Master Specification
Part PC-CN1

Testing and Commissioning

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Government of South Australia
Department for Infrastructure and Transport

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Contents

PC-CN1 Testing and Commissioning

1 General

a) This Master Specification Part sets out the requirements for the testing and commissioning of systems and services associated with transport infrastructure, including:

i) the documentation requirements, as set out in section 2;

ii) the Contractor's responsibilities, as set out in section 3;

iii) the pre-requisites to the commencement of testing and commissioning activities, as set out in section 4;

iv) the inspection, testing and commissioning requirements, as set out in section 5;

v) the requirements for the Testing and Commissioning Report, testing, schedules and plans, as set out in section 6;

vi) the requirements for decommissioning, as set out in section 7; and

vii) the Hold Point and Witness Point requirements, as set out in section 8.

b) Refer to PC-CN2 "Asset Handover" for Handover requirements.

2 Documentation

2.1 Testing and Commissioning Management Plan

a) The Contractor must establish, implement and maintain a Testing and Commissioning Management Plan, which must:

i) demonstrate that the Works as delivered comply with the requirements of the Contract Documents, including the relevant Master Specification Parts;

ii) define the organisational structure, roles and responsibilities of the Contractor's testing and commissioning team undertaking and documenting the inspection, testing and commissioning activities, including any Subcontractor details;

iii) describe the training, qualifications, certification and level of competency required by the Contractor for all roles as defined within the proposed organisational structure;

iv) detail all items of plant, equipment, sub-systems and systems that will be subject to the inspection, testing and commissioning process;

v) detail all test equipment and associated calibration and certification requirements;

vi) detail where and when testing is to occur;

vii) detail where testing is proposed to be conducted in an environment other than the final environment for level 2 (as described in section 5) or greater testing, including the differences between the test environment and the final environment;

viii) detail all processes and procedures to be used for inspection, testing and commissioning and decommissioning, including the progressive submission of finalised Testing and Commissioning Reports and Quality Management Records;

ix) reference all requirements, standards, specification and acceptance criteria;

x) include a draft copy of a typical Testing and Commissioning Report for a major subsystem, complete with a table of contents;

xi) include a copy of the Contractor's detailed inspection, testing and commissioning schedule identifying the duration, critical path and interdependencies in relation to all construction completion, inspection, testing and commissioning activities;

xii) detail all testing and commissioning activity levels as defined in section 5;

xiii) detail how all testing and commissioning activities are structured in a hierarchical manner to facilitate the progressive signoff of all testing and commissioning activities associated with each activity level (as set out in section 5) and construction phase;

xiv) nominate and describe the methodology and management system to be implemented to enable project testing and commissioning progress tracking to be transparently reported to all stakeholders, including the Principal;

xv) detail how appropriate cross discipline coordination will be managed; and

xvi) describe how the Testing and Commissioning Management Plan relates to the project verification and validation activities to ensure and provide confirmation that all requirements of the Contract Documents have been fulfilled.

b) The Testing and Commissioning Management Plan must be prepared, submitted and regularly updated in accordance with the requirements of PC-PM1 “Project Management and Reporting”.

c) The Contractor must not progress with any commissioning and testing activities until the Hold Point associated with the Testing and Commissioning Management Plan has been released.

d) The Contract Program must identify the duration, critical path and all interdependencies in relation to inspection, testing and commissioning activities.

2.2 Decommissioning Testing Plan

a) The Contractor must establish, implement, and maintain a Decommissioning Testing Plan in accordance with section 7.

b) The Decommissioning Testing Plan must be prepared, submitted, and regularly updated in accordance with the requirements of PC-PM1 “Project Management and Reporting”.

c) The Contractor must not progress with any decommissioning testing activities until the Hold Point associated with the Decommissioning Testing Plan has been released.

3 Contractor's responsibilities

a) The Contractor must ensure that the inspection, testing and commissioning is undertaken safely and in accordance with the requirements of the Contract Documents, including this Master Specification Part.

b) The Contractor must plan all testing and commissioning works to minimise disruptions and degradations to:

i) the operational management of the existing traffic movements within the Site; and

ii) the communications networks in use.

c) Where the testing and commissioning works will cause a disruption or degradation to the operational management of the existing traffic movements within the Site, the Contractor must first obtain the prior approval of the Traffic Management Centre via the Traffic Management Centre’s change control processes prior to the commencement of any testing or commissioning works.

d) The Contractor must:

i) nominate an experienced resource, who is responsible for managing the inspection, testing, and commissioning activities;

ii) establish, manage and co-ordinate the inspection, testing and commissioning activities including their programming, plant, equipment and personnel requirements and associated procedures;

iii) co-operate fully with the Principal (or other delegated parties) in facilitating access to Site as may be required to review physical progression and attend Hold Points and Witness Points;

iv) co-operate fully with the Principal in providing open access to any testing and commissioning management system;

v) manage all interfaces between the various systems and services captured within its contracted scope;

vi) provide all required assistance to the Principal during all phases of the inspection, testing and commissioning process;

vii) implement the inspection, testing and commissioning requirements included in the Contract Documents in accordance with the principles defined in this Master Specification Part;

viii) take into account applicable rules, procedures, constraints and practices of the Principal in formulating and implementing its inspection, testing and commissioning process;

ix) utilise a testing and commissioning management system, commensurate with the project scale to enable effective management of testing and commissioning records;

x) provide the Principal unfettered access to the testing and commissioning management system;

xi) ensure that the testing and commissioning management system forms part of or integrates with the Quality Management System; and

xii) rectify any damage incurred as a result of undertaking testing and commissioning.

4 Pre-requisites to the commencement of testing and commissioning activities

Prior to any of the following occurring:

a) any inspections testing, energisation and commissioning of any asset or subsystem detailed by section 5; or

b) the finalisation of the Testing and Commissioning Report,

the relevant construction Work Lot(s) associated with the asset(s) and subsystems to be inspected, tested, or commissioned must be closed in accordance with PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable).

5 Inspection, testing and commissioning

5.1 General

a) Where the manufacturer of test equipment indicates that the test equipment requires calibration, the Contractor must provide the Principal with a current certificate of calibration from a NATA accredited facility valid at the time of testing.

b) Where the supplier of equipment indicates that the equipment installation requires calibration of installation tools, the Contractor must provide the Principal with a current certificate of calibration from a NATA accredited facility valid at the time of testing.

c) All testing and commissioning Quality Management Records must clearly indicate:

i) the date(s) that the testing or commissioning was conducted;

ii) the identity of the responsible personnel undertaking the testing or commissioning; and

iii) the configuration, including hardware, firmware, application software and if applicable the serial number of the device(s) tested.

d) Testing and commissioning activities must be undertaken in accordance with the activity levels defined in section 5 with lower levels forming a prerequisite for those above (e.g. level 1 is a prerequisite to level 2 and level 2.1 is a prerequisite to level 2.2).

e) Work-zone traffic management must remain in place until all inspection, testing and commissioning is completed and Handover takes place.

f) Where testing or commissioning requires the use of workzone traffic management, the Testing and Commissioning Report(s) must include a copy of the WTMP implemented.

g) Where testing or commissioning requires the application of any safety provisions (excluding workzone traffic management), the Testing and Commissioning Report(s) must include a detailed description of the safety provisions.

h) All testing and commissioning activities must be undertaken in the logical order defined by the Contract Program, Testing and Commissioning Management Plan and associated schedule.

i) Each commissioned item, system, subsystem, and asset must be provided with a commissioning certificate, with a copy appended to the Testing and Commissioning Report and the associated Work Lot.

j) Where non-compliant test results are recorded, they must be treated as a Non-Conformance and the Contractor must issue a Non-Conformance Notice and Non-Conformance Report in accordance with PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable).

k) All Non-Conformance Reports for non-compliant test results must include all relevant amended documentation (such as O&M Manuals, updated Design Documentation, including Design Report, plant and equipment specifications and all Design Drawings).

l) All finalised Non-Conformance Reports raised during the testing and commissioning process must be appended to the Testing and Commissioning Report and the associated Work Lot.

m) The documentation required by the Testing and Commissioning Management Plan in relation to testing and commissioning activities must be included as Quality Management Records.

5.2 Testing and commissioning activity definition

a) The testing and commissioning phases are broken down into their constituent levels as detailed in Table PC-CN1 5-1. The word ‘level’ is adopted as terminology to assist in describing the technical content of the testing and commissioning processes.

b) The commissioning process must follow the order detailed in Table PC-CN1 5-1.

c) The following activities must be completed as a condition precedent to Handover and Completion:

   i) unless otherwise specified in the Contract Documents, all testing and commissioning levels nominated in this PC-CN1 “Testing and Commissioning” must be complete; and

   ii) all testing and commissioning documentation must be complete.

d) The rigour of testing and commissioning activities must be commensurate with the:

   i) complexity of the system;

   ii) novelty of the design; and

   iii) risk associated with a failure.

e) Where permitted in the Contract Documents, testing and commissioning activities (levels) may be merged and the level of rigour must be maintained.

Table PC-CN1 5-1 Summary of testing and commissioning phases and levels

Phase	Level	Name	Comment
Level 0 Design	0	Developmental testing and prototyping	Testing undertaken as part of the Contractor's developmental processes.
Level 1 Manufacturing Factory Acceptance Testing	1.1	Factory Acceptance Testing (FAT)	a) Offsite testing to demonstrate correct function of plant / equipment / device / system or subsystem, including foreseeable abnormal conditions. b) Certificate for type approved standard product may be used as evidence of prior FAT.
	1.2	Factory Integration Acceptance Testing (FIAT)	Offsite integration testing of new devices and subsystems.
Level 2 Post installation inspection and testing	2.1	Physical installation inspection	Testing and commissioning team undertakes its own inspection.
	2.2	Pre-energisation electrical testing and inspection (HV / LV)	Confirms HV and LV systems and devices are safe to energise.
	2.3	Post energisation electrical testing	Confirm correct phase rotation, earth loop impedance value and RCD trip testing.
	2.4	I/O testing (point to point)	Confirm I/O wiring is correctly connected prior to control system being energised.
	2.5	Field device interface testing	Confirm communications interfaces are correctly connected, configured and operational.
Level 3 Device testing and commissioning	3.1	Subsystem interface testing	Confirm interface to equipment is in accordance with the Design Documentation and communication can be established and maintained.
	3.2	Subsystem function testing	Confirm that the plant / equipment / subsystem functions in accordance with the Design Documentation intent when integrated.
Level 4 Acceptance testing	4.1	Site Acceptance Testing (SAT)	The plant / equipment / device system or subsystem functions as per the Design Documentation intent / applicable requirements.
	4.2	System Integration Acceptance Testing (SIAT)	Confirms that the integrated system (plant / equipment / device or module) functions as specified with no undesirable emergent behaviours.
	4.3	Operational Scenario Testing (OST)	Verify correct operation of the integrated systems to the Department’s traffic management and control system.
	4.4	User Acceptance Testing (UAT)	Wholistically test the assets operation including systems processes and people in normal and emergency conditions.
Level 5 Post-opening completion system tuning	5	Post-opening completion system tuning	Optimise the system performance based on operational experience.

5.3 Level 0: Developmental testing and prototyping

a) Development testing and prototyping must be undertaken by the Contractor as part of their system development processes.

b) Development testing and prototyping will be unique to the equipment or systems (as applicable) under development and the supplier development processes and must be described in:

i) the Systems Engineering Management Plan; or

ii) a relevant Project Plan (such as the Testing and Commissioning Management Plan), where a Systems Engineering Management Plan is not required.

5.4 Level 1: Manufacturers Factory Acceptance Testing (FAT and FIAT)

5.4.1 Level 1.1: Factory Acceptance Testing (FAT)

a) For the FAT the Contractor must demonstrate to the Principal (to the extent possible) that the system, plant or equipment (as applicable) satisfies the requirements and conforms to the Design Documentation, which will constitute a **Witness Point**.

b) The Contractor must establish, implement, and maintain a comprehensive FAT Plan which defines the proposed FAT activities and includes:

i) definition of the system, plant or equipment under consideration;

ii) details of all tests proposed for FAT and be relevant to the system, plant or equipment (as applicable);

iii) where Quality Management Records are to be relied upon to demonstrate the system, plant, or equipment (as applicable) satisfies applicable requirements they must be identified; and

iv) where the system, plant, or equipment (as applicable) includes control, monitoring and telecommunications-related systems, the testing of all software modules and all associated hardware.

c) The FAT Plan must be submitted to the Principal for approval, which will constitute a **Hold Point**. The relevant FAT must not occur until this Hold Point is released.

d) Where a number of identical devices being used for the same purpose are required in the Contract Documents, the Contractor may test individual devices to prove a device-type's compliance with the Contract Documents.

e) Where accepted by the Principal:

i) certificates for type approved products may be submitted as evidence or partial evidence (subject to the certificate scope), in demonstrating compliance with 5.4.1a); and

ii) test records for previously tested devices or subsystems may be submitted as evidence or partial evidence (subject to the testing scope), in demonstrating compliance with 5.4.1a).

f) Following the successful FAT process being complete, the Contractor must document the results in a FAT report and submit it to the Principal for approval, which will constitute a **Hold Point**.

g) The relevant system, plant, and equipment (as applicable) must not be delivered to Site until the Hold Point in accordance with section 5.4.1f) has been released.

h) The FAT and SAT programs must be designed to be complementary and minimise the level of site testing required as part of SAT by demonstrating to the Principal (to the extent possible), the system, plant or equipment (as applicable) satisfies the applicable requirements in FAT.

i) Where changes are made to systems, plant, or equipment (as applicable) between FAT and SAT, the required retesting must be identified and undertaken to ensure any potential impacts are identified.

5.4.2 Level 1.2 Factory Integration Acceptance Testing (FIAT)

a) The Contractor must establish, implement, and maintain a comprehensive FIAT Plan which defines, the proposed FIAT activities for each interface between systems or subsystems and includes:

i) definition of the system, plant or equipment under consideration;

ii) details of all tests proposed for FIAT and be relevant to the system, plant or equipment (as applicable);

iii) where Quality Management Records are to be relied upon to demonstrate the system, plant, or equipment (as applicable) satisfies applicable requirements they must be identified;

iv) capacity to establish and maintain communication;

v) correct exchange of each data point;

vi) correct response to under range and overrange values; and

vii) correct response to connection failure.

b) The FIAT Plan must be submitted to the Principal for approval, which will constitute a **Hold Point**. The relevant FIAT must not occur until this Hold Point is released.

c) Any interface between systems or subsystems must be evaluated as part of FIAT, which will constitute a **Witness Point**.

d) Following the successful FIAT process being complete, the Contractor must document the results in a FIAT report and submit it to the Principal for approval, which will constitute a **Hold Point**.

e) The relevant system, plant, and equipment (as applicable) must not be delivered to Site until the Hold Point in accordance with section 5.4.2d) has been released.

f) The FIAT and SIAT programs must be designed to be complementary and minimise the level of site testing required as part of SIAT by demonstrating to the Principal (to the extent possible), the system, plant or equipment (as applicable) satisfies the applicable requirements in FIAT.

g) Where hardware or software changes are made to systems, plant, or equipment (as applicable) between FIAT and SIAT, the required retesting must be identified and undertaken to ensure any potential impacts are identified and that the systems, plant or equipment still comply with the Contract Documents requirements.

5.5 Level 2: Installation, inspection and testing

5.5.1 Level 2: General requirements

a) Construction completion and verification following the installation of the relevant plant and equipment forms is a prerequisite to undertaking level 2 testing in accordance with this Master Specification Part.

b) For level 2 (installation, inspection and testing) the construction team must confirm the following prior to handover for testing and commissioning:

i) the plant and equipment (as applicable) has been unpacked, carefully and fully assembled, and installed within the Works in accordance with the Construction Documentation, including the Design Documentation and the manufacturers specifications, and it has been confirmed that no damage has been incurred during this process;

ii) that all fixings and fasteners have been torqued, checked and marked accordingly and that the ITP has been completed;

iii) that permanent labelling has been applied;

iv) that surface finishes are intact or have been appropriately reinstated in accordance with the Non-Conformance Report and the manufacturers repair process where any damage to such finishes have been incurred during the installation process;

v) all control and power cabling has been installed correctly on (or within) fully completed cable containment systems and that all cables are of the type specified and captured within the Design Documentation and cable schedule; and

vi) that all covers are in place and that all fasteners are present.

5.5.2 Level 2.1: Physical installation inspection

The Testing and Commissioning Management Plan must include installation inspection activities for all plant and equipment (as applicable) upon hand-over from the construction team, to confirm:

a) that the equipment has been assembled and installed in accordance with the Construction Documentation, including the Design Documentation and the manufacturer's requirements;

b) they are electrically and mechanically complete;

c) the origin and destination testing for cables;

d) they are free from damage and Defects; and

e) that correct equipment and cabling labelling is present.

5.5.3 Level 2.2: Pre-energisation electrical testing and inspection

a) The Testing and Commissioning Management Plan must include pre-energisation electrical inspection and testing activities for all of the HV and LV distribution systems.

b) All pre-energisation inspections for HV systems and LV switchboards will constitute a **Witness Point**. Proceeding to level 2.3 (post energisation testing) must not occur until the Contractor has satisfied this Witness Point.

c) For level 2.2 (pre-energisation electrical testing and inspection), the Contractor must include:

i) HV electrical system auditing and statutory inspections with the supply Authority (as applicable);

ii) HV electrical system testing to confirm the integrity of the HV distribution network prior to its energisation including both private and supply Authority protection system testing, as required; and

iii) LV electrical distribution system inspection and testing to confirm the integrity of the LV distribution system prior to energisation in accordance with the Reference Documents, including the Australian standards, and the supply Authority service and installation requirements.

d) Pre-energisation testing activities must only be performed by the Contractor's commissioning personnel once an area has been formally placed under the control of the commissioning personnel.

e) Energisation of the HV and LV power systems must not be undertaken until the pre-energisation electrical testing, inspection and auditing processes have been successfully completed.

f) Following successful completion of the pre-energisation electrical testing, inspection, and auditing processes and prior to commencement of the level 2.3 (post energisation testing) the Contractor must implement the Contractor's lock-out / tag-out (LOTO) system.

5.5.4 Level 2.3 Post energisation testing

a) The Testing and Commissioning Management Plan must include post-energisation electrical inspection and testing activities for all of the HV and LV distribution systems.

b) All post-energisation inspections for HV systems and LV switchboards will constitute a **Witness Point**. Energisation of the relevant system or switchboard (as applicable) must not occur until the Contractor has satisfied this Witness Point.

c) For level 2.3 (post energisation testing), the Contractor must:

i) inspect and test the HV electrical distribution system to confirm the integrity of the HV distribution system post energisation in accordance with the Reference Documents,

including the Australian standards, and the supply Authority service and installation requirements; and

ii) test the substation automation protection system.

d) For level 2.3 (post energisation testing), the Contractor must inspect and test the LV electrical distribution system to confirm the integrity of the LV distribution system post energisation in accordance with the Reference Documents, including the Australian standards, and the supply Authority service and installation requirements.

e) Post-energisation testing activities must only be performed by the Contractor's commissioning personnel once an area has been formally placed under the control of the commissioning personnel and is electrically isolated from the remainder of the Contractor's Activities.

5.5.5 Level 2.4: I/O testing

a) Where a system includes I/O devices then the Testing and Commissioning Management Plan must include I/O testing activities.

b) All I/O testing activities will constitute a **Witness Point**. Level 2.5 (field device interface testing) must not commence until the Contractor has satisfied this Witness Point.

c) For level 2.4 (I/O testing) testing and commissioning activities, the Contractor must verify:

i) all I/O wiring is correctly terminated and labelled, referred to and point to point testing is undertaken;

ii) that field cabling associated with each I/O point has been correctly installed, terminated and labelled in accordance with the Design Documentation;

iii) that field devices are connected to the correct I/O points in accordance with the Design Documentation; and

iv) that the I/O mapping within the logic solver is correct in accordance with the Design Documentation.

5.5.6 Level 2.5 Field device interface testing

a) Where a system includes field devices which use a serial or ethernet interface, then the Testing and Commissioning Management Plan must include testing activities to confirm that:

i) the field device is correctly connected via the allocated ports;

ii) reliable communication is established and maintained; and

iii) the function of the interface is evaluated in level 5 (system tuning) testing activities.

b) All level 2.5 (field device interface testing) activities will constitute a **Witness Point**. Level 3 (device and control software module testing and commissioning) must not commence until the Contractor has satisfied this Witness Point.

5.6 Level 3: Device and control software module testing and commissioning

5.6.1 Level 3.1 Subsystem interface testing

a) The Testing and Commissioning Management Plan must detail the required subsystem interface testing to verify:

i) the correct operation of each subsystem and field device in response to commands from the controlling system; and

ii) that each field device provides correct status to the controlling system in accordance with the Design Documentation.

b) All level 3.1 (subsystem interface testing) activities will constitute a **Witness Point**. Level 3.2 (subsystem function testing) must not commence until the Contractor has satisfied this Witness Point.

5.6.2 Level 3.2: Subsystem function testing

a) The Testing and Commissioning Management Plan must detail the required subsystem function testing to verify:

i) all field devices, plant and equipment installed within the scope of the project has been successfully integrated in accordance with the Design Documentation; and

ii) all fail-over provisions are functional.

b) All level 3.2 (subsystem function testing) activities will constitute a **Witness Point**. Level 3.2 (subsystem function testing) must not commence until the Contractor has satisfied this Witness Point.

5.7 Level 4: Acceptance testing

5.7.1 Level 4.1: Site Acceptance Testing (SAT)

a) The Contractor must establish, implement, and maintain a comprehensive SAT Plan which defines the proposed SAT activities and includes:

i) testing processes for acceptance outcomes of all level 4 (acceptance testing) testing and commissioning activities;

ii) processes to verify whether the installed equipment or system (as applicable) meets (or exceeds) the applicable requirements; and

iii) processes for each system that demonstrates the correct operation of each interface as defined by the interface control document prior to integrated testing.

b) The SAT Plan must be submitted to the Principal for approval, which will constitute a **Hold Point**. The relevant SAT must not occur until this Hold Point is released.

c) All level 4.1 (Site Acceptance Testing) activities will constitute a **Witness Point**.

d) Following the successful SAT process being complete, the Contractor must document the results in a SAT report and submit it to the Principal for approval, which will constitute a **Hold Point**.

e) Level 4.2 (system integration acceptance testing) must not commence until the Hold Point in accordance with section 5.7.1d) has been released.

5.7.2 Level 4.2: System Integration Acceptance Testing (SIAT)

a) The Contractor must establish, implement, and maintain a comprehensive SIAT Plan which defines the proposed SIAT activities and includes:

i) testing processes to confirm that the integrated system (comprising all plant, equipment, field devices and software modules) functions in accordance with the Design Documentation and satisfies all applicable requirements;

ii) processes which aim to reveal emergent system behaviours resulting from the interaction of the integrated system; and

iii) all SIAT activities to verify the operation of the systems provided for all the Works in normal and emergency conditions against the Design Documentation intent using actual (not simulated) system interfaces.

b) The SIAT Plan must be submitted to the Principal for approval, which will constitute a **Hold Point**. The relevant SIAT must not occur until this Hold Point is released.

c) All level 4.2 (system integration acceptance testing) activities will constitute a **Witness Point**.

d) Following the successful completion of the SIAT process, the Contractor must document the results in a SIAT report and submit it to the Principal for approval, which will constitute a **Hold Point**.

e) Level 4.3 (Operational Scenario Testing) must not commence until the Hold Point in accordance with section 5.7.2d) has been released.

5.7.3 Level 4.3: Operational Scenario Testing (OST)

a) The Principal will engage Transmax Pty Ltd to:

i) develop and conduct the Operational Scenario Testing; and

ii) be present onsite or at the Traffic Management Centre during this event to supply onsite support and aid test scenarios.

b) The Principal must ensure that Transmax Pty Ltd develops an OST Plan as part of their engagement, which demonstrates how the OST will demonstrate compliance with this Master Specification Part.

c) The Principal must ensure that the OST Plan is submitted by Transmax Pty Ltd to the Principal. The relevant OST must not occur until the Principal approves the OST Plan.

d) The Principal must ensure that the OST:

i) is undertaken from the Traffic Management Centre, after completion of the SIAT and once all devices controlled and monitored by STREAMS for a defined stage have been transferred to the Department's traffic management and control system production server;

ii) demonstrates that incident detection input into STREAMS automatically generates appropriate responses on the field devices;

iii) tests all possible functionality of either response plans or the field response engine within STREAMS for road management; and

iv) verifies operator competency to safely operate the Works under all foreseeable circumstances.

e) The Contractor must provide all required support to the Principal to enable the Principal to undertake OST. At a minimum, this must include:

i) all required site management including traffic management;

ii) provision of sufficient test vehicle(s) and vehicle operators where the OST requires the use of vehicles;

iii) on-site verification of correct ITS field device operation and response;

iv) on-site verification of correct sign displays;

v) field technical support to simulate field faults;

vi) technical support to ensure that devices are operating correctly, and to attend and repair any faults during OST;

vii) attendance for OST; and

viii) any other support specified in the Contract Documents.

f) Where the OST identifies any Defects associated with the system(s) supplied or modified by the Contractor, the Contractor must, at the Contractor's cost, including any delay costs:

i) rectify these Defects in accordance with the Contractor's change management process;

ii) if necessary, reschedule OST, including liaising with all required parties; and

iii) be available and provide support to repeat all Operational Scenario Testing on all systems and devices which may have been affected by the rectification process.

g) The Contractor must:

i) obtain confirmation from the Traffic Management Centre manager following the successful completion of the Operational Scenario Testing: and

ii) include all confirmation records required by section 5.7.3g)i) in the Quality Management Records.

h) Following the successful OST process being complete, Transmax Pty Ltd will document the results in an OST report.

i) Level 4.4 (user acceptance testing) must not commence until the OST report in accordance with section 5.7.3h) has been issued to the Contractor.

5.7.4 Level 4.4: User Acceptance Testing (UAT)

a) UAT must be coordinated by the Principal and the Contractor must provide all support required of the Principal.

b) UAT activities must be designed to:

i) holistically test the asset's operation in both normal and emergency conditions and must include all relevant arms of the emergency services; and

ii) test the processes, systems, people, training and interfaces that facilitate the operation of the asset.

c) The Contractor must provide all required support to the Principal to enable the Principal to undertake UAT. At a minimum, this must include:

i) providing all required site management including, traffic management;

ii) provision of sufficient test vehicle(s) and vehicle operators where the UAT requires the use of vehicles;

iii) on-site verification of correct ITS field device operation and response;

iv) on-site verification of correct sign displays;

v) provide field technical support to simulate field faults;

vi) provide technical support to ensure that devices are operating correctly, and to attend and repair any faults during UAT;

vii) attendance for UAT; and

viii) any other support specified in Contract Documents.

d) Where the UAT identifies any Defects associated with the system(s) supplied or modified by the Contractor, the Contractor must, at the Contractor's cost, including any delay costs:

i) rectify these Defects in accordance with the Contractor's change management process;

ii) if necessary, reschedule UAT, including liaising with all required parties; and

iii) be available and provide support to repeat all UAT on all systems and devices which may have been affected by the rectification process.

e) Following the successful UAT process being complete, the Principal will document the results in a UAT report.

f) Successful completion of all UAT activities (as determined by the Principal) is a condition precedent to Handover.

g) Level 5 (post-opening completion system tuning) must not commence until Handover has been achieved in accordance with the Contract Documents, including PC-CN2 "Asset Handover".

5.8 Level 5: Post-opening completion system tuning

a) For post-opening completion system tuning, the contractor must undertake tuning of all control algorithms as operational data is accrued to:

   i) maximise operational efficiency;

   ii) minimise energy consumption and waste streams; and

   iii) optimise operational safety (including minimisation of congestion).

b) Undertaking system tuning does not obviate the Contractors obligation to address Defects.

6 Testing and Commissioning Report, schedules and plans

6.1 Commissioning records submission

a) Subject to section 6.1c), the Contractor must utilise a testing and commissioning management system, with open access to the system being provided to the Principal for independent review, data analysis and report generation purposes.

b) The Contractor must ensure that:

   i) the testing and commissioning data is promptly entered into the testing and commissioning management system; and

   ii) the testing and commissioning management system is continuously maintained and kept in an up to date state (as much as possible).

c) Where permitted in the Contract Documents, the Contractor may choose to use an alternative method from the requirements in section 6.1a) to manage the testing and commissioning data.

d) The Contractor must progressively submit finalised Testing and Commissioning Reports (from either the testing and commissioning management system in accordance with section 6.1a) or the alternative system in accordance with section 6.1c) (as applicable)) and all associated Quality Management Records within 7 Business Days of the applicable commissioning activity having been completed.

6.2 Testing and Commissioning Report requirements

a) Testing and Commissioning Reports must include:

   i) a table of contents;

   ii) fully detailed test results, including test reports;

   iii) appendices with registers for all relevant ITPs, test results, Non-Conformance Reports, and commissioning certificates;

   iv) include all relevant finalised Quality Management Records (including any Non-Conformance Reports);

   v) details of any remedial works undertaken to facilitate the testing and commissioning process;

   vi) as a minimum, provide the information required by the Testing and Commissioning Report referred to in 2.1a)x); and

   vii) include all relevant completed commissioning certificates in accordance with section 5.1i).

b) Without limiting the requirements of PC-PM5 “Information Management”, all reports and manuals must be in the Principal’s template Microsoft Word format, and be bookmarked electronically for easy navigation and referencing. They must be formatted in accordance with the Principal’s template and have a linked table of contents.

c) The Contractor may add its company logo to the front page of the Testing and Commissioning Report provided it is of high-resolution quality and of a size no larger than the Department's logo.

6.3 Commissioning schedule

a) The Contractor must develop a fully detailed testing and commissioning schedule that contains all testing and commissioning activities and associated Hold Points and Witness Points.

b) The testing and commissioning schedule must be updated and submitted to the Principal on a weekly basis as testing and commissioning activities progress towards Handover and Completion.

7 Decommissioning

a) Where part of the Contractor's Activities, Works or Temporary Works includes the decommissioning of one or more systems, plant or equipment, the Contractor must establish, implement, and maintain a comprehensive Decommissioning Testing Plan which defines the proposed decommissioning test activities and includes:

   i) definition of the system, plant, or equipment under consideration; and

   ii) detail of all tests proposed to demonstrate the decommissioning activity has not adversely affected remaining parts of any operational systems, plant, or equipment.

b) For decommissioning of traffic signals, ITS equipment and lighting, refer to RD-ITS-C1 "Installation and Integration of ITS Equipment".

c) Disused materials, life expired plant and equipment must be recycled or re-used wherever possible.

d) The Contractor must dispose of all waste material, items and equipment generated during the commissioning process in accordance with the sustainability and waste management requirements.

8 Hold Points and Witness Points

a) Table PC-CN1 8-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

b) Table PC-CN1 8-2 details the review period or notification period, and type (documentation or construction quality) for each Witness Point referred to in this Master Specification Part.

Table PC-CN1 8-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period[(1)(2)]
5.4.1c)	FAT Plans	Documentation	90 days review
5.4.1f)	FAT report	Documentation	4 weeks review
5.4.2b)	FIAT Plan	Documentation	90 days review
5.4.2d)	FIAT report	Documentation	4 weeks review
5.7.1b)	SAT Plan	Documentation	90 days review
5.7.1d)	SAT report	Documentation	4 weeks review
5.7.2b)	SIAT Plans	Documentation	90 days review
5.7.2d)	SIAT report	Documentation	4 weeks review

Table notes:
(1) Unless otherwise required by a relevant Third Party Agreement, a Third Party is required to review the documentation in accordance with PC-QA2 “Quality Management Requirements for Major Projects” where the asset to be inspected, is the owner, maintainer or operator of that asset.
(2) Unless otherwise required by a relevant Third Party Agreement.

Table PC-CN1 8-2 Witness Points

Section reference	Witness Point	Documentation or construction quality	Review period or notification period
5.4.1a)	Factory Acceptance Testing (each instance)	Construction quality	a) 20 Business Days notification for domestic tests b) 45 Business Days notification for international tests
5.4.2c)	Factory Integration Acceptance Testing (each instance)	Construction quality	a) 20 Business Days notification for domestic tests b) 45 Business Days notification for international tests
5.5.3b)	Pre-energisation inspections for all HV systems and LV main switchboards	Construction quality	10 Business Days notification
5.5.4b)	Post-energisation inspections for all HV systems and LV main switchboards	Construction quality	10 Business Days notification
5.5.5b)	I/O testing (each instance)	Construction quality	10 Business Days notification
5.5.6b)	Field device interface testing (each instance)	Construction quality	10 Business Days notification
5.6.1b)	Subsystem interface testing (each instance)	Construction quality	10 Business Days notification
5.6.2b)	Subsystem function testing (each instance)	Construction quality	10 Business Days notification
5.7.1c)	Site Acceptance Testing	Construction quality	10 Business Days notification
5.7.2c)	Site integration acceptance testing	Construction quality	10 Business Days notification