ITS specification

Commissioning and Handover process (ITS-10-01)

First edition, Amendment 4

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NZ TRANSPORT AGENCY
WAKA KOTAHI

More information ...

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Document management plan

1) Purpose

The purpose of this document is to specify the requirements for the commissioning, handover and maintenance acceptance process requirements for technology systems and equipment.

2) Document information

Document name	*ITS specification: Commissioning and handover process*		
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3) Key words

ITS Commissioning and Handover.

Record of amendments

Amendment number	Section amended	Description of change	Updated by	Effective date
Draft R0	All	ITS Draft Specifications Issue	TLH & JF	22/9/2010
Draft R1	6.4.8	Supply of Software Source Code Removed	JF	28/01/10
Draft R2	6.6, 7.1, 7.2	RAMM Database requirements	NG	19/12/2011
Draft R3	All	Multiple ammendments	MF & NG	16/1/2012
Draft R4	All	Provisional	BW & JS	15/2/2012

Contents

1.0 Purpose of the document

1.1 Scope

The purpose of this document is to define the process that is to be followed in the delivery and handover of ITS Systems and Components into Operation and Maintenance (O&M).

This document describes the elements that should be considered prior to commencement of installation works through to those activities involved in handing ITS equipment (as defined by the NZTA specifications) over for operation and maintenance.

The key elements of commissioning are identified along with the order in which these shall be addressed. Familiarisation with this document shall enable the user to understand the correct sequence of events needed to ensure that the commissioning of ITS equipment is implemented successfully.

1.2 Staging

The key stages of the Technology Scheme commissioning and handover process as defined below are:

a. Stage 1 Factory Acceptance Testing

b. Stage 2 Site Acceptance Testing

c. Stage 3 Network Testing and Commissioning

d. Stage 4 Defects Liability Maintenance

e. Stage 5 Maintenance Handover

Key stakeholders involved within each stage of the Commissioning Process are identified within this document but the typical roles stated are subject to contract specific conditions and as such should be determined at the start of each stage.

Collaboration is a crucial element to the Commissioning and Handover Process and this is repeatedly emphasised throughout this document.

Each stage of the Commissioning Process includes a list of deliverables that shall be in place before the next stage of the process is commenced. This list is not exhaustive and is intended to give examples of the requirements on a typical scheme. Contract specific conditions shall always be applied to the generic requirements laid out within this document and the extensive list of associated specifications.

Specific areas of risk are also identified at the end of this overview chapter to allow the user to be aware of some of the issues that may prevent the Commissioning Process from progressing from one stage to the next.

1.3 Background

Effective maintenance and operation of ITS equipment is essential for the safety of all road users and for achieving the NZ Transport Agency's (NZTA) objectives as Network Operator.

The NZTA role includes whole of life support for its Technology Systems. The operation and maintenance element of this is provided by contractors appointed on a term basis. Their objectives are to optimise operational availability and minimise whole life costs, whilst protecting capital investment. Such objectives can only be achieved where there are economies of scale from standardised equipment, and effective operational and maintenance practice.

At the Maintenance Handover stage of a scheme (Stage 5), the systems provided must be handed over to the appropriate maintenance authority for ongoing O&M support. As part of this process, the NZTA needs to be satisfied that the systems can be maintained in accordance with national standards and practice.

This ensures that whole of life support objectives are achieved and that safety is not compromised.

It is therefore a contractual requirement for all schemes that provide ITS equipment to comply with the O&M requirements defined in this specification. Failure to comply will mean that adequate whole of life maintenance and support requirements cannot be guaranteed.

2.0 ITS equipment design considerations

2.1 Whole of life considerations

When designing a deployment of ITS field equipment it is important to consider the whole of life requirements of the asset including site maintenance access issues. The deployment of unsupported equipment types and systems can significantly impact ongoing costs, reliability and life span of the installed equipment.

It is important that there is consistency of hardware and communications protocols being integrated in the field, that the equipment is the current model approved by the NZTA with support provided by the manufacturer and available through more than one supplier.

If a new type of equipment is proposed, it must go through type approval testing by the NZTA and their network operations and maintenance organisations to ensure compatibility with existing systems and functional requirements for operations.

It is acknowledged that the ITS field is driven by constant technical advances and thus the network operations and maintenance organisations can provide guidance for any issues that the contractor may perceive.

It is very important to provide safe maintenance access for ITS installations as the sites are often critical to the safe operation of the road corridor and rapid access to assist without the need for traffic management.

2.2 Operational requirement considerations

During the design phase it is critical that the Control Room Operators, Network Operators and Regional Maintenance Organisations are consulted on the proposed locations of new equipment to ensure that the equipment locations are both serviceable and provide the Control Room Operators with an asset that fits their requirements.

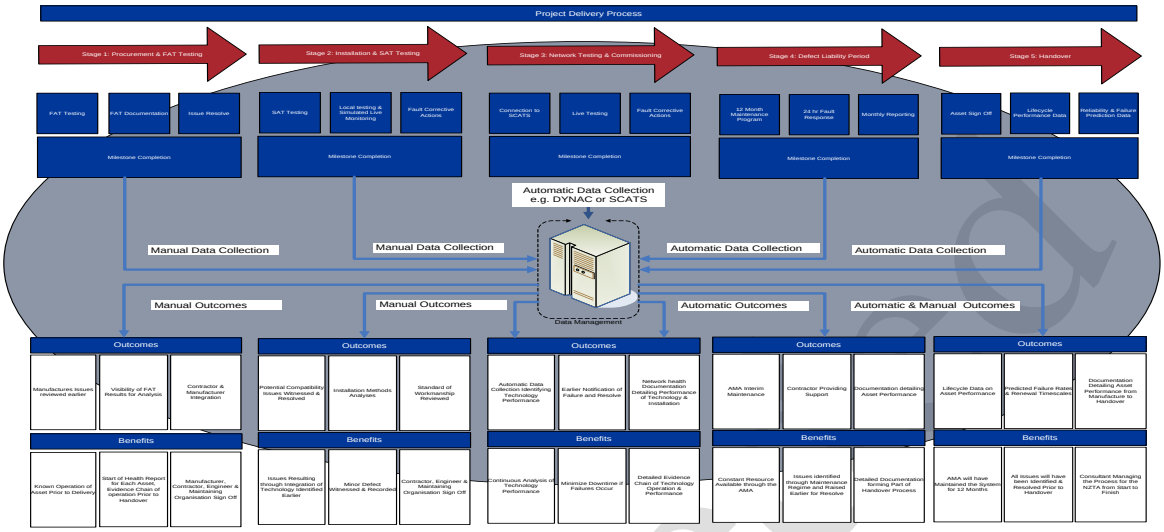
2.3 Assumptions

A control and development process controlled by the Contract Engineer runs in parallel to this specification and its functionality is mentioned but not described.

It is assumed that all change control requests and network configuration documentation have been compiled and approved by the relevant organisations for this process to proceed.

3.0 Process overview

Appendix A provides the Commissioning Process for ITS equipment. The flow chart may be applied to the commissioning of any ITS equipment and each Stage is summarised within this document.



There is a 'HOLD POINT' between each Stage in the process where all deliverables identified for that Stage of a scheme must be in place before progressing to the next Stage.

The Activities that make up each Stage of the process are identified in process charts within Appendix A of this document. These are expanded upon within Part B with descriptions, specific key deliverables, responsibilities and recommended timescales for all the activities

4.0 Stage 1 – Factory acceptance testing

4.1 Factory acceptance testing requirements

All items of equipment supplied shall be comprehensively tested in the manufacturer's production facility in accordance with documented and certified testing procedures.

Production test reports for each item of equipment shall be collated, bound and delivered as part of the As Built documentation requirements.

It shall be the Contractor's responsibility to demonstrate that all tests have been carried out and that the test reports demonstrate the equipment is fit for the designed purpose. Schedule of Works shall include dates for all tests. The Contractor shall provide adequate notice of dates when testing will actually take place.

All equipment and systems supplied are required to undergo comprehensive pre-delivery factory acceptance testing to be witnessed by the Engineer, or their representative.

Unless otherwise stated in the contract documents, three weeks before the scheduled date for factory acceptance testing, the Contractor shall submit a detailed list of the proposed factory acceptance test procedures for the Engineer's review and acceptance. The Engineer shall review the test procedure and the Contractor shall incorporate any requested modifications in the procedure and resubmit prior to the scheduled tests.

All measuring instruments required to measure parameters shall be calibrated by an approved testing authority.

The equipment will be inspected for standards of construction and electrical and mechanical safety.

Testing shall be carried out at the place of manufacture or assembly.

Unless otherwise stated in the contract documents, the Contractor shall inform the Engineer in writing two weeks in advance of the Contractor's intent to undertake the tests. The Engineer, or the Engineer's representative, will attend and witness the tests.

Prior to testing, all equipment under test shall be livened and left to "soak" for at least 24hrs.

4.2 Key activities, deliverables and responsibilities

Deliverables for key activities are summarised in the table below:

Key Activities	Deliverables
Equipment approval	All technology items identified in the design have met the criteria outlined in the Asset Technical Specification (e.g. functional requirements).
Factory Acceptance Test (FAT)	Witness that the operation of the technology meets the minimum requirements identified prior to purchase in the assets functional requirements and technical specifications.
FAT documentation	Compilation of test certificates detailing the asset's worthiness and operational abilities.
Milestone completion	The sign-off of each asset's operational suitability in order to move to the Site Acceptance stage.

Roles and responsibilities for key personnel for key activities are summarised in the table below:

Key Personnel	Equipment Approval	Factory Acceptance Test	FAT documentation	Milestone completion
NZTA Project Manager	Overall control of the project and order approval;	Overall control of the project	Overall control of the project	Overall control of the project
Contract Engineer (or Engineer's Representative)	Act on behalf of the client and providing liaison between contractor and the client	Act on behalf of the client and providing liaison between contractor and the client	Act on behalf of the client and providing liaison between contractor and the client and certification of the documentation to form part of the handover process	Act on behalf of the client and providing liaison between contractor and the client
Contractor	Responsible for the delivery of technology into operations and maintenance	Responsible for the delivery of technology into operations and maintenance	Prepares documentation for the Engineer	Install pre-approved technology
NZTA Network Communications Team	Confirm acceptability of proposed equipment in the network	N/A	N/A	Confirm acceptability of proposed equipment in the network
Maintenance Contractor	Advise acceptability of proposed equipment maintenance requirements	An optional attendee	Review test results and advise the Engineer of the acceptability of test results	Confirm their agreement with the technologies operational worthiness
Manufacturer	N/A	Perform the FAT	N/A	N/A

The expected outcomes and benefits of each key activity in Stage 1 are summarised in the table below:

Key Activities	Benefits
Equipment approval	The expected outcomes and benefits of early identification of proposed equipment for the Network Communication Team and Maintenance Contractor shall ensure no delays with integration further down the line, enabling the maintenance contractor to better plan maintenance regimes with the early notification of new assets.
Factory Acceptance Test (FAT)	The expected outcomes and benefits are that the asset's core functionality is confirmed and its ability to exist within the operational environment is highlighted and that manufacturing issues are identified prior to delivery, ensuring speedier resolution. Early involvement of the maintenance organisation to satisfy them of the validity of the test will streamline their subsequent acceptance of the equipment handover.
FAT documentation	Certification and sign-off from the NZTA and their maintenance contractor provides the start of the evidence chain of the asset's ability to operate. Documentation will form part of the handover process that will be delivered to the NZTA and their maintenance contractors in order for the ITS System and components to be handed over.
FAT documentation	The expected outcomes and benefits of ensuring that all parties have signed off prior to the completion of Stage 1 is to provide an audit trail that will assist in the successful handover of ITS equipment and the entire system into operational maintenance.

5.0 Stage 2 – Site acceptance testing

5.1 Installation and site acceptance testing

Upon completion and the sign-off of Stage 1 the technology is ready for installation. The purpose of the site acceptance test is to satisfy all parties that the asset and associated components are operating correctly in the local environment prior to any network configuration.

Unless the Contract Engineer agrees otherwise, a pre-SAT will be undertaken by the contractor prior to the actual SAT to ensure operational capability.

The Contractor shall supply structured site testing and commissioning procedures in line with the NZTA guidelines for site acceptance testing for all equipment in the scope of their supply. The procedures shall cover site tests to be performed on individual components, subsystems, and the complete system, as necessary to confirm that the system functions satisfactorily and fulfils the requirements of this specification.

These procedures shall be made available to the Contract Engineer prior to the commencement of any test. These procedures will be made available by the Engineer to both the NZTA Project Manager and the Maintenance Contractor for external review; only upon approval from both organisations shall the Engineer permit the tests to commence.

All tests shall only be carried out between the hours of 10:00 – 15:00 Monday to Friday to ensure the tests do not impact on the normal day to day operation of the network or cause any undue concern to motorists. However dispensation may be granted by the Engineer if these tests are undertaken in environments that are not accessible to the general public. Unless otherwise stated in the contract documents, tests that are required to be undertaken outside normal working hours shall need to be organised a minimum of 3 weeks in advance of the test to ensure all parties are available.

The following organisations shall be involved in all Site Acceptance Testing, their roles and responsibilities shall be fully defined within the testing procedures supplied by the contractor but will typically include:

- NZTA Project Manager: Responsible for the overall project
- Contract Engineer: Witness for the project
- Contractor: Responsible for undertaking the test
- Maintenance Contractor : Witness for O&M

5.2 Key activities, deliverables and responsibilities

Deliverables for key activities are summarised in the table below:

Key Activities	Deliverables
Network change request	The key deliverable is to ensure all technology that will be eventually connected to the NZTA network is configured in accordance with the NZTA Network operations protocols and relevant subsystem configuration, e.g. DVTel CCTV Configuration.
Develop site acceptance	The key deliverable is the detailed document outlining each test that will be

procedure	undertaken including a program of delivery that will outline the timings of each event and expected outcome.
Site Acceptance Test	The key deliverable is to witness that the operation of the technology meets the minimum requirements identified prior to purchase in the assets functional requirements and technical specifications and the equipment operates within the environment.
SAT documentation	The key deliverable is compilation of test certificates detailing the asset's worthiness and operational abilities in its operational environment.
Milestone completion	The key deliverable is the sign-off that the ITS site and associated assets are operational in order to move to the Network Testing and Commissioning stage.

Roles and responsibilities for key personnel for key activities are summarised in the table below:

Key Personnel	Network change request	Develop site acceptance procedure	Site Acceptance Test	SAT documentation	Milestone completion
NZTA Project Manager	Overall control of the project;	Overall control of the project	Overall control of the project	Overall Control of the Project	Overall control of the project
Contract Engineer (or Engineer's Representative)	Review network change requests and provide liaison between contractor and the client	Approves testing procedure on behalf of the client. Liaison between contractor and required attendees of the test	Act on behalf of the client and providing liaison as witnessing the test	Act on behalf of the client and providing liaison between contractor and the client and certification of the documentation to form part of the handover process	Act on behalf of the client and providing liaison between contractor and the client
Contractor	Produce the relevant documentation that will enable each asset to connect to the NZTA network and associated sub systems	Responsible for the development of a testing plan	Responsible for the site acceptance testing	Prepares documentation for the Engineer	Install factory tested technology
NZTA Network Communications Team	Approval of network change requests	Advised of proposed testing - impact is minimal as equipment is not to be connected to	N/A	N/A	Confirm acceptability of proposed equipment in the network

		the network			
Maintenance Contractor	N/A	N/A	An optional attendee	Review test results and advise the Engineer of the acceptability of test results	Confirm their agreement with the technologies operational worthiness

The expected outcomes and benefits of each key activity in Stage 2 are summarised in the table below:

Key Activities	Expected outcomes and benefits
Network change request	The expected outcome and benefit of ensuring that all control and addressing documentation is complete is a speedier integration into the NZTA network resulting in a right first time response and that when all parties are fully aware of what is due to be connected there will be no gaps in commissioning.
Develop site acceptance procedure	The expected outcomes and benefits are that the asset's core functionality is confirmed and its ability to exist within the operational environment is highlighted and that manufacturing issues are identified prior to delivery, ensuring speedier resolution. Early involvement of the maintenance organisation to satisfy them of the validity of the test will streamline their subsequent acceptance of the equipment handover.
Site Acceptance Test	The expected outcomes and benefits are that the asset's core functionality and its ability to work in the operational environment is confirmed and that local issues are identified and resolved prior to network integration, ensuring speedier resolution. Early involvement of the maintenance organisation to satisfy themselves of the validity of the test will streamline their subsequent acceptance of the equipment handover.
SAT documentation	Certification and sign-off from the NZTA and their maintenance contractor continues the evidence chain of the asset's ability to operate. Documentation will form part of the handover process that will be delivered to the NZTA and their maintenance contractors in order for the ITS System and components to be handed over.
Milestone completion	The expected outcomes and benefits of ensuring that all parties have signed off prior to the completion of stage 2 is to provide an audit trail that will assist in the successful handover of ITS components and the entire system into operational maintenance.

6.0 Stage 3 – Network testing and commissioning

6.1 Network testing

Upon completion of Stage 2 and with the agreement of the Contract Engineer and Maintenance Contractor, each site and associated assets shall be in a position for network integration.

Strict adherence to NZTA procedures shall be followed to ensure the integrity of the existing network and that associated assets are not comprised by the introduction of additional and new technologies. This stage of the commissioning and handover process shall be a collaborative effort between the following parties:

a. NZTA Project Manager

b. Contract Engineer

c. Contractor

d. Maintenance Contractor

e. NZTA Network Communications Team

A detailed testing and commissioning plan shall be developed between the Contract Engineer and the Installation Contractor outlining in clear detail the delivery timescales and the roles and responsibilities that each member of the Testing and Commissioning Team shall undertake.

This plan shall include:

a. Dates and times the integration shall take place

b. The order of connection

c. Provide detail of all assets that are being connected including:

d. Equipment type

e. Manufacturer

f. Serial number

g. Communication path

h. IP address

i. MAC address

j. Relevant configuration detail

k. SAT results

l. Relevant technology tests – including the definition of a 'fault-free' period

m. Roles and responsibilities

n. All involved contact details, including a fall back contact

Upon completion of the testing and commissioning plan it shall be circulated to the relevant parties involved for their approval, and upon agreement the network integration can commence.

6.2 Site / system commissioning

The Commissioning Process identifies the activities that shall be undertaken to ensure that the new systems installed under a scheme are fully operational and suitable to be taken into operational maintenance.

Each asset shall have completed a Site Acceptance Test (SAT) which tests every operation of that system. The majority of the commissioning is carried out from the Traffic Operations Centre.

Collaboration shall form an integral part of the site commissioning and a detailed plan shall need to be developed with the assistance of the Traffic Operations Centre. The following parties shall be involved in the process:

a. NZTA Project Manager
b. Contract Engineer
c. Contractor
d. Maintenance Contractor
e. NZTA Network Communications Team
f. Traffic Operations Centre and Management

By the end of the commissioning stage the systems installed under a scheme shall be fully operational and in use by the operators. At this point the scheme shall be handed into 'Support' Maintenance until such a time that the activities described under the handover process have been completed.

This should be a short period of time if the requirements of this document have been followed and all milestones completed.

The following table outlines the elements of the testing and commissioning process.

6.3 Key activities, deliverables and responsibilities

Deliverables for key activities are summarised in the table below:

Key Activities	Deliverables
Detail commissioning plan	The key deliverable is an entire system commissioning plan resulting in an operational system.
Operator training	The key deliverable is that each Traffic Operations Centre operator is familiar with the technology assets and the system in its entirety.
User acceptance testing	The key deliverable is live operational testing of components within the system and the system itself.
UAT documentation	The key deliverable is certification detailing the Traffic Operation Centre sign-off of the operational ability of the asset.
Milestone Completion	The key deliverable is the sign-off of each asset's operational suitability in order to move to the Defect Liability Period.

Roles and responsibilities for key personnel for key activities are summarised in the table below:

Key Personnel	Detail commissioning	Operator training	User acceptance	UAT documentation	Milestone completion

	plan		testing		
NZTA Project Manager	Overall control of the project and order approval	Overall control of the project	Overall control of the project	Overall control of the project	Overall Control of the Project
Contract Engineer (or Engineer's Representative)	In collaboration with the Traffic Operations Centre and Contractor, produce the commissioning plan that will enable the system to be handed into operational maintenance	Provide testing procedure approval on behalf of the client and liaison between contractor and required trainees	Act on behalf of the client and providing liaison as witness for the client	Act on behalf of the client and providing liaison between contractor and the client and compiling the UAT documentation to form part of the handover process	Act on behalf of the client and providing liaison between contractor and the client
Contractor	Develop commissioning plan and undertake site tests during commissioning	Responsible for the arrangement of training courses	Responsible for the test and production of operator reference manuals	Prepares documentation for the Engineer	Install pre-approved technology
NZTA Network Communications Team	N/A	N/A	O&M witness of user testing	N/A	Confirm acceptability of proposed equipment in the network
NZTA Traffic Operations Centre	Assist in developing commissioning plan with the Engineer and Installation Contractor;	Make operators available for training	Operator availability for user acceptance testing	UAT sign-off	N/A
Maintenance Contractor	N/A	N/A	N/A	Review and sign-off on fault management system	Confirm their agreement with the technologies operational worthiness

The expected outcomes and benefits of each key activity in are summarised in the table below:

Key Activities	Expected outcomes and benefits
Detail commissioning plan	The expected outcomes and benefits are an agreed commissioning plan and timescales, all parties identified and within which order activities should be undertaken to ensure no delays with integration further down the line
Operator training	The expected outcomes and benefits are that when all operators are fully versed in the operation of the assets and understand their relationship to the overall system the system operation will be optimised
User acceptance testing	The expected outcomes and benefits are that the asset's core functionality is

	confirmed and its ability to exist within the operational environment is highlighted and that manufacturing issues are identified prior to delivery, ensuring speedier resolution. Early involvement of the maintenance organisation to satisfy them of the validity of the test will streamline their subsequent acceptance of the equipment handover.
UAT documentation	Sign-off from the Traffic Operations Centre confirms the systems acceptance into operation. Documentation will form part of the handover process that will be delivered to the NZTA and their maintenance contractors in order for the ITS System and components to be handed over
Milestone Completion	The expected outcomes and benefits of ensuring that all parties have signed-off prior to the completion of Stage 3 is to provide an audit trail that will assist in the successful handover of ITS components and the entire system into operational maintenance

6.4 Practical completion and handover requirements

6.4.1 General

Running parallel to the system commissioning and handover to operations will be the practical completion process that will enable the completion of stage 3. It is at this point that all documentation and software associated with the project will be complete in preparation for handover. All documentation, software and spares will need to be handed to the NZTA prior to the practical completion inspections, and the documentation will form part of this process.

The following list details the required documentation to be handed to the NZTA prior to Practical Completion - all documents shall be made available in both paper and electronic format:

All as-built drawings shall be in an NZTA approved format that the NZTA agreed to at time of contract signing and supplied in a fully editable version with all relevant reference layers. Paper copies in A3 landscape format shall also be provided.

6.4.2 Contractual information

Signed contract excluding pricing information, supplied by the NZTA.

Notice to Engineer detailing variations and engineer requests, supplied by the Engineer to the Contract.

6.4.3 Operations and maintenance information

Project Overview - provided by the NZTA.

System Operations Manual - prepared by the Contractor.

Asset Manuals including conformance certification - prepared by the Contractor.

6.4.4 As-built documentation

Site Drawings - marked up by the Contractor and certified by the Engineer.

Fibre Optic Information - provided by the Contractor.

Power Supply Details - provided by the Contractor.

Cabinet Wiring Diagrams - provided by the Contractor.

Structural Designs - provided by the Design Engineer.

6.4.5 Certification and test results

Civil Construction Results - provided by the Contractor.

Safety Audit Report - provided by the Engineer.

Producer Statements - provided by the Contractor.

Electrical Certificates - provided by the Contractor.

SAT / FAT / UAT Documentation - provided and certified by the Engineer.

6.4.6 Training documentation

Operations and Maintenance Manuals - provided by the Contractor.

Test / Maintenance Software - provided by the Contractor from the manufacturer.

6.4.7 Spares documentation

Critical spares - provided by the Contractor.

Long lead time spares - provided by the Contractor.

Quantity list of all assets - provided by the Contractor.

6.4.8 Software / firmware

Firmware version list - provided by the Contractor.

Copies of all current firmware - provided by the Contractor.

Special instructions of software use and requirements – provided by the Contractor.

6.4.9 Site data

System configuration information - provided by the Contractor.

GPS coordinates - provided by the Contractor.

Full equipment list - provided by the Contractor.

Warranty details of all assets - provided by the Contractor.

Site data will form part of the RAMM requirements which are detailed in Section 6.6.

6.5 Operational handover

Deliverables in each key activity are summarised in the table below:

Key activity	Deliverables
Practical completion plan	The key deliverable is a program delivery plan detailing the roles and

	responsibilities of all people in regard of the Practical Completion of the site.
Practical completion inspections	The key deliverable is to Undertake Practical Completion inspections at all sites within the project delivered directly by the installation contractor.
Practical completion documentation	The key deliverable is the production of a comprehensive report detailing the condition of each site and any defects in existence at the time of inspection.
Milestone completion	The key deliverable is the sign-off of each asset's operational suitability in order to move to the Defects Liability stage.

Roles and responsibilities for key personnels in key activities are summarised in the table below

Key Personnel	Practical completion plan	Practical completion inspections	Practical completion documentation	Milestone completion
NZTA Project Manager	Overall control of the project	Overall control of the project	Overall control of the project	Overall Control of the Project
Contract Engineer (or Engineer's Representative)	In collaboration with the Traffic Operations Centre and Contractor, produce the Practical Completion plan	Attends and certifies each inspection	Review report prior to issue	Act on behalf of the client and providing liaison between contractor and the client
Contractor	Develop Commissioning Plan and Practical Completion Plan	Carries out each inspection under the guidance of the Contract Engineer	Prepares report documentation for the Engineer	Install pre-approved technology
NZTA Network Communications Team	Confirm acceptability of proposed equipment in the network			Confirm acceptability of proposed equipment in the network
Maintenance Contractor	Develop Commissioning Plan with the Engineer and Installation Contractor	Attends to ensure each site is maintainable	Review report prior to issue and advise the Contract Engineer of any issues	Confirm their agreement with the technologies operational worthiness

The expected outcomes and benefits of each key activity in are summarised in the table below:

Key Activities	Expected outcomes and benefits
Practical completion plan	The expected outcomes and benefits are an agreed Practical Completion Plan and timescales with all parties identified and within which ordered activities should be undertaken.
Practical completion inspections	The expected outcomes and benefits are that all Practical Completion inspections are completed on time with minimal defects discovered and that the maintenance organisation is satisfied with the quality of work and

	acceptance of the asset into operational maintenance after successful completion of the 28-day test.
Practical completion documentation	Documentation of the full agreement between the Client, Contractor Engineer, Installation Contractor and the Maintenance Organisation of the status of each site and the required work needed to ensure handover.
Milestone completion	The expected outcomes and benefits of ensuring that all parties have signed off prior to the completion of Stage 3 is to provide an audit trail that will assist in the successful handover of ITS components and the entire system into operational maintenance.

6.6 Road asset maintenance management

The Office of the Auditor General requires the NZTA to maintain an ITS asset register that accurately captures the current state, location, condition and quantities of assets deployed on the State Highway network. RAMM is the NZTA asset management tool used to record details of the existing condition and status of all road assets and street furniture. The contractor shall request the relevant RAMM data collection spreadsheet from the NZTA at the start of the contract. The information required to be collected for ITS assets includes but is not limited to:

a. Location details.

b. Asset Type, Sub-type and Description.

c. Support Type.

d. Construction and Maintenance Contract numbers.

e. Maintenance Contractor.

f. Manufacturer, Supplier, Model and Serial Number.

g. Design Life and Purchase Cost.

h. Installation Date and DLP start and end dates.

i. Condition and Risk Rating.

j. Control System and Communication medium.

Level 1 RAMM certification is a requirement for RAMM data collectors and level 2 RAMM certification is required for users who input data directly into the RAMM database (a requirement of SHDOM – State Highway Database Operations Manual). Detailed guidance in terms of data requirements and collection rules is provided in SHDOM Appendix 6.

7.0 Stage 4 – Defects liability

Upon completion of Stage 3 and the practical completion inspections a defect liability period will be enforced for a period of time determined at the start of the contract. This will be the period of time that the Contractor will be required to remedy all defects detected during the practical completion inspections and any subsequently picked up during the remaining Defects Liability Period (DLP).

The DLP will include all warranties that have been provided for each asset / system.

7.1 Maintenance requirements for new assets

Between installation and acceptance into operational maintenance the installation contractor shall be responsible for the maintenance of all assets (pending an agreed handover to the maintenance contractor). This is to include all preventative maintenance and fault rectification work undertaken in accordance with the agreed maintenance regime service response and resolve times determined at the start of the contract.

To ensure that asset warranties are not compromised, it is important that the maintenance requirements of individual assets are determined and recorded prior to the installation of the asset, and that these requirements are communicated in a timely fashion to the maintenance organisation.

The maintenance period will be dependent on the number of assets and scale of installation. For small schemes, the handover of operational maintenance shall occur at the end of the 28-day test For larger projects the Contractor may be asked to provide a maintenance facility for an agreed period of time.

During this period the installation contractor is responsible for capturing any changes to the deployed asset base (including permanent replacement of any components recorded in RAMM) and the communication of these changes on a monthly basis to the Maintenance Contractor for verification and RAMM update.

7.2 28-day test

Prior to final handover to the maintenance organisation, a defined fault free operation period of 28 days will need to occur. The requirements of the 28-day fault free period shall be dependent on the asset type and will be agreed at the start of the contract. A level of faults of varying criticality may occur during this period, which may mean that the equipment can still be classified as

'fault free'. This should be stated in the commissioning plan and agreed by the NZTA.

Upon completion of the 28-day fault free period the assets can be handed into operational maintenance. Fault events that occur or events that inhibit the assets from functioning correctly will be examined to determine root cause, and any issues deemed to be the responsibility of the asset will be classed as a failure. Upon resolution of the identified fault the 28-day test will start again.

During this period it is the responsibility of the installation contractor to communicate any changes to the deployed asset base to the NMC for verification and RAMM update.

8.0 Stage 5 – Maintenance handover

Dependent on the maintenance arrangements agreed at the start of the contract and the length of the DLP period delivered through Stage 4 the system and associated assets shall be in a position to be formally handed over into operational maintenance.

All contractual documentation shall have been delivered through Stage 3 and all that remains will be the operational reports identifying the level of performance.

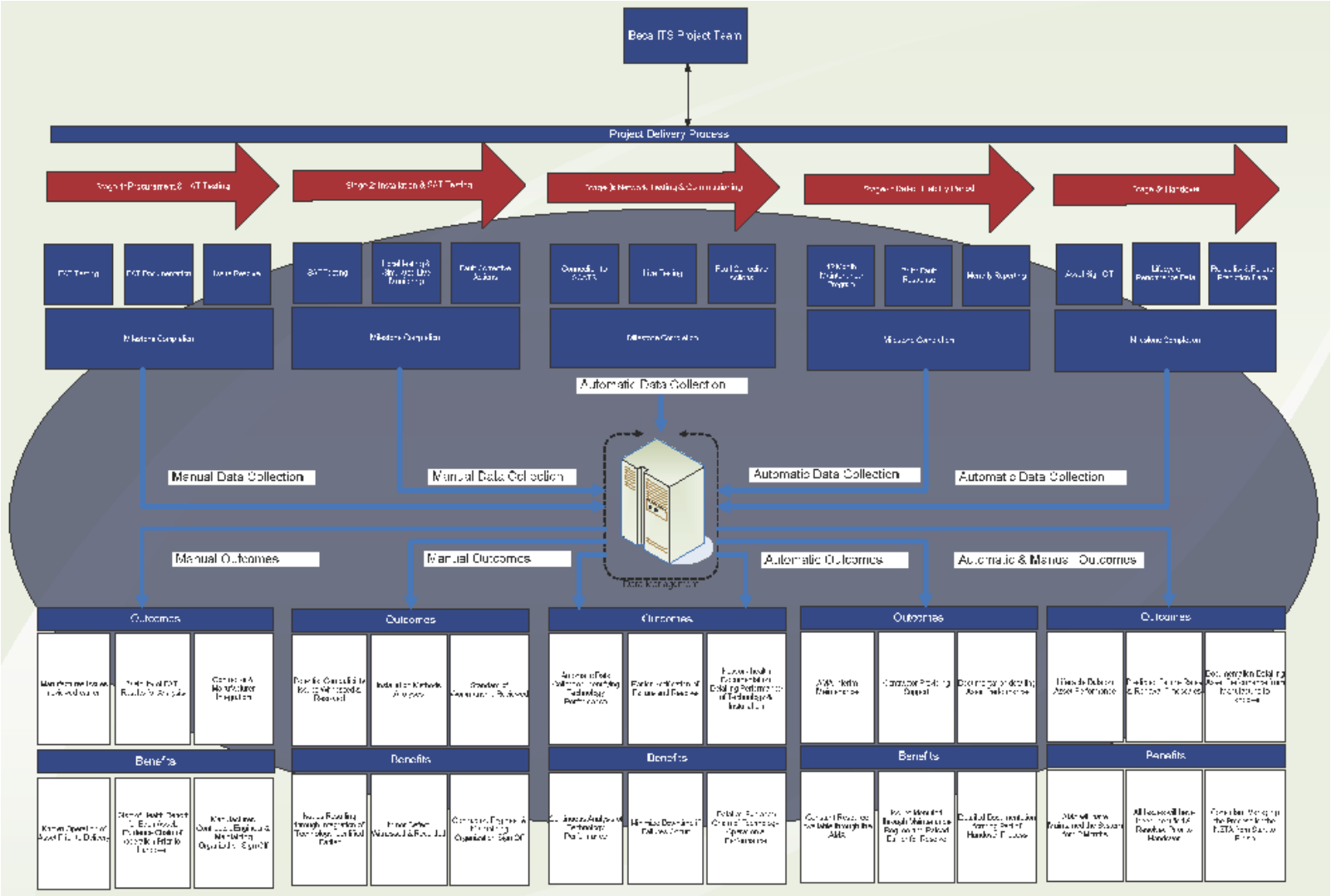
Prior to final handover the following will need to be provided by the Contract Engineer to the NZTA:

- Resolution report of all defects.
- Maintenance records of all assets and systems.
- Fault / performance records of all assets (28-day test).

Once these reports have been completed they will be circulated to the NZTA Project Managerand the current Maintenance Contractor, and upon approval the assets and associated systems can be formally taken into operational maintenance.

9.0 Appendices

9.1 Appendix A – Handover flow chart


Beca ITS Project Team
Project Delivery Process
Automatic Data Collection
Manual Data Collection
Manual Data Collection
Automatic Data Collection
Automatic Data Collection
Manual Outcomes
Manual Outcomes
Automatic Outcomes
Automatic & Manual Outcomes
Outcomes
Outcomes
Outcomes
Outcomes
Outcomes
Benefits
Benefits
Benefits
Benefits
Benefits

9.2 Appendix B – Auckland motorways guidelines

Auckland Motorway Alliance Operations and Maintenance Guidelines for Planning, Design, Construction and Handover of Capital Projects in the Auckland South Area Motorway Network - October 2009 is available from the Auckland Motorway Alliance.