

Project Controls

Master Specification

PC-CN1 Testing and Commissioning

Document Information

K Net Number:	13710603
Document Version:	2
Document Date:	19/09/2019

DEPARTMENT FOR
INFRASTRUCTURE
AND TRANSPORT



Government of South Australia
Department for Infrastructure
and Transport

Document Amendment Record

Version	Change Description	Date	Endorsement record (KNet ref.)
1	Initial issue (formerly CH80)	19/07/19	
2	Formatting and Hold Point changes	19/09/19	

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PC-CN1 Testing and Commissioning

1 General

1.1 This part specifies the requirements for the management of the inspection, testing and commissioning process. Refer also to PC-QA1 "Quality Management Requirements".

1.2

1.3 The following definitions apply to terms used in this Part:

Term	Definition
Component	Includes materials, plant and equipment.
COTS	Commercial Off The Shelf.
FAT	Factory Acceptance Testing.
SAT	Site Acceptance Testing.
SIT	System Integration Testing.
Type Test	The testing applied to a single component which enables other identical components to be used without further Testing.

2 Contractor's Responsibilities

2.1 The Contractor is responsible for the inspection, testing and commissioning in accordance with the requirements of this Part and Contract Documents.

2.2 The Contractor must:

- a) appoint an experienced Commissioning Engineer;
- b) establish, manage and co-ordinate the inspection, testing and commissioning principles, program, requirements and procedures;
- c) co-operate fully with the Principal's Representative who will take a support role throughout the inspection, testing and commissioning process;
- d) manage the interfaces of its systems with other systems, the external Commissioner of Highways networks and the external facility networks;
- e) provide all necessary and appropriate assistance and co-operation to the Principal's Representative during all phases of the inspection, testing and commissioning process;
- f) implement the inspection, testing and commissioning requirements included in this Contract in accordance with principles defined in this Part; and
- g) take into account the rules, procedures, constraints and practices of the Principal's Representative in formulating and implementing the inspection, testing and commissioning process.

3 Commissioning and Testing Management Plan

3.1 The Contractor must develop, implement and comply with the Commissioning and Testing Management Plan which is suitable for demonstrating that the Works comply with the requirements of this Contract.

3.2 The Inspection, Testing and Commissioning Management Plan must:

- a) describe the subcontractors and personnel undertaking inspection, testing and commissioning, including contract details, organisational structure, roles and responsibilities;
- b) describe the training, qualifications and / or certification of competency required for personnel undertaking inspection, testing and commissioning;
- c) detail all Items and Systems that will be subject to inspection, testing and commissioning;
- d) detail all test equipment and calibration requirements;

- e) detail all processes and procedures to be used for testing and commissioning;
 - f) reference requirements, standards, specification and acceptance criteria;
 - g) integrate all Inspection and Test Plans (ITPs);
 - h) detail the appropriate parts of the Safety Management System (including how testing will be managed in a live operating environment);
 - i) define the validation and QA process that provides confirmation that all Requirements are met.
- 3.3 The inspection, testing and commissioning plan must address “Whole of System” inspection, testing and commissioning requirements to ensure all of the interfaces have been managed to prevent any “Whole of System” failure.
- 3.4 The Contractor must submit the first draft of the Commissioning and Testing Management Plan at least 30 working days prior to the first planned commissioning and testing.
- 3.5 The Commissioning and Testing Management Plan must include a draft Commissioning Report with a table of contents.
- 3.6 The Contract Program must identify the duration, critical path and interdependencies in relation to all inspection, testing and commissioning activities.
- 3.7 The Contractor must develop, implement, maintain and comply with Inspection and Test Plans (ITPs) for all commissioning and testing to provide objective evidence of compliance with the requirements of this Contract.
- 3.8 Approval of the Commissioning and Testing Management Plan by the Principal is a **Hold Point**.

4 Pre-requisites to Commissioning and Testing

- 4.1 The Contractor must submit the following documentation to the Principal with the Commissioning and Testing Management Plan.
- 4.2 The Issue For Construction (IFC) drawings must be updated to As-Constructed (or As-built) status as follows:
- a) red pen mark-ups for any drafting changes;
 - b) blue pen mark-ups explaining why the change was made including:
 - i) a reference to the designers approval for the change; and
 - ii) the date of the change.
- 4.3 Each work lot to be commissioned and tested needs to closed and a signed ITP provided.
- 4.4 Each component incorporated into the permanent works must have a complying FAT certificate included in the completed work lot package.
- 4.5 All electrical and plumbing works must be issued a certificate of compliance in accordance with the following South Australian legislation:
- a) Electricity Act 1996;
 - b) Water Industry Act 2012;
 - c) South Australia Public Health Act 2011.
- 4.6 Further information is available from:
- a) <https://www.sa.gov.au/topics/energy-and-environment/electrical-gas-and-plumbing-safety-and-technical-regulation/electricity-trades/electrical-certificates-of-compliance>; and
 - b) <https://www.sa.gov.au/topics/energy-and-environment/electrical-gas-and-plumbing-safety-and-technical-regulation/plumbing-trades/plumbing-certificates-of-compliance>.
- 4.7 The Contractor's Certificates of Compliance must be included in the completed work lot package.

- 4.8 If the contract requires a post-construction or pre-opening Road Safety Audit (RSA), the Contractor must provide a copy of the report, together with the Contractor's response and close-out details of each issue raised in the RSA.
- 4.9 The Contractor must prepare and submit to the Principal for approval a table of contents together with a sample Operations and Maintenance (O&M) Manual prior to preparing the O&M Manual. Following approval, the Contractor must prepare and submit to the Principal for approval, the draft O&M Manual.
- 4.10 The Contractor must prepare and submit to the Principal for approval a Training Manual for any training associated with testing and commissioning.
- 4.11 The Training Manual must cover both classroom training and field training on site.
- 4.12 The Contractor must conduct pre-commissioning classroom training with the Principal's nominated officers before undertaking any commissioning activities on site. The training must include commissioning activities, safe operations of the completed work and safe maintenance procedures for maintaining the completed work.

5 Inspection, Testing and Commissioning

- 5.1 Work-Zone Traffic Management aftercare must remain in place until all inspection, testing and commissioning is completed and Commissioning Handover takes place.

Bridges

- 5.2 The Contractor must request an inspection of bridge structures with the Principal's Principal Structural Engineer 10 working days prior to the proposed inspection date.
- 5.3 The pre-commissioning records for all bridge components such as bearings, safety railing, pre-stressing, post-tensioning pre-cast elements, piling records, expansion joints etc. must be provided with the request for inspection. This constitutes a **Hold Point**.
- 5.4 If the bridge is an "opening bridge", all electrical components, pumps and hydraulics need FAT prior to installation and testing.
- 5.5 The bridge shall only be accepted by the Principal after the Principal's Principal Structure Engineer has inspected and approved the structure.

Closed Circuit Television (CCTV)

- 5.6 The Contractor must provide FATs and Warranty Certificates for each camera prior to inspection and testing. The CCTV must be operational and accepted by the Traffic Management Centre for the Principal to accept the works as completed and commissioned. The Contractor must commission all CCTV as one lot package.

Drainage and Stormwater (including pumps)

- 5.7 The Contractor must provide:
 - a) CCTV proving footage and photos showing all drains and joints are sealed, free of debris and free of damage from the construction activities;
 - b) Evidence that gradients of the drains are proved as free draining; and
 - c) FATs, Warranty Certificates and Certificates of Compliance to the Principal prior to inspection, testing and commissioning of any pumps.

Electrical Assets and Road Lighting

- 5.8 The Contractor must provide:
 - a) Electrical Certificates of Compliance for all electrical works prior to any inspection, testing and commissioning activities;

- b) FATs and Warranty Certificates of all electrical components incorporated into the permanent works;
- c) Evidence that all electrical components are functioning correctly and in accordance with the manufacturers specifications; and
- d) Evidence that each electrical component is clearly labelled with the Principal's Asset Number.

Intelligent Traffic Systems (ITS)

5.9 For the purposes of this section, ITS includes Lane Use Management Systems (LUMS). Prior to integration of any ITS with the Principal's operating system, the Contractor must:

- a) provide logic diagrams of any ITS and how it integrates with the Principal's operating system;
- b) provide pre-commissioning test results showing the systems operate correctly;
- c) provide fault testing and failure testing to ensure all alarms and warning devices work;
- d) provide Electrical Certificates of Compliance and Warranty Certificates;
- e) provide "what if" testing to demonstrate the logic of the ITS functions correctly;
- f) provide list of spare parts;
- g) commission all Signs as one lot package;
- h) commission all CCTV as one lot package; and

provide evidence that each ITS component is clearly labelled with the Principal's Asset Number.

5.10 The Contractor must provide complying reflectivity testing of pavement markings and completed work lot packages.

Pavement Wearing Coarse

5.11 The Contractor must provide compliant:

- a) Roughness testing;
- b) Skid resistivity testing for asphalt surfaces with speed limits 80 kph or over; and
- c) Completed work lot packages.

Roadways

5.12 The Contractor must apply for an Operational Handover Site Inspection 10 business days prior to the intended inspection with the Principal's Representative.

5.13 The purpose of the Operational Handover Site Inspection is to confirm the roadway has been constructed in accordance with the approved design and legal requirements of the Traffic Control Plans.

5.14 The Contractor must provide a copy of the following with the request for an Operational Handover Site Inspection:

- a) As-constructed records for the Traffic Control Plans; and
- b) A pre-opening Road Safety Audit (RSA) Report, together with the Contractor's response to all issues raised in the RSA if a pre-opening RSA is a contract requirement.

5.15 The date and time of the Principal's acceptance of the roadway must be recorded on the Drawing Acceptance Form before Work-Zone Traffic Management is removed and the roadway opened to public traffic.

Safety Barriers and Wire Ropes

5.16 The Contractor must provide evidence of the following:

- a) Correct set-out and adjustments required to the design to ensure the permanent works operate correctly and in accordance with the manufacturer's specification (e.g. clear distances behind barriers and ropes, minimum off-set from roadway, deflection of end terminals etc.);
- b) Test results for tensioning;
- c) Warranty Certificates;
- d) Maintenance intervals; and
- e) Testing and re-tensioning required for safe maintenance.

Safety Cameras

5.17 The Contractor must provide evidence of complying:

- a) Wiring diagrams;
- b) FAT results;
- c) Warranty Certificates;
- d) Electrical Certificates of Compliance;
- e) SA Police Witness Testing;
- f) Loop test results; and
- g) Licensed survey of the position of the loops.

Static Signage

5.18 The Contractor must provide evidence of complying:

- a) Reflectivity test results;
- b) Positioning in accordance with the approved Traffic Control Layout;
- c) Off-sets from the roadway;
- d) Vertical height (both minimum off-set from NSL and maximum height); and
- e) Height clearances in pedestrian areas.

Traffic Signals

5.19 The Contractor must provide:

- a) Wiring diagram;
- b) Warranty Certificates;
- c) Electrical Certificates of Compliance;
- d) Traffic Controller test results; and
- e) Loop test results.

Tunnels

5.20 The Contractor must inspect, test and commission any tunnels in accordance with Austroads Publication No. AGRT02-15 Guide to Road Tunnels Part 2: Planning, Design and Commissioning.

5.21 Utility Services (Gas, Power, Sewer, Telecommunications, Water)

5.22 The Contractor must provide evidence of the asset owner's acceptance of any modifications or impacts of the permanent works on any utility services.

Variable Message Signs (VMS)

5.23 The Contractor must provide complying FAT results, list of spare parts, Electrical Certificates of Compliance and Warranty Certificates. Each sign must be operational and accepted by the Traffic

Management Centre for the Principal to accept the works as completed and commissioned. The Contractor must commission all signs as one lot package.

Variable Speed Limit Signs (VSLS)

- 5.24 The Contractor must provide complying FAT results, list of spare parts, Electrical Certificates of Compliance and Warranty Certificates. Each sign must be operational and accepted by the Traffic Management Centre for the Principal to accept the works as completed and commissioned. The Contractor must commission all signs as one lot package.

Weather Stations

- 5.25 The Contractor must provide complying FAT results, list of spare parts, Electrical Certificates of Compliance and Warranty Certificates. Each weather station must be operational and accepted by the Traffic Management Centre for the Principal to accept the works as completed and commissioned. The Contractor must commission all weather stations as one lot package.

6 Commissioning Reports and Records

- 6.1 The Contractor must provide the following commissioning reports and records no later than 7 working days after the applicable commissioning activity.
- 6.2 All reports and manuals must be in the Department's template MSWord format, convertible to Adobe, and be bookmarked electronically for easy navigation and referencing. They must have a formatted style guide and linked table of contents. The Contractor can obtain the Department's current template from the Principal's Representative.
- 6.3 The Contractor may add its company logo to the front page of the report or manual provided it is of high resolution quality and of a size no larger than the Department's logo.
- 6.4 Approval of all commissioning reports and records by the Principal constitutes a **Hold Point**.

Commissioning Report

- 6.5 The Commissioning Report must include a table of contents, appendices with registers for all relevant ITPs, test results, NCRs, and commissioning certificates.
- 6.6 Completed ITPs and work lot packages must be included in the commissioning report.
- 6.7 All compliant test results for commissioning activities must be incorporated into the completed ITP and work lot package. Noncompliant test results must have an NCR raised and closed out and be included in the commissioning report.
- 6.8 Each commissioned item must have a Commissioning Certificate approved by the Principal's Representative. These are to be included in the commissioning report.

Final Training Manuals and Records of Training

- 6.9 The Contractor must incorporate all of the Principal's comments and amendments into the final Training Manual. Any issues that arise during the training, testing and commissioning activities must be addressed and incorporated in the final Training Manual.

Final Operation and Maintenance Manual

- 6.10 The Contractor must incorporate all of the Principal's comments and amendments into the final Operations and Maintenance Manual. Any issues that arise during the training, testing and commissioning activities must be addressed and incorporated in the final Training Manual.

Road Safety Audit

- 6.11 If the Contract requires a post implementation Road Safety Audit (RSA), the Contractor must provide a copy of the report, together with the Contractor's response and close-out details of each issue raised in the RSA.

7 Decommissioning

- 7.1 The Contractor must take into account any decommissioning and disposal of any items or systems in its Commissioning and Testing Plan. Disused materials should be recycled or re-used wherever possible.
- 7.2 The Contractor must identify and list each item or system which needs to be decommissioned and disposed in its Commissioning and Testing Plan.
- 7.3 The Contractor must develop, implement, maintain and comply with the plan for safe shut down or dismantling of the system.
- 7.4 The Contractor must dispose of all redundant material, items and systems during the commissioning to avoid any infringement, confusion or distraction to road users, operators or maintainers.

8 Commissioning Handover

- 8.1 At the time of commissioning hand over, all documentation related to tests carried during inspection, testing and commissioning must have been provided progressively by the Contractor to the Principal's Representative and must have been accepted by the Principal.
- 8.2
- 8.3 Commissioning handover takes place when the Principal's Representative has recommended to the Principal and the Principal has accepted that all the relevant tests of the inspection, testing and commissioning including trial or test run has been successfully completed.
- 8.4 Work-Zone Traffic Management aftercare signage must not be removed until commissioning handover takes place.
- 8.5 Refer to Master Specification PC-CN2 "Asset Handover" for further details on Asset Handover.

9 Hold Points

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

Document Ref.	Hold Point	Response Time
3.8	Approval of the Commissioning and Testing Management Plan	30 working days
5.3	Request for an inspection of bridge structures including provision of pre-commissioning records	10 working days
6.4	Approval of all commissioning reports and records	