Systems Management Plan which identifies the procedures, processes and management systems for all ICT and software.
- 12.2 The ICT and Software Systems Management Plan must:
- a) document the software engineering processes adopted as part of the Contractors systems engineering framework with specific treatment of the software implementation process in accordance with ISO/IEC 12207 (2008) Systems and Software engineering - software life cycle processes;
 - b) include a detailed description of the processes to identify and manage all safety critical items and reliability critical items for ICT and software; and
 - c) include a detailed description of the SIL derivation process for ICT and software, with reference to AS 61508 Functional safety of electrical / electronic / programmable electronic safety-related systems, along with the Contractor's method of internal approval of the derived SILs.
- 12.3 The provision of a Software Plan constitutes a **Hold Point**

- 12.4 The ICT and Software Systems Management Plan must clearly describe the Contractor's strategy for actively managing all ICT and software systems including equipment and components over the term.
- 12.5 The ICT and Software Systems Management Plan must address the processes, methods, and standards, which are applied to ICT and software systems including:
- a) requirement analysis, functional allocation, architecting and design;
 - b) testing and acceptance strategies including test cases and pass / fail criteria;
 - c) software quality assurance;
 - d) software security, including user access policies;
 - e) procurement and development;
 - f) integration and testing including hardware unit testing, software unit testing and hardware and software integration testing;
 - g) deployment to operation and acceptance;
 - h) ongoing operational support, including support subsystems;
 - i) change and defect management;
 - j) maintenance, scheduled, reactive and preventative;
 - k) enhancement; and
 - l) transition:
 - i) to a major new version;
 - ii) to a new infrastructure base; and
 - iii) through replacement by a different software system.
- 12.6 The ICT and Software Systems Management Plan must identify key ICT and software design personnel responsible for implementing the ICT and Software Systems Management Plan. Key ICT and software design personnel must be tertiary educated and experienced in the use of structured, analytical software engineering methods.
- 12.7 The Contractor must develop and deliver software documentation that provides sufficient detail to enable the software to be supported and maintained throughout the planned life of the Project. For all software developed or significantly modified for the Project, this must include:
- a) software detail design documentation;
 - b) software product technical specification, including source code and details of the software development environment;
 - c) identification and designation of all safety-critical software systems; and
 - d) software integrity test results.

13 Human Factors

- 13.1 Human factors principles and processes adopted by The Contractor must be documented and meet the requirements of AS7470:2016 Human Factors Integration in Engineering Design – General Requirements.
- 13.2 The Contractor must identify all human factors risks associated with the Project Activities, ensuring integration with safety and design reviews.
- 13.3 The Contractor must establish and maintain a Human Factors Issue Register (HFIR).
- 13.4 The Contractor must record all identified human factors issues in the HFIR and the management of controls required to comply with the Design Requirements within a Human Factors Integration Plan (HFIP).
- 13.5 The provision of a Human Factors Integration Plan constitutes a **Hold Point**

- 13.6 The human factors integration plan at a minimum will cover all phases of the Asset life cycle and ensure the design requirements around:
- a) integration with safety requirements;
 - b) human reliability analysis;
 - c) human-system interface assessment;
 - d) risk based training needs assessment; and
 - e) consideration of normal and degraded operations.
- 13.7 The Contractor must establish a Human Factors Integration process to maximise effectiveness and efficiency by full consideration of the human contribution to system performance. The objectives of Human Factors Integration activities are:
- a) reduce the likelihood and severity of accidents resulting from human behaviour;
 - b) identify the influence human factors may have on a particular project before starting development or construction;
 - c) identify and understand the user population and their physical and cognitive needs;
 - d) reduce the need to redesign at a later stage to accommodate user requirements and limitations which were not identified at the outset;
 - e) develop a product or system that “fits” the user population and the objectives of the organisation (increasing user and customer acceptance of the system);
 - f) save money and time by removing the need to redesign and shortening the process of regulatory acceptance;
 - g) reduce health and safety costs by designing out conditions that may cause harm to users; and
 - h) improve recruitment and retention by improving the working environment and fitting the task to the user.
- 13.8 The Contractor must develop, implement and maintain a Human Factors Integration Plan (HFIP) in accordance with the Rail Commissioner’s safety management requirements that identifies how the contractor will comply with human factors requirements for Project Activities.
- 13.9 The Human Factors Integration Plan must cover all Project Activities and as a minimum consider:
- a) cognitive ergonomics;
 - b) human reliability analysis;
 - c) human-system interface assessment;
 - d) risk based training needs assessment;
 - e) normal and degraded operations; and
 - f) Human Factors risk register.

14 Reliability, Availability and Maintainability

- 14.1 The Contractor must establish a Reliability, Availability and Maintainability (RAM) analysis framework which must be based on EN50126 for the planning, delivery and operation of the assets, infrastructure and services for the Project.
- 14.2 The Contractors RAM process must be defined and detailed in the Reliability, Availability and Maintainability Plan.
- 14.3 The provision of the Contractors RAM Plan constitutes a **Hold Point**.
- 14.4 The Contractor must minimise single point failures in Assets and operational procedures.
- 14.5 The RAM analysis process must include functional analysis and failure modes, effects and criticality analysis for all systems, equipment and components that could contribute to Rail Commissioner’s ability to meet the service requirements.

- 14.6 The RAM analysis conducted by the Contractor must take into account all potential factors that might affect the Services, including those which may be beyond the control of Rail Commissioner.
- 14.7 The Contractor must conduct RAM analyses at Relevant Asset and Spares level to demonstrate that the performance requirements can be achieved.
- 14.8 The Contractor must develop a RAM assurance process with reviews that are aligned with the Design, Engineering and Testing Plan(s) and integrated with the requirements management processes.
- 14.9 The Contractor must apportion RAM performance targets to Asset Categories and operational processes and during each of the design stages and documented in a RAM analysis report.
- 14.10 The sources of all data used by the Contractor in RAM analyses must be identified and justified as being applicable to the Project.
- 14.11 For the Contractor's Activities, RAM assurance statements and RAM assurance reports must be developed, updated and submitted as requested by the Rail Commissioner on a progressive basis in order to demonstrate progressive RAM assurance.
- 14.12 During testing and commissioning, then continuing into the delivery and operations phase, the Contractor is to implement and manage a failure review and corrective action system (FRACAS). The FRACAS must:
- a) be integrated into the Asset Information System (AIS);
 - b) include a best practice Root Cause Analysis (RCA) process;
 - c) record all failures and problems related to a product or process;
 - d) failure analysis; and
 - e) corrective actions.
- 14.13 The management of RAM requirements must be documented within a RAM Plan with linkage to the Design & System Engineering Management Plan and the Asset Management Plan.
- 14.14 The Contractor must develop, implement and maintain a RAM Plan which meets the requirements of EN50126.
- 14.15 The RAM Plan must document the RAM assurance process encompassing the whole Project lifecycle with reviews that are aligned with the design management plan and integrated with the requirements management processes.
- 14.16 The RAM Plan must set out the apportion RAM process for performance targets to Asset Categories and operational processes to be captured in the RAM analysis Report(s).

15 Hold Points

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

Document Ref.	Hold Point	Response Time
2.2	Preliminary Contractor's Engineering and Design Management Plan	10 working days prior to 4A
2.2	Final Contractor's Engineering and Design Management Plan	10 working days prior to 4B
4.3	Design Program	10 working days prior to 4A
4.5	Work Breakdown Structure	10 working days prior to 4A
5.9	Gated Reviews	4A, 4B, 4C, 4D, 4E
5.15	Proposed Alternative Approach to Systems Engineering	As appropriate
7.3	RAATM	4A, 4B, 4C, 4D, 4E
11.4	Draft Design Documents	10 working days prior to 4A
11.9	Final Design Documents	10 working days prior to 4B
11.17	Traffic Control Drawings	As appropriate
11.19	Site Assessment Report	As appropriate
12.3	Software Plan	10 working days prior to 4A

Document Ref.	Hold Point	Response Time
13.5	Human Factors Integration Plan	10 working days prior to 4A
14.3	Reliability, Availability and Maintainability (RAM) Plan	10 working days prior to 4A

16 Records

- 16.1 The Contractor must develop, maintain, and supply all records as necessary to provide evidence of compliance with the requirements of this Part in accordance with the requirements of PC-RW60 "Asset Management Handover".
-