



**Government of South Australia**

Department of Planning,  
Transport and Infrastructure

## **PUBLIC TRANSPORT SERVICES**

# **GUIDELINES FOR INSPECTION, TESTING AND COMMISSIONING OF ASSETS FOR RAIL PROJECTS**

**PTS-AR-10-PM-GUD-00000098**



**and THINK**

**Zero Harm**



## Document Control

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## 1.0 INTRODUCTION

The Department of Planning, Transport and Infrastructure (DPTI) Public Transport Services Division (PTS) owns, operates and maintains the Adelaide Metropolitan Passenger Rail Network (AMPRN).

From time to time PTS undertakes projects that introduce new public transport assets or modify existing assets to ensure that services and facilities continue to meet the expectations of the travelling public.

These new or modified assets can only be introduced to the system following a rigorous inspection, testing and commissioning process that ensures they meet all functional and design requirements and are introduced to the AMPRN safely and without any negative impact on service delivery.

There are two levels of inspection, testing and commissioning applicable to the introduction of assets into operational service:

- individual asset or component testing – Level 1
- 'whole of system' integration testing – Level 2

Level 1 is applicable to individual assets or components. Level 2 covers the introduction of multiple individual assets or components to the network.

## 1.1 PURPOSE

This document provides the guidelines to be applied by Project Managers in ensuring that:

- all inspection, testing and commissioning of individual assets or components is carried out to meet user / functional requirements, specifications and designs,
- all inspection, testing and commissioning of interdependent multiple asset types introduced into service is carried out to meet the 'whole of system' user / functional requirements, specifications and designs,
- the inspection, testing and commissioning for the introduction of new or modified assets is comprehensive, documented, and without compromise to 'whole of system' safety or service delivery.

## 1.2 SCOPE

This document is applicable to all projects delivering new or modified assets to the AMPRN.

Signalling and Communications projects often involve additional testing and commissioning requirements. Refer to the PTS Signalling and Telecommunication Department for these requirements.



### 1.3 ACRONYMS AND REFERENCED DOCUMENTS

#### 1.3.1 Acronyms

Acronym	Full Name
AMS	PTS Asset Management System (Maximo based information system for asset management especially maintenance).
AMPRN	Adelaide Metropolitan Passenger Rail Network
CMT	Commissioning Management Team
CMP	Commissioning Management Plan
DPTI	Department of Planning , Transport and Infrastructure
EMS	Engineering Management System
FAT	Factory acceptance Test
FSAT	Final System Acceptance Test
PEMP	Project Engineering Management Plan
PTS	Public Transport Services
PTSOM	Public Transport Services Operations & Maintenance
SAT	Site Acceptance Testing
SEMP	System Engineering Management Plan
SIT	System Integrity Testing

#### 1.3.2 Reference Documents

Document Number or Abbreviation	Title
RSA	Rail Safety Act , South Australia
PTS-MU-10-EG-PLN-0000017	Systems Engineering Management Plan
PTS-MS-10-EG-PRC-0000032	Approval of Technical Standards & Waivers Procedure
PTS-MS-05-AM-PRC-0000091	Asset Management Technical Data Requirements for Projects
PTS-AR-10-EG-PRC-00200220	Procedure for Management of Engineering Requirements for Rail Projects



## 2.0 RESPONSIBILITIES

### 2.1 DIRECTOR ASSET MANAGEMENT

The Director Asset Management is responsible for ensuring that this document is available to all Project Managers engaged on delivering new or modified assets to the AMPRN.

### 2.2 PROGRAM DIRECTOR - RAIL REVITALISATION

The Program Director - Rail Revitalisation is responsible for ensuring that all Project Directors comply with this document.

### 2.3 PROJECT DIRECTOR

The Project Director is responsible for:

- ensuring that all Project Managers develop a Project Engineering Management Plan (PEMP) for their project that contains all of the individual asset / component and 'whole of system' integration inspection and testing requirements in accordance with this document and
- determining if the status of the project is "Major" and whether the establishment of a Commissioning Management Team (CMT) and a Commissioning Management Plan (CMP) are required to be specified in the PEMP
- appointing the positions of Project Manager and Project Manager – Testing & Commissioning,

### 2.4 PROJECT MANAGER

The Project Manager is responsible for:

- establishing and documenting individual asset or component user / functional requirements and specifications relevant to inspection and testing,
- ensuring the Project Design Life Cycle Process is followed in accordance with the Systems Engineering Management Plan (SEMP),
- ensuring the Project Engineering Management Plan (PEMP) contains all of the necessary individual asset or component inspection and testing requirements for the project,
- ensuring the main contractor (associated sub-contractor) prepares, documents and implements all individual asset or component inspection and testing in accordance with this document and the PEMP and
- reviewing and assessing the suitability of the Commissioning Management Plan (CMP) for major projects.

### 2.5 MAIN CONTRACTOR (ASSOCIATED SUB-CONTRACTOR)

The Main Contractor (associated sub-contractor) is responsible for preparing, documenting and implementing all individual asset and component inspection and testing in accordance with this document and the PEMP.



## 2.6 PROJECT MANAGER - TESTING & COMMISSIONING

The Project Manager – Testing and Commissioning is responsible for:

- ensuring that all 'whole of system' user / functional requirements and specifications are established and documented as the basis for development of relevant inspection and testing for the 'whole of system' integration of assets,
- ensuring the Project Engineering Management Plan (PEMP) contains all of the necessary 'whole of system' Integration inspection and testing requirements for the project,
- ensuring that all asset and system interdependencies and interfaces are identified, documented and managed through the inspection and testing process
- establishing a Commissioning Management Team (CMT) for major projects
- preparing a Commissioning Management Plan (CMP) for major projects and
- ensuring that all 'whole of system' Integration inspection and testing is documented and carried out in accordance with this document and the PEMP.

**Note:** The Project Manager may also be the Project Manager – Testing & Commissioning. In this case the responsibilities assigned to the Project Manager – Testing & Commissioning shall be undertaken by the Project Manager.

## 2.7 DIRECTOR - OPERATIONAL READINESS

The Director - Operational Readiness is responsible for:

- reviewing and endorsing user / functional requirements for major projects,
- reviewing and endorsing the Commissioning Management Plan (CMP) for major projects and
- liaising with the Project Manager – Testing & Commissioning / Project Manager and / or Project Director regarding the adequacy of the individual asset and component and 'whole of system' Integration inspection, testing and commissioning



### 3.0 LEVELS OF INSPECTION TESTING & COMMISSIONING FOR ASSETS

Because railway systems have many different asset types that may be added or removed from the system the approach to inspection, testing and commissioning often needs to be tailored depending on the type of asset. Common asset types include but are not limited to:

- Building services, equipment, plant and systems
- Stations
- Electrical systems with varying voltages
- Overhead wiring (OHW) traction and power supply
- Track
- Civil structures
- Signalling
- Communications
- Train detection and control systems
- Rollingstock

The two levels of inspection, testing and commissioning applicable to the introduction of assets into operational service are detailed below:

#### **Individual Asset or Component Testing – Level 1**

Inspection and testing, where individual asset or component are being introduced or modified, is to be carried out to verify the following:

- that the individual asset or component, when fully operational, will meet the agreed user/functional requirements and specifications,
- that the individual asset or component, when fully operational, complies with the agreed final design and
- that the individual asset or component performs as intended when introduced into operational service.

For individual asset or component testing the main contractor or sub-contractor is normally responsible for developing an Inspection and Test Plans which shall detail testing methodology, technical processes, safety procedures, witness, and hold points.

The Project Engineering Management Plan (PEMP) shall contain all of the necessary individual asset and component inspection and testing requirements for the project including engineering acceptance authorities.

#### **'Whole of System' Integration Testing – Level 2**

Railway projects rarely introduce a single individual asset or component into service – they usually involve the commissioning, often simultaneously, of multiple assets which are connected and interdependent. This requires an advanced level of integrated / interconnected 'whole of system' inspection, testing and commissioning to ensure:

- that all individual asset and component inspection and testing meets the specific user / functional requirements, specifications and designs,
- that the integrated / interdependent multiple asset system when fully operational meets the agreed 'whole of system' user / functional requirements and specifications,





- that the integrated / interdependent multiple asset system when fully operational complies with the 'whole of system' final design and
- that the introduction to service of the new interconnected assets is seamless and does not compromise safety or service delivery.

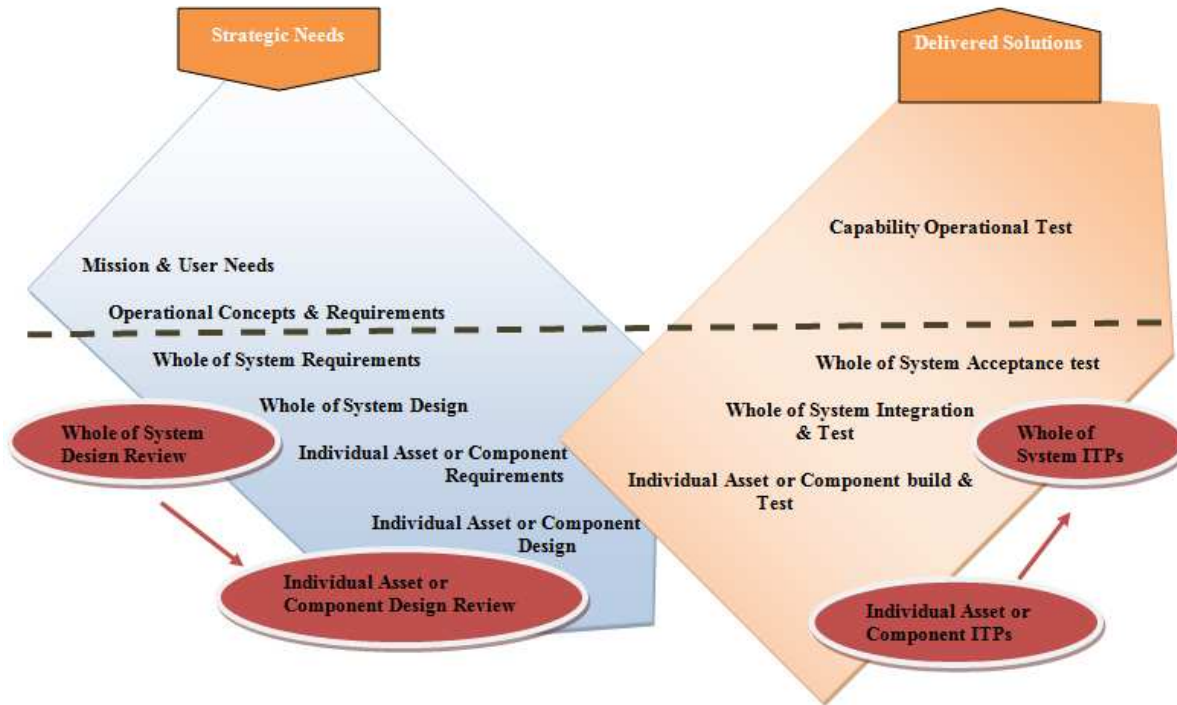
While this level of inspection, testing and commissioning may be undertaken by the main contractor or sub-contractor it is the responsibility of the Project Manager - Testing & Commissioning to ensure that the introduction of interdependent multiple asset types into service, having 'whole of system' impact, is carried out effectively and efficiently.

The Project Engineering Management Plan (PEMP) shall contain the entire 'whole of system' inspection, testing and commissioning for the project including engineering acceptance authorities.

#### **4.0 USER / FUNCTIONAL REQUIREMENTS CAPTURE**

For user / functional requirements capture refer to PTS-AR-10-EG-PRC-00200220 "Procedure for Management of Engineering Requirements for Rail Projects"

## 5.0 SYSTEMS ENGINEERING APPROACH



The left hand side 'leg' is driven top-down with mission, business and user needs at the program level. It progresses through a range of analyses such as operational analysis, rail network modelling and simulation and options analysis to select the most cost-effective solution classes. Once solution classes are identified 'whole of system' requirements are developed, then system design, flowing down to Individual Asset or Component requirements and design. Similarly the design review process is also flowing down from 'whole of system' design review to Individual Asset or Component design review.

The right hand side 'leg' is built bottom-up starting with 'Individual Asset or Component' usually developed / delivered by contractors. Various individual assets or components are gradually brought together using 'whole of system' integration and test until an operational baseline is ready for contract acceptance testing, then finally operational testing as part of commissioning. Traceability, verification and validation are conducted against the original and modified requirements and design documents that were baselined during the left hand side 'leg'.

## 6.0 INSPECTION, TESTING AND COMMISSIONING REQUIREMENTS FOR PROJECTS

Shown at Appendix 1 is the model that is to be used to identify the requirement capture and inspection and testing deliverables required to be submitted through the life cycle of the project.



## 7.0 INDIVIDUAL ASSET OR COMPONENT INSPECTION AND TESTING – LEVEL 1

While the principles of inspection and testing are applicable to all projects the specific form of ITP may vary with the type of individual asset or component being introduced to the system. For example the introduction of a new section of track will require a different inspection and test regime to that required for the installation of a new station. Below are examples of typical inspection and testing requirements that could be applicable to individual assets or components.

### 7.1 FACTORY ACCEPTANCE TESTING (FAT)

Individual assets or components that are manufactured or supplied must be thoroughly tested by the main contractor (associated sub-contractor) prior to dispatch to site for installation. Specific FAT inspection and test plans shall be developed by the contractor and submitted to the Project Manager for review and comment. In some cases the FAT will require witnessing by the Project Manager or other representatives of PTSOM. The contractor will be advised of this requirement at the review stage.

The FAT should provide:

- independent proof of functionality, quality and integrity,
- verification of all important documents, such as manuals, instructions, plans, drawings and
- assurance that the individual asset or component performs as expected under the testable range of foreseeable conditions, including misuse and error.

The FAT may include, but is not limited to:

- comprehensive checking for completeness,
- proof of functionality, by conventional function testing or simulation,
- verification of contractual requirements,
- verification of the availability and quality of documents and
- final inspection.

### 7.2 INSTALLATION AND OPERATIONAL TESTING

Installation and Operational Testing shall be carried out by the contractor during and after the installation of individual assets or components. Such tests will be used to identify design and installation errors prior to the Site Acceptance Testing (SAT). The main contractor (associated sub-contractor) shall supply documentation detailing the scope and results of the installation and operational tests.

Installation and Operational Testing assures, through appropriate performance tests and related documentation and records, that the individual assets or components have been installed correctly and that all future operations will be reliable within prescribed or specified operating limits.

### 7.3 INDIVIDUAL ASSET AND COMPONENT INTERFACE TESTING

The main contractor (associated sub-contractor) shall prepare an Interface Inspection and Test Plan that addresses the following:

- the individual asset or component interfaces, and
- the methodology to be used to ensure that individual assets or components operate safely and effectively across the defined interfaces.



This testing is intended to ensure that any issues at interfaces between components of an individual asset are addressed. For example, an individual asset such as a railway station has a number of interfaces i.e. shelter/lighting system, platform/drainage system, CCTV/PI system.

It is essential that these interfaces are identified, managed, and testing undertaken to verify that there is no impediment presented by component interfaces to prevent the individual asset from functioning as intended i.e. the station as a whole functions as a station should.

## 7.4 SITE ACCEPTANCE TESTING (SAT)

The contractor shall undertake a SAT following the installation of an individual asset or component. The SAT shall not commence until the FAT and Installation and Operational Testing have been completed and approval is received from the Project Manager to proceed to Site Acceptance Testing.

The SAT covers inspection, testing and validation of individual assets or components by the main contractor (associated sub contractor). Specific SAT plans shall be developed by the main contractor (associated sub contractor) and submitted to the Project Manager for review and approval. In some cases the SAT will require witnessing by the Project Manager or other representatives of PTSOM. The main contractor (associated sub contractor) will be advised of this requirement.

## 8.0 WHOLE OF SYSTEM INSPECTION, TESTING AND COMMISSIONING - LEVEL 2

Having undertaken a range of inspection and testing to ensure that the individual asset will work as intended it must then be tested for suitability for integration into the whole network. This introduces a set of higher level interfaces that will require testing and commissioning to ensure that there will be no adverse impact on the integrity of the whole network when the asset 'goes live' e.g. if an individual signalling asset is being introduced to the network then 'whole of system' testing is essential to ensure that it is not going to cause a failure of the whole signalling system.

All of the interfaces between the individual asset and the 'whole of system' must be identified and documented. 'Whole of system' inspection, testing and commissioning plans shall be developed that detail the way in which the new or modified assets are to be integrated. A testing regime is to be developed that will validate that all of the interfaces have been managed to prevent any 'whole of system' failure.

The 'whole of system' inspection, testing and commissioning plans will be developed jointly with PTSOM and will comprise System Integrity Testing and a Final System Acceptance Test.

## 8.1 SYSTEM INTEGRITY TESTING (SIT)

System Integrity Testing (SIT) shall be undertaken prior to Final System Acceptance Testing (FSAT) to:

- ensure that the interfaces between individual assets and all the relevant AMPRN operational systems have been identified and documented,
- ensure that all testing across the individual asset and 'whole of system' interfaces that can be carried out prior to 'go live' is undertaken to provide assurance that at handover they will operate effectively and safely without any adverse effect on any AMPRN operational systems, and
- that any issues arising from the testing are identified and remedial actions planned and implemented before the FSAT .



The SIT may use indirect methods such as simulation, test trains or track recording to test the quality of the interface management.

The Project Manager Testing and Commissioning shall issue formal notification to the Director - Operational Readiness and the appropriate PTSOM Manager before a SIT is to be conducted. Advice will be provided as to whether the PTSOM Manager or other representatives of PTSOM intend to attend the SIT. If attendance is confirmed then the SIT must not proceed unless the PTSOM Manager or other PTSOM representative is present.

## 8.2 FINAL SYSTEM ACCEPTANCE TESTS (FSAT)

Final System Acceptance Tests (also known as Client Acceptance Tests) shall not be carried out until all the SIT testing has been completed and all issues arising from those tests have been closed out to the satisfaction of PTSOM.

The FSAT is undertaken at or close to the 'go live' stage of the project lifecycle and is a final verification that the new or modified assets have been commissioned successfully into the AMPRN. The form of the FSAT will vary according to the type of asset being commissioned; for example for the introduction of a new section of track the FSAT may involve a final test train before the signing of a Certificate of Train Running that permits revenue trains to commence operations.

The Final System Acceptance Tests shall be carried out as a joint activity between the Project representatives and PTSOM. The scope of these tests must be developed in close cooperation with PTSOM.

## 9.0 COMMISSIONING MANAGEMENT PLAN

For all major projects a Commissioning Management Team will be established during the early design phase which will oversee the preparation of a Commissioning Management Plan.

The Commissioning Management Team will be responsible for coordinating and monitoring the inspection, testing and commissioning process for a particular project. The membership of the CMT will be determined jointly by the Project Manager Testing & Commissioning and the Director Operational Readiness and should include representatives from PTSOM, the main contractor (associated sub contractor).

The Project Manager Testing & Commissioning is responsible for development of a Commissioning Management Plan. The CMP will detail the objectives, events, activities, tasks, timelines, stakeholders, risk mitigation measures and the methods that will be used to manage the inspection, testing and commissioning process. The CMP shall be reviewed for suitability by the Project Manager and submitted to the Director Operational Readiness for endorsement.

The CMT shall identify and schedule all of the significant commissioning activities, determine timelines and allocate responsibility for monitoring each activity to a member of the CMT.

The CMT shall hold regular meetings and minutes shall be recorded and distributed.

## 10.0 RECORDS

All documentation associated with all inspection, testing and commissioning using this document shall comply with PTS-MS-O5-AM-PRC-0000091 'Asset Management Technical Data for Projects'.

APPENDIX 1

# Inspection, Testing and Commissioning Requirements for Projects

