

## PART D11 ENGINEERING AND DESIGN MANAGEMENT – RAILWAYS

### CONTENTS

1. GENERAL
2. THE CONTRACTOR'S OBLIGATIONS
3. CONTRACTOR'S MANAGEMENT PLANS
4. ENGINEERING AND DESIGN MANAGEMENT PLAN
5. REQUIREMENTS MANAGEMENT
6. CONFIGURATION MANAGEMENT
7. THE CONTRACTOR'S DOCUMENTS
8. DESIGN COORDINATION
9. SYSTEM SAFETY ENGINEERING
10. PROVISION OF CONTRACTOR'S DOCUMENTS TO THE PRINCIPAL
11. HOLD POINTS
12. RECORDS

### 1. GENERAL

This part specifies the requirements for the management of the Contractor's engineering and design activities for Railway Infrastructure. These are in addition to the general design management requirements specified in Part D10.

The Contractor must comply with:

AS 4292:	Railway Safety Management
AS 10007:	Quality Management Systems – Guidelines for Configuration Management.
AS 15288:	Systems Engineering – System Lifecycle Process
EN 50126	Railway Applications—Specification and demonstration of reliability, availability, maintainability and safety (RAMS)

Where appropriate, the Contractor must comply with following DPTI documents:

FR-SR-GE-002	PTSOM Integrated Safety Management System
PTS-MU-10-EGPLN-00000017	PTSOM Systems Engineering Management Plan
PTS-MU-10-EG-PRC-00000016	Design Decisions Records Procedure ("PTS 16")
PTS-MU-10-EG-PRC-00000023	Design Lifecycle Management ("PTS 23")
PTS-MS-05-DC-PRC-00000061	Rail Asset Management Technical Data (Documents and Drawings) Acceptance Procedure ("PTS 61")
PTS-MS-05-DC-PRC-00000090	Identification and Numbering of Technical Documents and Drawings ("PTS 90")
PTS-MS-05-AM-PRC-00000091	Asset Management Technical Data Requirements for Projects ("PTS 91")
PTS-MS-10-EG- PRC-00000032	Approval of Technical Standards and Waivers Procedure ("PTS 32")
PTS-AR-03-EG- PRC-00000048	Assessment of Competency for Members of the Rail Engineering Team Procedure ("PTS 48")
PTS-AR-10-EG- PRC-00200220	Procedure for Management of Engineering Requirements for Rail Projects ("PTS 220")
PTS-AR-10-EG- PRC-00203000	Obtaining Type Approval for Safety Critical Rail Assets Procedure ("PTS 00")
PTS-AR-PW-PM-PLN-00110004	Human Factors Management Plan (HFMP) ("PTS 04")

The definitions in this Part apply to Railway Infrastructure only.

**"Configuration Management"** means the process for establishing and maintaining consistency of a product's performance, functional and physical attributes with its requirements, design and operational information throughout its life.

**"Design Stage Review"** (refer PTS 23) means a formal review of the design which is undertaken when the design has progressed to a specified stage of completion and includes:

**Requirements Definition** (notionally 15% complete);

**Preliminary Design Stage** (notionally 30% complete);

**Detailed Design Stage** (notionally 70% complete);

**Final Design Stage** (complete, except for release of final Hold Point); and

**Engineering Completion Review** (all work complete which is necessary for the rail system to be operated for its normal purpose).

“**Engineering Authority**” means the authority to approve a document for implementation pursuant to Schedule 1, Clause 4 (2) of the *Rail Safety National Law National Regulations*.

“**ISA**” means Independent Safety Assessor;

“**SFAIRP**” has the meaning described in the National Rail Safety Guideline - Meaning of Duty to Ensure Safety *So Far As Is Reasonably Practicable*.

“**Rail Safety Justification**” is a comprehensive and structured argument, supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given operating environment. Also may be referred to as Assurance Argument or Safety Case.

## **2. THE CONTRACTOR’S OBLIGATIONS**

The Contractor must:

- (a) implement a systems engineering approach to the management of engineering and design activities in accordance with AS 15288;
- (b) comply with the applicable requirements of the PTS procedures and plans relevant to the engineering and design activities;
- (c) provide a coordinated and integrated design;
- (d) provide all necessary documentation required demonstrate safe operation of the Railway Infrastructure and to obtain Engineering Authority;
- (e) provide the Contractor’s Documents to the Principal in a manner which enables the Engineering Authority approval to be obtained before implementation; and
- (f) provide reasonable assistance and support to the Principal’s personnel to enable the Rail Commissioner to maintain its accreditation in respect of the changes to the AMPRN resulting from this Contract.

In regard to any equipment installed for Railway Infrastructure, the Contractor must ensure that:

- (a) system integration is achieved for the new equipment;
- (b) system integration with existing systems installed on the AMPRN is achieved for new equipment;
- (c) the equipment has no detrimental effect on neighbouring equipment or systems to the railway; and
- (d) the equipment is not affected by neighbouring equipment or systems to the railway.

## **3. CONTRACTOR’S MANAGEMENT PLANS**

The Contractor must prepare and comply with an integrated suite of management plans which cover all planning, design, construction and handover requirements under this Contract, including:

- (a) Quality (Part G20);
- (b) Inspection and Test / Commissioning (Parts G20, CH91);
- (c) Risk (Part G25);
- (d) Safety (including Interfaces, Human Factors) (Part G40);
- (e) Railway Corridor Access (Part G45)
- (f) Environmental (Part G50);
- (g) Design (Part D10)
- (h) Railway Engineering and Design Management (Part D11)
- (i) Configuration Management (Part D11)
- (j) Verification / Validation (Part D12)
- (k) Training (Part CH92); and
- (l) Assets (Part CH93);

#### **4. ENGINEERING AND DESIGN MANAGEMENT PLAN**

In addition to the requirements of Clause D10.2 “Design Management Plan”, the Contractor must prepare and comply with the Contractor’s Engineering and Design Management Plan (CEDMP) for the management of the engineering and design activities for Railway Infrastructure. Unless covered in other management plans, the CEDMP must provide details of (at a minimum):

- (a) proposed engineering lifecycle;
- (b) the application of value management activities through each design stage;
- (c) Design Stage Review requirements, deliverables and meetings,
- (d) the approach to ensuring alignment with PTS personnel and any external rail operators;
- (e) application of both technical and construction integration/interface management activities to engineering and design management;
- (f) processes for capture and recording of design decision Records;
- (g) methodology for the development and update of a technical deliverables register;
- (h) procedures for reliability, availability, maintainability and safety; and
- (i) procedures for EMC hazard identification and control (where applicable).

The CEDMP is a Controlled Document (refer Part G20 “Quality System Requirements”). Provision of the CEDMP and any revision to the CEDMP shall constitute a **HOLD POINT**.

#### **5. REQUIREMENTS MANAGEMENT**

The Contractor must ensure that all specified Rail Infrastructure requirements are documented, analysed, prioritised and traced during the Contract. If not already provided for in the Contractor’s Quality Management System, the Contractor must implement a commercially available requirements management tool and provide all outputs to the Principal. At a minimum, the Requirements model must include:

- (a) structure of the model;
- (b) attributes to be defined for each requirement;
- (c) requirements document sets to be delivered to the Principal’s Authorised Person (as a minimum this shall include Principle and System Requirements documents); and
- (d) strategy for partitioning and ownership of requirements for delivery.

#### **6. CONFIGURATION MANAGEMENT**

The Contractor must develop and comply with a Configuration Management Plan (CMP), which demonstrates the Contractor’s effective control of documentation and information and the management of baselines and change. Configuration management must generally be undertaken in accordance with AS 10007 Quality Management Systems – Guidelines for Configuration Management. At a minimum the CMP must provide details of the following;

- (a) document control, (refer to Part G20 Quality Systems Requirements);
- (b) any configuration tool to be employed;
- (c) baselines for all deliverables;
- (d) management of change, including:
  - (i) how changes are fully identified, described and documented in a change register;
  - (ii) identification of all parties impacted by engineering change;
  - (iii) the roles and responsibilities of staff;
  - (iv) the impacts on safety that may arise from the change;
  - (v) details of the proposed defined process for dealing with changes of different classification and to ensure conformity with the Contract, legislation, accepted codes and standards; and
  - (vi) details of the impacts of any proposed changes on the Principal’s employees and third parties; and
- (e) configuration coding (asset coding);
- (f) how change will be managed during the project life cycle; and
- (g) Conformance with the requirements specified in the following documents:
  - (i) PTS 23
  - (ii) PTS 61
  - (iii) PTS 90
  - (iv) PTS 91.

## **7. THE CONTRACTOR'S DOCUMENTS**

### **7.1. Requirements Definition Report**

The Contractor must prepare a Requirements Definition Report, which summarises the sources of requirements that the Contractor must comply with. These sources include:

- (a) this Contract;
- (b) review of existing operating manuals, documents, rule books;
- (c) Australian and international standards;
- (d) validation with other comparable rail systems;
- (e) Preliminary Hazard Analysis;
- (f) Preliminary Safety Case; and
- (g) stakeholder input, including the training, operations, maintenance, and asset management functions.

### **7.2. System Requirements Specification**

The Contractor must prepare:

- (a) a Design Basis Report (refer Clause D10.7.2) for the Rail Infrastructure; and
- (b) a System Requirements Specification (SRS) in response to the Design Basis Report.

The Contractor warrants that the SRS will result in a standard, performance and durability not less than that which would be achieved using the Technical Specification and Operational and Performance Requirements included in the CSTR. Compliance with the requirements of the Contractor's SRS does not relieve the Contractor of the obligation to comply with any other requirement of the Contract.

The submission of the System Requirements Specification (SRS) shall constitute a **HOLD POINT**

### **7.3. Application Specific Architecture (ASA)**

The Contractor must produce the Application Specific Architecture (ASA) for the AMPRN system, including any sub-architecture required to support implementation stage works (e.g. temporary fringe interfaces, temporary control system interfaces, signalling plans, control tables etc).

The ASA must be detailed down to:

- (a) Individual field equipment item level (points, train detection, repeater; signals, etc.);
- (b) The number of items of major equipment, including: object controllers, interlockings, communications nodes, train control servers etc;
- (c) The physical location of all equipment; and
- (d) All interfaces.

The Contractor must complete RAMS and performance modelling based on the ASA to verify the System meets its performance requirements.

The Contractor must implement those elements of the V&V Plan required to demonstrate the final system design is safe, mitigates risk SFARP and meets all performance and functional requirements, including a traceability report from the Requirements Management Tool.

### **7.4. Overall System Design**

The Contractor must produce the Overall System Design that describes the system down to generic sub-system levels and defines all interfaces external to that system.

The Overall System Design must include:

- (c) a generic system architecture showing the context of the system and the interfaces between the various sub-systems;
- (d) sub-system descriptions that provide identification of the proprietary, Commercial Off The Shelf (COTS) and bespoke equipment that are used for each sub-system. The information provided must be sufficient to support Product Acceptance of generic products;
- (e) Interface Control Documents for the major sub-systems;

- (f) Interface Control Documents for all 3rd party interfaces; and
- (g) Contractor's Signalling Principles, including ATP Principles that take into account the functionality that has been derived from the SRS.

### 7.5. **Design Reports**

In addition to the requirements of Clause D10.7 "The Design Documents", the Design Reports for Rail Infrastructure must summarise:

- (a) risks to successful delivery against time, cost and quality benchmarks;
- (b) review comments register;
- (c) design change register;
- (d) discussions and unresolved issues;
- (e) the status of any type approval for Safety Critical Rail Assets;
- (f) details of any engineering waivers obtained;
- (g) deliverables register;
- (h) Safety Assurance and System Engineering activities;
- (i) the status of Asset Management Technical Data;
- (j) technical Interface management; and
- (k) report on Design Stage Review and, Independent Verification / Proof Engineering.
- (l) evidence that all relevant performance requirements including constructability, maintenance and operations requirements have been met and integrated into the Design Documents;
- (m) evidence that all applicable design elements have been integrated into the Design Documents;
- (n) integration of different design elements;
- (o) Integrated Support Plan;
- (p) any other specific issues or design decisions related to the project, and
- (q) commissioning of the asset.

## 8. **DESIGN COORDINATION**

### 8.1. **Design Stages and Design Stage Reviews**

PTS 23 specifies the requirements for the management of changes to the AMPRN.

The Contractor must convene and host a review ("Design Stage Review") with the Principal's key personnel in accordance with PTS 23 at the completion of the following Design Stages:

- (a) Requirements Definition (notionally 15% complete)
- (b) Preliminary Design (notionally 30% complete)
- (c) Detailed Design (notionally 70% complete)
- (d) Final Design; and (notionally 100% complete)
- (e) Engineering Completion (at the completion of the construction of the Works but prior to commissioning of the Works).

All necessary documentation (including the Design Reports) must be provided to the Principal prior to the applicable Design Stage Review. Without affecting the Contractor's Obligations under this Contract, at each Design Stage 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.

The conduct of each Design Stage Review constitutes a **HOLD POINT**.

### 8.2. **Review Comments Register**

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.

The register must be updated fortnightly, and reviewed at design review meetings. The register must be submitted as a deliverable along with the Stage Design Report at each Design Stage Review.

The Contractor's Engineering and Design Management Plan must detail the processes for the capture, processing and close out of stakeholder comments through design review.

### **8.3. Design Decision Records**

The Contractor must plan and implement procedures to capture design decisions, consistent with the requirements of PTS 16.

### **8.4. Contractor Proposed Alternative Approach**

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 4292 and PTS 23. Submission of a proposal for an alternative approach by the Principal constitutes a **HOLD POINT**.

## **9. SYSTEM SAFETY ENGINEERING**

### **9.1. General**

This Clause is in addition to the requirements specified in Part D16 Safety in Design.

The Contractor must:

- (a) ensure that safety principles are considered throughout the design process so that hazards are identified, analysed and treated to eliminate or minimise risks SFAIRP;
- (b) ensure its design procedures have due regard for the requirements of the documents listed in Clause 1 "General" and, where appropriate, comply with any guideline established by the Rail Commissioner;
- (c) adopt a suitable model for safety engineering that is proven and accepted in the Rail industry, such as the guidance provided by Engineering Safety Management - UK Yellow Book Edition 3 (Yellow Book) or EN 50126, EN 50128 and EN 50129;
- (d) ensure the Risk Management Plan includes the identification, analysis, evaluation and treatment of safety risks, that relate to the construction, operation and maintenance of the Works;
- (e) prepare all records and other documentation required to enable the Commissioner to obtain accreditation from the National Rail Safety Regulator for the Works; and
- (f) have a documented Safety in Design procedure which outlines the Contractor's process for managing design implications in demolition, construction, operations and maintenance of the Works through each design stage.
- (g) have a clearly defined process to accept residual Hazards (including supporting documentation) from works undertaken by the Principal including Third Party Services relocation and include those items in their approach to System Integration and Rail Safety Justification.

### **9.2. Accreditation with the National Rail Safety Regulator**

The Contractor must prepare a Rail Safety Justification (Safety Assurance Argument) which demonstrates that the hazards introduced by the work under the Contract have been mitigated SFAIRP and is suitable for submission to the National Rail Safety Regulator to obtain accreditation for the Works.

The Contractor must provide reasonable assistance and cooperation with the Commissioner's personnel regarding the preparation of a submission for accreditation from the National Rail Safety Regulator.

The Rail Safety Justification must include relevant information necessary to satisfy the National Rail Safety Regulator in regard to:

- (a) definition of the systems delivered or modified as part of the Works;
- (b) change impact assessment;
- (c) safety;
- (d) quality;

- (e) commissioning;
- (f) validation;
- (g) interfaces; and
- (h) any other information reasonably requested by the Principal, or as required by the Rail Commissioner's guideline.

**9.3. Independent Safety Assessor**

The Contractor must engage an ISA to:

- (a) provide an independent professional review of the Contractor's safety systems and activities;
- (b) independently verify the Contractor's Systems & Safety Assurance Plan;
- (c) independently verify the safety deliverables for technical quality and suitability; and
- (d) independently verify the Safety Argument ahead of each milestone submission as the basis of providing a suitable and robust demonstration/defence of the safety being achieved.

The ISA is subject the prior approval of the Principal prior approval, which must not be unreasonably withheld.

Within the Safety Management Plan, the Contractor must include the ISA arrangements, the ISA assessment activities, the ISA's proposed interactions with the Contractor and the ISA's deliverables to the Principal.

The ISA must:

- (a) at all times, be independent of any commercial, financial or other conflicts with any party to this contract;
- (b) ensure that there is a balance of direct evidence (for instance, from assessment of evidence obtained from analysis, test or review) and indirect evidence (for instance, from checking the definition and compliance to processes for risk assessment, development; and
- (c) ensure that all parties are informed of any safety issues arising.

**9.4. Safety Assurance Argument**

The Contractor must prepare a Safety Argument in a Goal Structuring Notation (GSN) format approved by the Principal that demonstrates the safety of each Operable Stage, Section and of the final System.

The primary purpose of the goal structure is to show how goals (claims about the system) are successively broken down into sub-goals until a point is reached where claims can be supported by direct reference to available evidence (solutions). As part of this decomposition, using the GSN, the Contractor must make clear the argument strategies adopted (e.g. adopting a quantitative or qualitative approach), the rationale for the approach and the context in which goals are stated (e.g. the system scope or the assumed operational).

**10. PROVISION OF CONTRACTOR'S DOCUMENTS TO THE PRINCIPAL**

The Contractor must provide the Principal with a Contractor's Document when that document reaches each stage specified in the **Contract Specific Requirements**.

Further details of the minimum documentation to be provided at each stage Design Stage Review is specified in the following Parts of this CSTR (as appropriate to the scope of work):

- Part D81: Design – Railway Tracks;
- Part D82: Design – Railway Signalling and Communications; and
- Part D83: Design – Railway Overhead Wiring.

**11. HOLD POINTS**

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

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2.	Provision of the CEDMP	10 working days
4.3	Provision of the Design Package Work Breakdown Structure	10 working days
4.4.	Provision of the Site Assessment Report	10 working days
5.1	Conduct of the Requirements Definition stage review	10 working days

<b>CLAUSE REF.</b>	<b>HOLD POINT</b>	<b>RESPONSE TIME</b>
5.1	Conduct of the Preliminary Design stage review	10 working days
5.1	Conduct of the Detailed Design Stage Review	10 working days
5.1	Conduct of the Final Design Stage Review including provision of the Final Contractor's Documents prior to construction	10 working days
5.1	Conduct of the Engineering Completion stage review	10 working days
5.6	Provision of the Design Basis Report(s)	10 working days
5.7	Submission of a proposal for an alternative approach	10 working days
6.9	Submission of the Principle Requirements Document	10 working days
6.9	Submission of the System Requirements Specification	10 working days

## **12. RECORDS**

The Contractor must maintain all records as necessary to provide evidence of compliance with the requirements of this part in accordance with the requirements of Part G20 "Quality System Requirements".