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WestConnex M4-M5 Link Tunnels

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REF: WCXSTG3A-LSB-WCX-GC-004500

21 November 2022

Shelley Reed
Team Leader
Infrastructure Management
NSW Department of Planning and Environment

Dear Shelley,

Air Quality Design Optimisation

Condition of Approval E13 – Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol

As you are aware, under the Planning Approval (SSI 7485), Condition E13 states;

A Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) must be prepared in consultation with the TMC. The Protocol must be reviewed and endorsed by a suitably qualified and experienced independent ventilation specialist. The Protocol must demonstrate that the ventilation and traffic management systems would operate together to ensure conditions of this approval are met.

Condition E15 further stipulates that;

The Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol must be submitted to the Secretary for information no later than one (1) month prior to commencement of operation of a tunnel (whether in full or in part).

Accordingly, the Protocol is provided for information as **Attachment 1** to this letter, with evidence of consultation with TMC provided as **Attachment 2** and evidence of the review and endorsement by a suitably qualified and experienced independent ventilation specialist provided as **Attachment 3**.

Should you have any questions, please don't hesitate to contact Environment and Sustainability Manager Martin Howe (Martin.Howe@m4-m5linktunnels.com.au).

Kind regards,

Andrew Marsonet

Project Director

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Attachment 1: Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol

WestConnex M4-M5 Link Tunnels

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Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol

M4-M5 LINK TUNNELS PROJECT

Document No.:	M4M5-LSBJ-PRW-GEN-OP01-PLN-0006
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Project No.	**259954**			
Title:	**Plan – Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol**			
Doc. No.	**M4M5-LSBJ-PRW-GEN-OP01-PLN-0006**			
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	Name	**Date**	**Position**	**Signed / Approved**
Originator(s)	Adam Wawrzyniak	11/11/2022	CPS & Mech Design Manager	
Review	Ashkun Jalili	11/11/2022	Engineering Manager	
Approval	Thomas Celimene	11/11/2022	M&E Director	

Document Revisions

Rev No	Date	Issue / Description
A	**06/10/2022**	**First issue for consultation**
B	**03/11/2022**	**Revised to address TMC & Ventilation Specialist Comments**
00	**11/11/2022**	**Revised to address TMC & Ventilation Specialist Comments**

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Terms and Definitions

Term	Definition
Company	WestConnex
Contractor	Acciona Samsung Bouygues Joint Venture (ASBJV)
Deed	WestConnex 3A D&C Deed
Independent Certifier	Reviews the design and construction output to ensures that each party meets their obligations in accordance with the requirements of the contract.
Subcontractor	The party providing the specified design and equipment
Scope of Works and Technical Criteria	Exhibit M of the Deed
Specification	A document that sets out the requirements and parameters, that the design and/or construction must meet.

Abbreviations

Abbreviation	Definition
AHD	Australian Height Datum
AS	Australian Standard
ASBJV	Acciona Samsung Bouygues Joint Venture
ANZECC	Australian and New Zealand Environment and Conservation Council
ATLOS	Average Traffic Level of Service
CO	Carbon Monoxide
CSSI	Critical State Significant Infrastructure
C2C	Centre-to-Centre
D&C	Design and Construction Project
EIS	Environmental Impact Statement
ERP	Emergency Response Plan
FAT	Factory Acceptance Test
IC	Independent Certifier
IFC	Issued for Construction
IFV	Issued for Verification
IMS	Incident Management System
IOMCS	Integrated Operations Management and Control System
IRP	Incident Response Plan
IRPs	Incident Response Procedures
ISLUS	Integrated Speed and Lane Usage Sign
ITC	Inspection and Test Checklist
ITP	Inspection and Test Plan
i-VCS	Integrated Ventilation Control System

Abbreviation	Definition
M4E	M4 East tunnel (stage 1b)
MCoA	Minister's Conditions of Approval
M&E	Mechanical & Electrical
NM5	New M5 tunnel (stage 2)
NOx	Oxides of Nitrogen
NO2	Nitrogen Dioxide
O&M	Operation and Maintenance
OMCS	Operations Management and Control System
PM2.5	Particulate matter (2.5 micrometres or less in diameter)
PM10	Particulate matter (10 micrometres or less in diameter)
The Project	M4-M5 Link Tunnels project (also WestConnex Stage 3A)
RFI	Request for Information
PMCS	Plant Monitoring and Control System
S1-VCS	Stage 1 Ventilation Control System
S2-VCS	Stage 2 Ventilation Control System
S3-VCS	Stage 3 Ventilation Control System
SCADA	Supervisory Control and Data Acquisition
SiD	Safety in Design
SPI	St Peters Interchange
SPIR	Submissions and Preferred Infrastructure Report
SSI	State Significant Infrastructure
SWC	Sydney Water Corporation
SWTC	Scope of Works and Technical Criteria
TCP	Traffic Control Plan
TCRO	Traffic Control Room Officer
TfNSW	Transport for New South Wales
TMC	Traffic Management Centre
TMCS	Traffic Management and Control System
VCS	Ventilation Control System
VMS	Variable Message Sign
WCX	WestConnex (M4-M5 Link Project)

1 Introduction

1.1 Purpose

The purpose of this "Tunnel Ventilation, Incident Response and Traffic Management Systems Integration Protocol" (the Protocol), as required under Ministers Conditions of Approval E13 to E17, is to demonstrate that the systems provided will operate together to ensure that the objectives defined in Part E of the Infrastructure Approval for the WestConnex M4-M5 Link are achieved.

1.2 Executive Summary

The objective of this document is to demonstrate that the systems provided for the WestConnex M4-M5 Link project would operate together to ensure that the conditions outlined in the MCoA are met. Maintaining the air quality limits outlined in this document will ensure that the limits specified in condition E2A, E3, E4, E5 and E6 are not exceeded due to operation of the tunnel.

To achieve this, the following approach has been adopted:

- The ventilation system has the ability to control the tunnel ventilation depending on air-quality measurements in order to comply with the minimum air-quality limits under Normal Operation
- The traffic management system is able to implement the specific traffic control practices to achieve specified objectives
- The ventilation system alone is capable of meeting majority of incident conditions and the traffic management system assists by controlling the amount of produced pollution which impacts the required ventilation capacity to maintain air quality limits;
- Operational philosophy has utilised an integrated approach for the control of ventilation and traffic management. This is to avoid congestion even though the tunnel ventilation has the capacity to control air quality within nominated limits under traffic conditions as specified in the SWTC;
- Incident Response Plan developed for operation of the tunnel integrates all systems to provide optimum response under any incident condition;
- All systems will be thoroughly tested inclusive of integrated systems commissioning, in accordance with this Protocol, prior to opening the motorway to traffic. The focus of this document is on the WestConnex M4-M5 Link project as a stand-alone tunnel and as a tunnel operating in conjunction with the two adjoining WestConnex project stages currently under operation.

2 MCoA Requirements for this Protocol

2.1 General

Clause	Requirement
A1	The CSSI must be carried out in accordance with the terms of this approval and generally in accordance with the description of the CSSI in the WestConnex M4-M5 Link Environmental Impact Statement – Volumes 1A-C and 2A-J (dated August 2017) (the EIS) as amended by: a) the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (dated January 2018) (the SPIR); b) the WestConnex M4-M5 Link Mainline Tunnel Modification Report (dated September 2018) (Modification 1 Report) as amended by the WestConnex M4-M5 Link Mainline Tunnel Modification Response to Submissions (dated November 2018) (Modification 1 RtS); Items (c) through (e) refer to Rozelle Interchange and are not included here

2.2 Air Quality Design Optimisation

Clause	Requirement
E13	A Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) must be prepared in consultation with the TMC. The Protocol must be reviewed and endorsed by a suitably qualified and experienced independent ventilation specialist. The Protocol must demonstrate that the ventilation and traffic management systems would operate together to ensure conditions of this approval are met.
E14	The Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol must include a commissioning procedure that is to be carried out before a tunnel (or any part of it) is opened to traffic.
E15	The Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol must be submitted to the Secretary for information no later than one (1) month prior to commencement of operation of a tunnel (whether in full or in part).
E16	The Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol, must be implemented for the duration of operation.
E17	Prior to commencing operation, a person or organisation, who is independent from the design and construction of the CSSI, whose appointment has been approved by the Secretary, must review the in-tunnel ventilation and ventilation outlet design of the project and the Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol prepared in accordance with Condition E13 to verify that: a) the final design achieves the in-tunnel and ventilation outlet limits for all traffic conditions including congestion (as described by the regulatory worst-case scenario in Chapter 9 of the EIS); b) the predicted impacts of the final design are no greater than predicted in the documents listed in Condition A1 for the equivalent operating conditions; and c) the ventilation system has been optimised to achieve effective and responsive treatment of in-tunnel air quality and efficient energy consumption. The operating scenarios used to model the final design should be the same as those used in the documents listed in Condition A1. Should the design review adopt a modelling program different to that used in the EIS, the EIS predictions shall be re-modelled using the model adopted for the design review, to establish the predicted outcomes under part (b). The information required in this condition must be made available to the Secretary on request.

3 Air Quality Limits and Goals

The following limits are extracted from the Conditions of Approval and are applicable to the permanently installed tunnel systems. Note that the ambient air quality limits outlined in MCoA E6 are not used to actively control the tunnel ventilation system. Instances of exceedances in the ambient air quality goals will be dealt with through the notification and reporting requirements outlined in MCoA E32.

The following tables have also been included in the Conditions of Approval for both M4E (SSI 6307) and M8 (SSI 6788) projects. The following table shows congruency of the air quality limits and goals for the adjacent projects.

Table 1: Congruency of Air Quality Limits and Goals

Component	Requirement(s)	M4 East MCoA Reference	M8 MCoA Reference	M4-M5 Link MCoA Reference
In-tunnel Air Quality	Identical	E2, E3, E4	E4, E5, E6	E3, E4, E5
Outlet Air Quality	Identical	E14	E19	E2
Ambient Air Quality	Identical	E9	E14	E6

Table 2: Ventilation Outlet Air Quality Limits – MCoA E2

Pollutant / Parameter	Type of Measurement	Concentration Limit
Solid Particles (mg/m³)	Average – 1 hour	1.1
NO2 or NO or both as NO2 equivalent (mg/m³)	Average – 1 hour block	20
NO2 (mg/m³)	Average – 1 hour block	2.0
CO (mg/m³)	Average – 1 hour rolling	40
VOC (as Propane) (mg/m³)	Average – 1 hour rolling	4.0

Table 3: In-tunnel Air Quality Limits – MCoA E3 to E5

Pollutant / Parameter	Type of Measurement	Concentration Limit
CO (ppm)	Rolling Average – 15 min	87
CO (ppm)	Rolling Average – 30 min	50
CO (ppm)	Rolling Maximum – 3 min	200
NO2 (ppm)	Rolling Average – 15 min	0.5
Visibility (m-1)	Rolling Maximum – 15 min	0.0050

Table 4: Ambient Air Quality Goals – MCoA E6

Pollutant / Parameter	Type of Measurement	Concentration Limit
CO (ppm)	Average – 8 hour rolling	9
NO2 (ppm)	Average – 1 hour block	0.12
PM10 (µg/m³)	Average – 24 hour rolling	50
PM2.5 (µg/m³)	Average – 24 hour rolling	25
PM10 (µg/m³)	Average – Annual	25
PM2.5 (µg/m³)	Average – Annual	8

Table 5: Ventilation Outlet Tip Heights – MCoA E12

Location	Outlet Reference	Outlet Elevation (m AHD)
Campbell Rd St Peters	SPI-5 / SPI-6	32.9 – 35.9
	SPI-7,	32.8 – 35.8
	SPI-8	32.6 – 35.6
Haberfield	As constructed by M4E Contractor	

4 Consultation on this Protocol

Transport Management Centre (TMC) have been involved in the development of this Protocol in accordance with the requirements of the WestConnex M4-M5 Link Infrastructure Approval.

The process for development and review for this Protocol was:

1. The Contractor developed:
   (a) The Traffic Management and Control System (TMCS) in accordance with the SWTC and WestConnex M4-M5 Link Infrastructure Approval.
   (b) The Tunnel Ventilation Design in accordance with the SWTC and WestConnex M4-M5 Link Infrastructure Approval.
2. The Contractor developed the Emergency Response Plan (ERP) with stakeholder consultation with Fire & Rescue NSW and NSW Police. The Asset Owner and the Operator developed the Incident Response Plan (IRP) and associated Protocols and Procedures (IRPs) with stakeholder consultation with Fire & Rescue NSW, NSW Police Force and Ambulance Service of NSW.
3. The Contractor developed a draft protocol to demonstrate the integration of the systems to meet the objectives defined in condition E13-E17 of the Infrastructure approval (This document)
4. Transport for NSW (TfNSW) and Transport Management Centre (TMC) were consulted on the development of this Protocol, as required by condition E13-E17 of the Infrastructure Approval.

   A draft version of the Protocol was provided to TMC on the 07/10/2022.

   A meeting was held on the 21/10/2022 with TMC, M4-M5 Link Group, TfNSW and ASBJV representatives attending.

   TMC provided comments to ASBJV on the 28/10/2022.

   A meeting was held on the 04/11/2022 with TMC, M4-M5 Link Group, TfNSW and ASBJV representatives attending.

   Comments received and discussions held during these meetings were considered by ASBJV and the Protocol has been updated to address.
5. The Contractor has engaged BG Consulting Engineers as a suitably qualified and experienced independent ventilation specialist to review and endorse this Protocol. This review concluded that the relevant Conditions of Approval have been satisfied.

5 Compliance to Ambient Concentrations

In accordance with MCoA clause E12, the ventilation outlets at St Peters have been constructed to have a tip height of RL 32.8 m relative to the Australian Height Datum (AHD).

In order to ensure compliance with clause E6, the Contractor has undertaken dispersion modelling during the design phase of the project. The results of this analysis are contained in Appendix N.1 of the ME02 design report and indicate that the ambient conditions for the regulatory worst case and design year 2033 are equal to or better than that described in the EIS.

Table 6: Haberfield – Predicted Maximum Ground Level Concentration (µg/m³)

Pollutant	Averaging Time	GRAL – EIS vs Design		GRAL – 2033 DSC		GRAL - RWC	
		EIS	Design	Cumulative	Goal	Cumulative	Goal
CO	1 hour	52.6	43.9	569.4	30,000	569.4	30,000
	8 hour	~	~	279.6	10,000	~	10,000
NOX	1 hour	28.5	28.0	~	~	~	~
	Annual	0.71	0.67	~	~	~	~
NO2	1 hour	~	~	199.3	246	201.5	246
	Annual	~	~	21.4	62	~	62
PM10	24 hour	1.2	1.1	21.1	50	~	50
	Annual	0.1	0.1	17.3	25	~	25
PM2.5	24 hour	0.8	0.7	17.1	25	~	25
	Annual	0.1	0.1	8.1	8	~	8

Table 7: St Peters – Predicted Maximum Ground Level Concentration (µg/m³)

Pollutant	Averaging Time	GRAL – 2033 DSC		GRAL – 2033 DSC		GRAL - RWC	
		EIS	Design	Cumulative	Goal	Cumulative	Goal
CO	1 hour	82.7	75.9	446.2	30,000	924.7	30,000
	8 hour	~	~	296.4	10,000	~	10,000
NOX	1 hour	63.9	54.0	~	~	~	~
	Annual	2.3	1.9	~	~	~	~
NO2	1 hour	~	~	203.7	246	209.2	246
	Annual	~	~	23.4	62	~	62
PM10	24 hour	2.6	2.6	21.9	50	~	50
	Annual	0.4	0.4	17.4	25	~	25
PM2.5	24 hour	1.7	1.7	11.6	25	~	25
	Annual	0.3	0.2	8.2	8	~	8

6 Description of the Tunnel Ventilation System

The Tunnel Ventilation System design is based on a longitudinal ventilation concept whereby the in-tunnel air quality is maintained by achieving a longitudinal flow of air through the tunnel. The tunnel airflow is generally developed in the direction of traffic flow and assisted by a series of jet fans distributed throughout the tunnels.

Typically, fresh air will be drawn in from the entry portals and pushed towards the mainline exit portals by the vehicle generated piston effect. Where the vehicle generated airflow is insufficient, such as during slow moving traffic conditions, the mainline airflow will be assisted by jet fans. The vitiated tunnel air will be then extracted from the tunnel upstream of the tunnel exit portals by ventilation fans located in the portal ventilation stations. This air will be extracted via the ventilation stations located at exit portals and inter-project boundaries.

The exhaust air is ducted via dedicated underground ventilation tunnels to exhaust ventilation stations and outlets located at Haberfield and St Peters. These buildings also serve to extract smoke in case of a fire event from the affected tunnel.

The overall ventilation system comprises of:

- Exhaust fans;
- Supply fans;
- Jet fans (reversible where required);
- Shutoff and airflow balancing dampers;
- Air flow and pollution measurement equipment both in tunnel and at the outlet; and
- Plant Management and Control System (PMCS)

These will operate together with the traffic management control system to ensure the air quality requirements detailed in conditions E3, E4 and E5 are met for all normal and congested conditions managed in accordance with Incident Response Procedures (IRPs) as discussed in Section 8 below. Maintaining these air quality limits will additionally ensure that the limits specified in conditions E2A and E6 are not exceeded as a result of operation of the tunnel.

The following figures provide an overview of the control modes available to the operators to exercise control of the ventilation system:

Figure 1: Changing Ventilation Modes

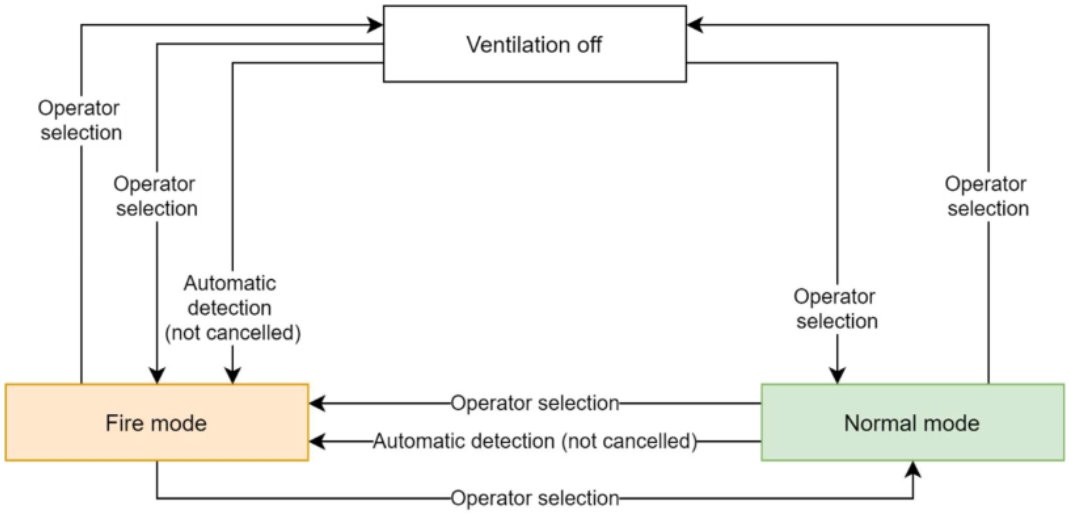
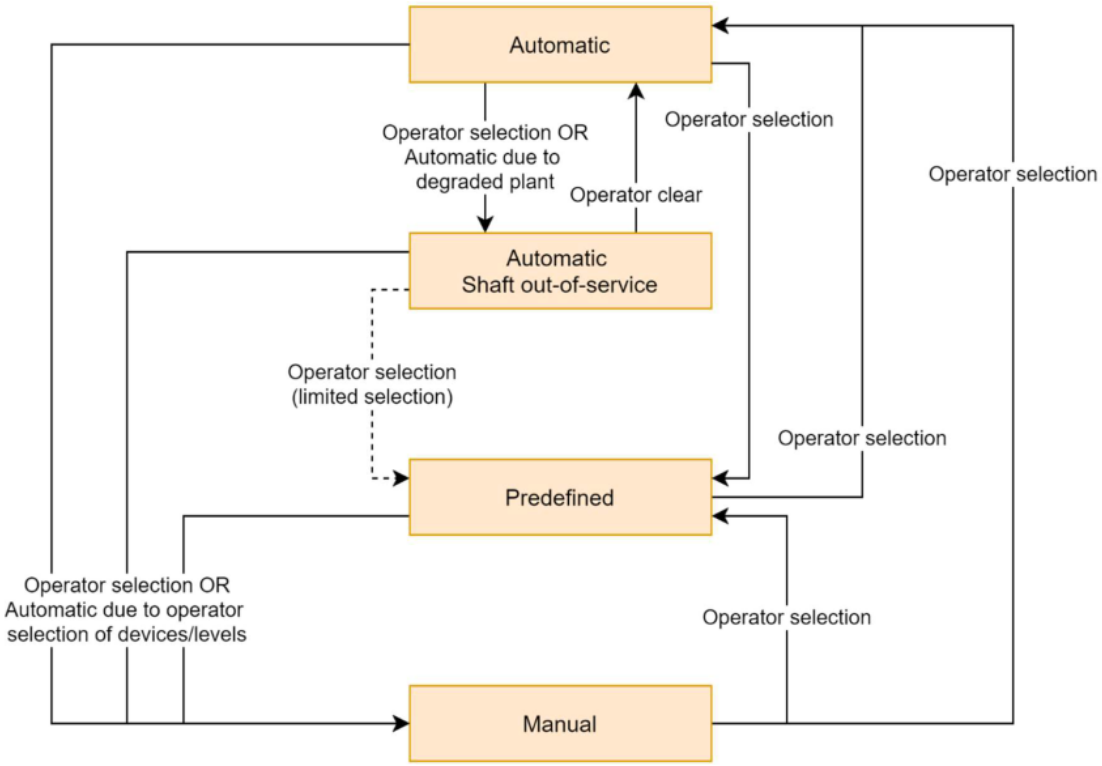


Figure 2 - Changing Ventilation Sub-Modes within Normal and Fire Modes



The following table provides a brief description of the functionality available in each mode of operation.

Table 8: Available Functionality in Normal/Fire Modes

Operation Type	Normal Mode	Fire Mode
Manual	Each device remains in the same status as the previous operation until they receive a manual command. The operator has full control of the tunnel through the management of individual devices.	
Predefined	The ventilation devices operate based on configurable mode tables. These mode tables can be changed by the operator. Some modes use feedback to control to target values and some have fixed plant responses without feedback as defined in the table.	The operation of ventilation devices is set by predetermined tables. There is no change to ventilation devices based on feedback.
Shaft out of Service Automatic	The ventilation devices are controlled automatically to meet the performance requirements while one shaft is out of service.	
Automatic	The ventilation devices are controlled automatically to meet the performance requirements. The operator has minimal control of the tunnel ventilation response. The algorithm controls most aspects of device and setpoint control.	

The Ventilation Control System (VCS) is set up primarily to ensure that the maximum pollution levels are kept under the defined limits and portal emissions are prevented. This is achieved by limiting the amount of time a sample of air spends within the tunnel.

During low speed and congested operations additional fresh air may be introduced via the air exchange function in the mainline tunnel to provide further dilution to the in-tunnel air. Using this functionality, 95% of the tunnel air can be exchanged at the M4-M5 Link boundaries.

During normal operation, the base ventilation level of the Tunnel Ventilation System will be set by the maximum of both the time-of-day table and the vehicle flow and average vehicle speed (traffic service level). Feedback from the in-tunnel and outlet air quality sensors will also be used by the VCS to activate air exchanges between stages and/or apply an offset to the ventilation level should the air quality exceed the approach air quality levels in Table 9 and Table 10 below. Further visual indication will be provided to the TCRO if stage 1 to 4 air quality levels are met or exceeded via a SCADA status display. A critical alarm will be raised and an in-tunnel or outlet air quality incident will be triggered if the MCoA limits are met or exceeded.

Table 9: In-tunnel Air Quality Set Points

Pollutant	Approach	Stage 1	Stage 2	Stage 3	Stage 4	MCoA Limit
CO - 3 min (ppm)	100	140	160	180	190	200
CO - 15 min (ppm)	35	60	70	80	84	87
CO - 30 min (ppm)	20.0	35.0	40.0	45.0	47.5	50.0
NO2 - 15 min (ppm)	0.20	0.30	0.35	0.40	0.45	0.50

Pollutant	Approach	Stage 1	Stage 2	Stage 3	Stage 4	MCoA Limit
Visibility (m-1)	0.0020	0.0030	0.0035	0.0040	0.0045	0.0050

Table 10: Outlet Air Quality Set Points

Pollutant	Approach	Stage 1	Stage 2	Stage 3	Stage 4	MCoA Limit
Solid Particles	0.88	0.90	0.95	0.97	1.00	1.10
NOX	16	17	18	19	19.5	20
NO2	1.60	1.70	1.80	1.90	1.95	2.00
CO	32	34	36	38	39	40
VOC (as propane)	3.2	3.4	3.6	3.8	3.9	4.0

The VCS will reference the normal operation look-up table, which will specify the required airflow for each section of the tunnel and the extraction requirements of the portal ventilation stations for each ventilation level.

The VCS will determine the number of jet fans required to operate to maintain tunnel air quality and prevent portal emissions under varying traffic conditions, which will be altered in response to the varying flow rates induced by traffic. There is a dead-band applied to the target airflows in each section of the tunnel to avoid unnecessary changes in jet fan operation.

The VCS will usually operate in a fully automatic manner for normal operation. However, it may be overridden or manually commanded by the operator to activate any of the pre-programmed ventilation modes or operate individual equipment in manual mode if required.

Control system functionality will generally comprise the following elements:

(a) Traffic and/or pollutant level data and/or portal emission management will determine the overall ventilation rate and target flow rates;

(b) Airflow through tunnel sections will be maintained by automatic feedback control of jet fans to meet airflow requirements; and

(c) Higher pollutant levels, as measured by the air quality sensors, will cause the VCS to increase the ventilation level.

7 Description of Traffic Management Control System

The Traffic Management and Control System (TMCS) controls the operation of traffic control and driver advisory devices in and around the M4-M5 Link Tunnel. Real time traffic and incident information is then transferred from the OMCS to RMS and TMC systems via the Centre-to-Centre (C2C) interface.

The TMCS devices are designed to be operated manually and/or automatically and can be used as a means of limiting or stopping vehicles entering the tunnel (i.e. avoiding congestion) which, if required, could be used to control air quality. Altering of traffic flow is determined by an incident and managed and actioned by approved Incident Response Procedures (IRPs) and Traffic Control Plans (TCPs).

The TMCS hardware is configured in a fully redundant fashion similar to but separate to the PMCS. It consists of the following major blocks:

- Redundant operator workstations (Integrated with PMCS);
- Redundant application/database servers;
- Redundant communications network;
- Redundant PLCs;
- Distributed I/O to control field equipment;
- Physical devices such as ISLUS, VMS, TMS, etc.

The TMCS and its equipment within the Tunnel, derive power through same distribution network used for the PMCS. The computing elements, communications equipment and some essential TMCS equipment is further supported by Uninterruptible Power Supplies.

TMCS software is structured in the following fashion:

- Device Management Modules - for the control and alarming of each piece of TMCS equipment e.g. TMS, CMS, ISLUS etc;
- Function Management - for the control and planning coordinated functions such as Incident Detection, Incident Alert, Incident Management, etc;
- System functions such as Alarm Handing, Logging, User Security etc. Each of the above items is implemented in three domains:
- Human Machine Interface;
- Application Server and Database; and
- Programmable Logic Controller.

The following block diagram (Figure 3) depicts the information and process flow through the TMCS incident management software.

Traffic monitoring devices (traffic loops, over height detectors, etc) provide data for incident detection. For detection of traffic flow anomalies APID and McMaster algorithms are used to create and send alerts to the TCRO. Alerts are also created for over-height, emergency telephone, breakdown bay usage and air quality threshold events (from PMCS). The TCRO review alerts, and if necessary, declare a traffic incident. From the type and location of the alert, the operator is

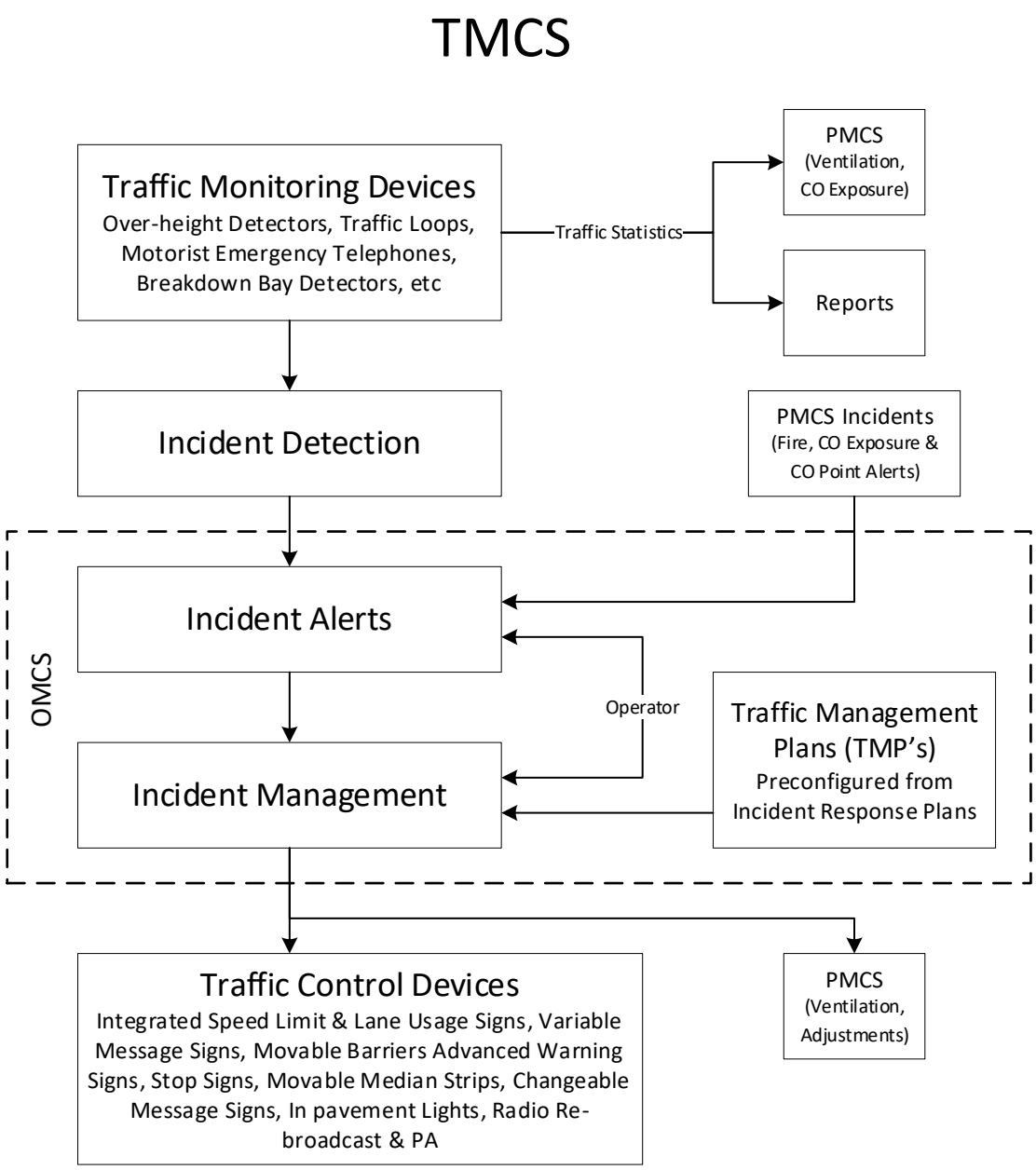
prompted with a selection of applicable Traffic Control Plans (TCPs) available to be implemented. The TCPs are a predefined collection of device settings based on Incidents Response Procedures (IRPs).

The TMCS actions the required device settings from the TCRO selected TCP during all active incidents to provide an output to the relevant devices. TMCS resolves competing actions to a single TMCS device by the use of message priority (e.g. a Closed ISLUS aspect has priority over a Caution aspect on the same ISLUS). The TMCS will not automatically operate to prevent traffic from entering the tunnel until directed to by the TCRO via a selected TCP.

During an incident the TMCS can send outputs which provides an offset to the ventilation levels as required. This offset is combined with the ventilation levels determined from the traffic statistics (flow and speed).

All traffic incidents have a ventilation offset that permits the TCRO to increase the ventilation level above the automatic level determined through the normal control system. This provides additional flexibility to allow for varying traffic conditions within the operation of an incident.

Figure 3 - TMCS Overview



In addition to the automatic detection of incidents, the M4-M5 Link Tunnel will have an extensive CCTV network, to allow trained operators (on shifts 24 hours per day) to monitor the tunnel to detect possible and actual incidents in the tunnel.

8 TVS Interactions with Other Systems

8.1 TVS Actions triggered by the TMCS

The TMCS will trigger the following actions in the TVS:

1. The base ventilation level will change due to a change in the Averaged Traffic Level of Service (ATLOS) - The ATLOS is calculated by SIDERA via traffic flow and speed data received by the TMCS from the traffic loops. The ATLOS is an integer between 1-4 and is calculated for each ventilation zone of the tunnel. The ATLOS is used by the TVS to set a minimum base ventilation level of the Ventilation Zone. A decrease in the ATLOS will only be recognised by the TVS if the ATLOS remains decreased for a period of 15 minutes.

This is tested in the OMCS PMCS Ventilation SAT Test Cases ITR (M4M5-SICE-PRW-MES-OM30-ITR-1008), where the ATLOS level will be manually increased to trigger a base ventilation level increase via a simulation screen in the OMCS. The decrease and associated time delay will also be tested.

The ATLOS and associated minimum base ventilation level table will be reviewed and modified through Level 7 testing post opening. This will be performed with live vehicle speed and traffic data to confirm the appropriateness of the ATLOS level and associated base ventilation level.

8.2 TMCS Actions triggered by the TVS

The TVS will not trigger any action in the TMCS.

8.3 TVS Actions in the Incident Management System

The following air quality events will trigger an incident in the IMS by the TVS if the associated condition is met:

1. Incident type Air Quality - sub-type In-tunnel Air Quality - if CO, NO2 or Visibility MCoA limit is exceeded;
2. Incident type Air Quality - sub-type Outlet Air Quality - if Solid Particles, NOx, NO2, CO, VOC or outlet air velocity MCoA limit is exceeded;
3. Incident type Air Quality - sub-type Segment Degraded - if more than the allowable number of fans are not available for automatic control. Allowable number of fans not available is identified in document M4M5-LSBJ-PRW-MES-ME03-SPC-0001, Appendix A, Table A.7.

This is tested in the IOMCS Incident Management System I-SIT Test Cases ITR (M4M5-SICE-PRW-MES-OM63-ITR-7008), where an exceedance of the MCoA limit is simulated to trigger an incident and associated IMS actions.

The IMS Ventilation Management tab will have the following commands and statuses available depending on the location of the incident, as identified in document M4M5-SICE-PRW-MES-OM17-RPT-0005:

- Test Mode;
- Southbound Mode;
- Southbound Predefined;
- Southbound Zone 1 Ventilation Level;
- Southbound Zone 2 Ventilation Level;
- Northbound Mode;
- Northbound Predefined;
- Northbound Zone 1 Ventilation Level;
- Northbound Zone 2 Ventilation Level;
- Southbound PRVF Exchange;
- Southbound SPI Exchange;
- Southbound SPI Flow Reversal;
- Northbound SPI Exchange;
- Northbound PRVF Exchange;
- Northbound PRVF Flow Reversal.

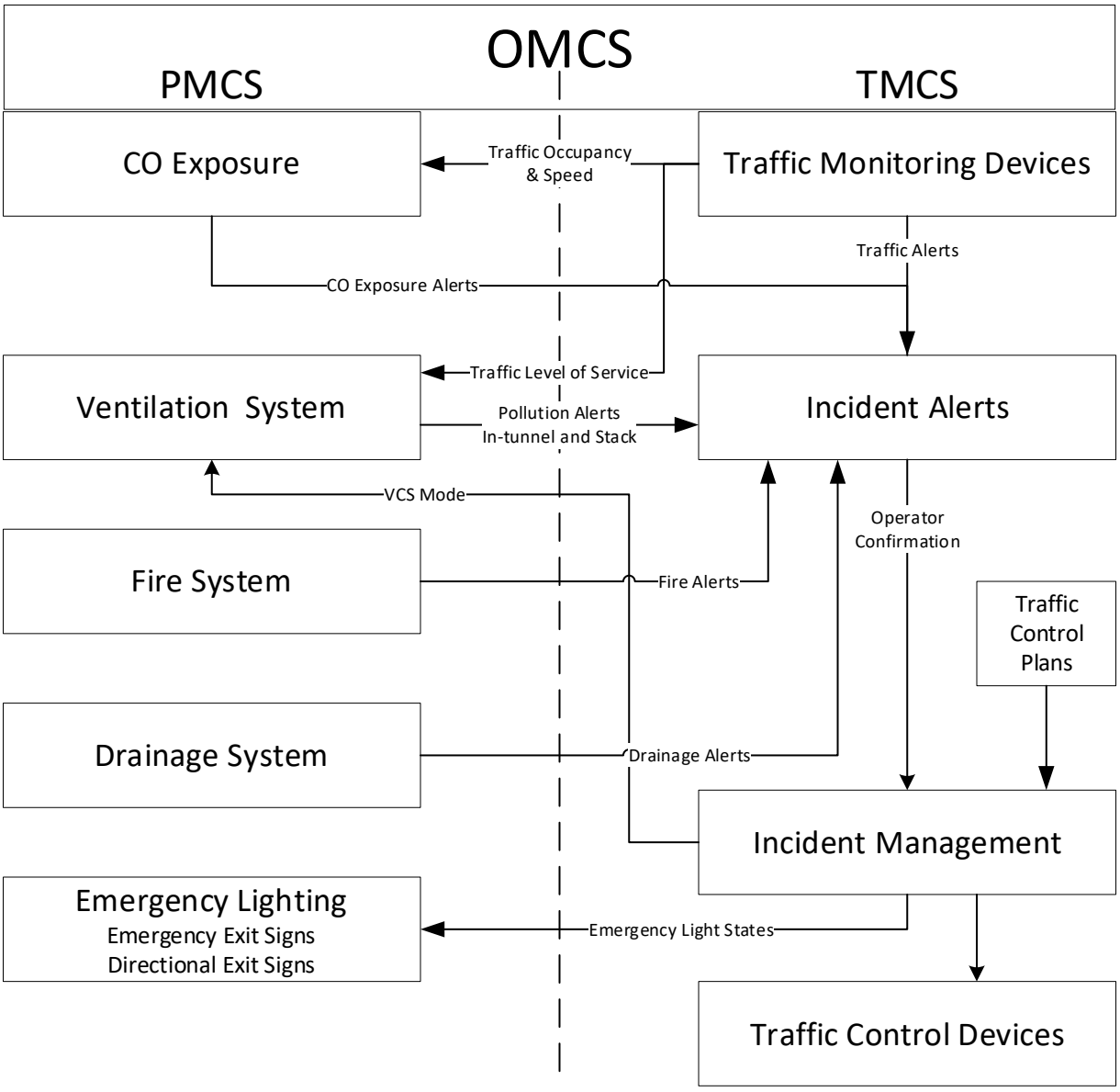
9 M4-M5 Link Tunnel Integrated System Design Approach

While the PMCS and TMCS field systems are stand-alone to guarantee high level of redundancy, with these two systems integrated via a high-level communication link with the OMCS. The TMCS and PMCS systems and their communication is supervised by the OMCS, and traffic data is made available the plant system for air quality and ventilation control, and plant based and traffic system alert data is sent to OMCS to allow the operator to manage incidents as a result of these alerts.

The OMCS provides an interface to both of the PMCS and TMCS systems in a combined graphical display that is presented to the operator.

A pictorial representation of this integration and data flow is shown in Figure 4.

Figure 4 - TMCS PMCS Interface



The PMCS will control ventilation equipment, as described above, to maintain a high-quality ventilation environment within the tunnel that satisfies the air quality limits specified in the condition of approval. Further, the PMCS is monitoring air quality, fire detection and tunnel drainage to bring potential problems to the attention of the operator. The TMCS is monitoring the traffic speed and flow through the tunnel and bringing anomalous traffic flow to the attention of the operator.

If anomalous traffic flow or any of the other events described above is detected by the system, an alert is generated. The operator, after investigation e.g. with CCTV, may promote the alert into an incident. The operator is then presented with a selection of suitable TCPs to control the traffic around the incident. When the TCP is implemented, the traffic control devices will be automatically set to the required display. The operator may adjust the operation of the ventilation system, in anticipation of the traffic impact on ventilation. This adjustment is associated with the incident and will be cleared when the incident is cleared by the operator.

The displays and controls for the operator are integrated in a seamless set of displays. The operator need not be concerned with which system (TMCS or PMCS) the data is associated. The tunnel ventilation system is capable of fulfilling incident conditions with traffic at capacity and the minimum average vehicle speed is at least 20 km/h as specified in the Scope of Works and Technical Criteria (SWTC). During lower average vehicle speeds the Operator uses the traffic management control system to assist the ventilation system by controlling the amount of traffic entering the tunnel and therefore the produced pollution, which impacts the required tunnel ventilation capacity to achieve and/or maintain air quality levels in the tunnel.

It should be further noted that the best outcome both in terms of motorist experience and fire and life safety is achieved by an integrated response using both ventilation and traffic management systems.

10 Possible Actions

The overarching strategy in the event of congestion is to maintain as high a speed as possible within the tunnel by restricting the amount of vehicles entering the tunnel. In this way, stalled traffic will develop outside the tunnel on the approaches.

The possible actions to deal with an incident to prevent an air quality exceedance are listed below. In addition to the steps noted below, the motorway and operators also have a variety of electronic signage that can be used to advise motorists of potential delays and possible alternative routes.

1. Increase ventilation level manually;
2. Implement suitable TCP (as outlined in WCX-OP-PR-13), e.g.:
   (a) VMS to warn motorists of congestion severity;
   (b) Close lane in tunnel to reduce capacity;
   (c) Close ramp;
   (d) Implement ramp metering.
3. Consider additional measures to manage air quality (as outlined in WCX-OP-PR-24), e.g.:
   (a) Direct motorists to turn off engines if traffic is stationary;
   (b) Request TMC relieve external network congestion if possible;
   (c) Restore ventilation fans to service if capacity is reduced due to maintenance.

Congestion leading to air quality issues will be dealt with in almost all cases through the automatic normal operation ventilation control mode and the approach set points as outlined above.

The key in implementing any or all of the above actions is around timing. As the traffic volumes vary significantly during the day and night, and an incident near the exit of the tunnel will have more of an impact on air quality than one at the entrance, the TCRO will need to closely monitor incidents and react according to the circumstances. Whilst commissioning procedures have been developed and can be tested prior to opening, these will be done based on simulated air quality data.

It is also expected that the TCRO will use knowledge developed during the tunnel operation to implement a response prior to trigger points being reached.

11 Incident Response Plan

The Incident Response Plan (IRP) is primarily used by the Asset Owner and Operator to identify the management structure, systems, integrated processes and procedures that the TCRO's will use in carrying out Incident Management for the M4-M5 Link. It also introduces the user to the Incident Response Procedures (IRPs), which outline how the systems are utilised as part of a procedural response in managing incidents. The primary method of executing these plans is via the OMCS and IOMCS through Traffic Control Plans (TCPs).

The effective implementation of the Incident Response Plan shall ensure that the Asset Owner and Operator complies with relevant legislation, standards and codes of practice, and that the utilisation of traffic and plant management systems and procedures is integrated seamlessly with automatic operational modes. Implementation of the Incident Response Plan and associated documentation shall be verified by periodic audits performed by internal auditors.

The purpose of the WestConnex Incident Response Plan is to establish the procedures for the response to, and recovery from, emergencies and incidents that may occur during operation of the tunnels.

Control of ventilation management systems is particularly relevant in the following WestConnex Incident Response Procedures:

- WOM-OP-PR-24 Air Quality
- WOM-OP-PR-13 Congestion
- WOM-OP-PR-19 Systems Failure or Degradation.

The Incident Response Plan and associated procedures have been developed by the Asset Owner and Operator and subjected to a stakeholder consultation process with the Fire & Rescue NSW, NSW Police Force and Ambulance Service of NSW. Final tests of the IRP will be conducted via an emergency exercise involving these agencies, as required by conditions E142 and E143.

11.1 Air Quality

This procedure details the steps taken by the Traffic Control Room Officers (TCRO) in assessing the ventilation and air quality monitoring systems and applying staged traffic management where the automatic ventilation system is not able to effectively maintain in tunnel conditions within the air quality limits. It may be initiated alone or as part of a response to another incident, be that traffic or system / equipment related.

11.2 Congestion

This procedure details the requirements to be observed by the TCROs when alerted to congestion on the WestConnex motorway. The procedure requires the TCRO to refer to Air Quality procedure for advice on managing the in-tunnel air quality.

11.3 Systems Failure or Degradation

System failure or degradation procedure details the steps taken by the TCRO's in the detection and management of a specific condition in the tunnel or an associated asset. It covers all M&E devices in the tunnel and associated infrastructure, including ventilation stations. It may be initiated alone or as part of a response to another incident such as in tunnel air quality.

12 WestConnex Motorway Integrated Ventilation Design Approach

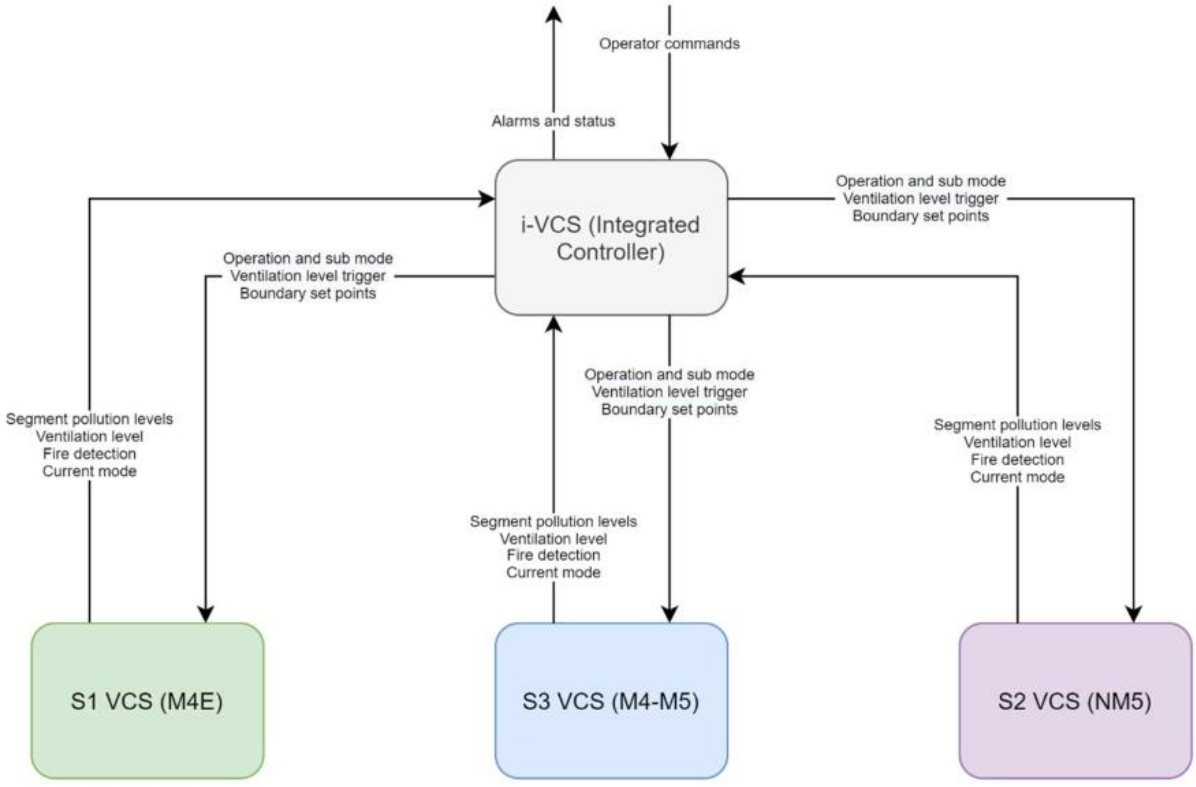
An Integrated Ventilation Control System (i-VCS) has been designed to integrate the three stage independent control systems, to provide high level monitoring and control such that all 3 stages function as an Integrated WestConnex Motorway.

Each stage of the motorway reports parameters such as length average pollution for each unique travel path, the level of ventilation currently being used for that project stage, and the location of a fire within the fire affected stage.

The i-VCS utilises this information and sends a coordinated ventilation strategy to each of the project stage control systems to control air movement and pollution within the combined network. A summary of the information exchanged between the VCS's and the i-VCS is contained in the figure below.

Control of the integrated motorway can be achieved via the IOMCS or by the separate stage VCS's operating in integrated mode.

Figure 5 – i-VCS Overview



13 Commissioning Procedures

The ventilation and traffic management systems will be thoroughly tested during and following completion of the construction phase. The commissioning will be carried out in a progressive manner to determine whether there are any shortcomings in performance of any part of the plant, equipment or installation. A substantial, detailed commissioning plan has been prepared and is presented as an Appendix to this Protocol (refer to Appendix A).

Wherever possible the testing of individual items of equipment will have been carried out in the factory, or vendor premises, before delivery to site. This provides for the most efficient testing and rectification of defects. Relevant FAT certificates and results will complement the testing that will be done on site, where required to ensure integrity after site installation. Some equipment that has already been subjected to FAT, will be re-tested during site commissioning.

The overall Commissioning Plan and testing procedures, ITPs and ITCs will be developed for each sub-system, system and integrated commissioning of all Tunnel services. The ITPs will nominate agreed "witness" and "hold" points by parties external to ASBJV, such as Independent Certifier and TfNSW.

It is envisaged that the Asset Owner and Operator, will be actively involved in the commissioning activities to gain familiarity with the installed systems and gain practical applications skills following the project operation and maintenance documentation.

The testing and commissioning phase will be carried out to demonstrate the following:

- The plant (ventilation, traffic control and all other mechanical, hydraulic, electrical, control and communication) systems and subsystems, or parts thereof, operate in the correct manner and in accordance with the design objective;
- The plant meets requirements of occupational health and safety legislation and other statutory requirements as nominated in the contract and relevant standards and regulations;
- The plant interfaces in an appropriate manner with systems, subsystems, equipment and services provided by others, particularly TfNSW.

The following key elements shall be validated during the commissioning tests prior to motorway opening.

- Validation that the minimum exit velocity at the ventilation outlet;
- Validation of required airflows in the various tunnel ventilation sections as described in the Ventilation System design report;
- Calibration and validation of the performance of the air monitoring devices in measuring against the required criteria;
- Confirmation that the limits and actual values are easily visible on the OMCS and IOMCS operator screens;
- Validation that the required traffic management plans can be implemented on the OMCS and IOMCS system, and the required traffic control devices operate as expected.

At the completion of commissioning, the plant shall be ready for operation in a reliable and safe manner.

Successful completion of commissioning will provide a precondition to handover of the plant to the Asset Owner and Operator and opening the Tunnel to traffic.

Dedicated testing software (JIRA) will be used to perform test executions and an associated JIRA plugin (Zephyr) will be used for defect management of software tests. JIRA will also be used as a requirements management tool and will be the mechanism to demonstrate compliance to all requirements has been satisfied. This is further described in Section 6.5 of the Testing and Commissioning Management Plan, refer to Appendix A.

14 Conclusion

This Protocol meets the requirements of conditions E13 to E17. It outlines the components which make up the overall system for the control and management of air quality in and around the tunnel using the tunnel ventilation system and plant management system, the traffic management and overall control systems. Further detail on these components is found in the documentation listed in Section 15.

15 References

15.1 Internal References

Table 11: List of Internal Project Reference Documents

Document Reference No.	Document Title
Ventilation Technical Reports	
M4M5-JAJV-TUN-MES-ME01-RPT-0005	Tunnel Ventilation Analysis Report
M4M5-LSBJ-PRW-MES-ME02-RPT-0005	Tunnel Ventilation Plant Design Report
M4M5-LSBJ-PRW-MES-ME03-RPT-0005	Tunnel Ventilation Controls Report
M4M5-LSBJ-PRW-MES-ME02-RPT-0005 – Appendix N.1	Tunnel Ventilation Air Dispersion Modelling Report
OMCS Technical Reports	
M4M5-SICE-PRW-MES-OM01-RPT-0005	OMCS Hardware Report
M4M5-SICE-PRW-MES-OM10-RPT-0005	OMCS Software Architecture Report
M4M5-SICE-PRW-MES-OM17-RPT-0005	SIDERA Core Functionality Design Report
M4M5-SICE-PRW-MES-OM21-RPT-0005 to M4M5-SICE-PRW-MES-OM26-RPT-0005	TMCS Functionality Technical Reports
M4M5-SICE-PRW-MES-OM30-RPT-0005	PMCS Functionality – Ventilation Design Report
IOMCS Technical Reports	
M4M5-SICE-PRW-MES-OM60-RPT-0005	IOMCS Software Design Report
M4M5-SICE-PRW-MES-OM63-RPT-0005	Integrated SIDERA Core Functionality Design Report
Commissioning Documentation	
M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Management Plan
M4M5-SICE-PRW-MES-OM30-ITR-1008	OMCS PMCS Ventilation SAT Test Cases
M4M5-SICE-PRW-MES-OM63-ITR-7008	IOMCS Incident Management System I-SIT Test Cases
Emergency Response Documentation	
M4M5-LSBJ-PRW-GEN-OP01-PLN-0005	Emergency Response Plan

15.2 External References

Table 12: List of Applicable Standards and External Reference Documents

Document Reference No.	Document Title
WestConnex M4-M5 Link Project Specifications	
DPIE Conditions of Approval SSI-7485	WestConnex M4-M5 Link Infrastructure Approval
M4-M5 Link D&C Deed - Exhibit M	WestConnex M4-M5 Link Scope of Works and Technical Criteria
Asset Owner and Operator Documentation	
WOM-OP-PL-2	Incident Response Plan
WOM-OP-PR-13	Incident Response Procedure – Congestion
WOM-OP-PR-19	Incident Response Procedure – Systems Failure or Degradation
WOM-OP-PR-24	Incident Response Procedure – Air Quality

Appendices

Appendix A

Testing and Commissioning Management Plan

Appendix A. Testing and Commissioning Management Plan

WestConnex M4-M5 Link Tunnels

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Testing & Commissioning Management Plan

M4-M5 LINK TUNNELS

Client: M4-M5 Link Group | Project No.: 259954 | Date: 30/05/2022

Document No.: M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Revision: 03

Document Control

Title:	Testing & Commissioning Management Plan			
Document No./Ref.:	M4M5-LSBJ-PRW-MES-MP01-PLN-0003			
Status:	Non-Design Issued for Review (NDIFR)			
Disciplines	Mechanical & Electrical			
	Name	**Position**	**Date**	**Signed/Approved**
Originator(s)	Daniel Washburn	M&E T&C Manager	30/05/22	
Review	Thomas Celimene	M&E Director	30/05/22	
Approval	Andrew Marsonet	Project Director	30/05/22	

Document Revisions

Rev No	Date	Issue/Description	Approved
00	10/10/2019	Issued for NDIFR	
01	10/02/2021	Updated to address stakeholder comments	
02	13/09/2021	Update to address stakeholder comments	
03	30/05/22	• Update to address stakeholder comments • Addition of L4/5/6 test scope details • Updated testing matrix	

Contents

Appendices

1. INTRODUCTION

1.1 General

The WestConnex M4-M5 Link Main Tunnel Works (the project) will link the M4 and M5 Motorways and other Motorways, through new tunnel and road infrastructure that will be constructed in stages:

- Stage 1 includes an upgrade of the M4 Motorway (from Parramatta to Homebush) and the first stage of the connected tunnels (from Homebush to Haberfield).
- Stage 2 includes an effective duplication of the M5 East tunnels, including updates to the M5 from King Georges Road and tunnels from Kingsgrove to a new interchange at St Peters).
- Stage 3A (M4-M5 Link Main Tunnel Works (Haberfield to St Peters)) includes the tunnels that will connect the tunnels of Stage 1 with the tunnels of Stage 2, integration / transition of operations of all 3 stages to the WMCC and repurposing the M4E MCC to the multistage WDRS. This link will also provide physical and system interfaces to a further Stage 3B to Rozelle.
- M5 East which will be integrated into the operation from the WMCC through its dedicated OMCS (not via the I-OMCS).

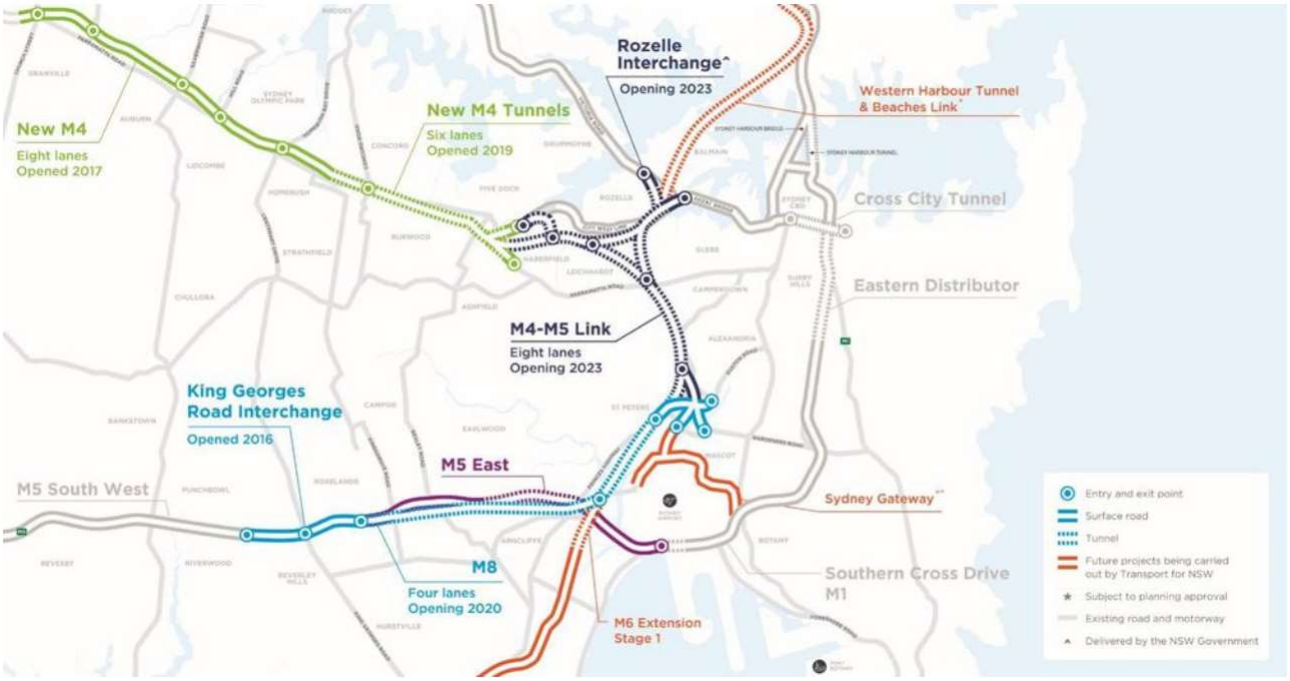

Figure 1 – WestConnex Project map (source: www.westconnex.com.au)

Each stage is being constructed separately, with a dedicated operations and management control system (OMCS).

The OMCS for the stages will be integrated through a supervisory control system called the WestConnex Integrated OMCS (IOMCS). The IOMCS will facilitate day-to-day operation and maintenance (O&M) of the entire infrastructure and will guarantee the two main objectives of this project: safety and efficiency.

The project comprises all Works associated with the M4-M5 Tunnel and its associated OMCS and traffic control and plant equipment, as well as development and integration of the IOMCS across Stages (1, 2 and 3A) into an integrated operating motorway.

1.2 Purpose

The purpose of the Testing and Commissioning (T&C) Plan is to describe how ASBJV will manage the overall testing and commissioning process for the project, including the integration of the M4-M5 Link with operating M4E and NM5 (M8) motorways and other interfacing infrastructure and road networks.

The plan covers all electrical and mechanical tunnel and surface equipment and systems including:

- The Operations Management Control System (OMCS) and Integrated OMCS (IOMCS) control and monitoring systems including incident management
- Ventilation System
- Voice Communication systems
- Data Communication Systems
- Fire and Life Safety Systems
- Incident detection systems.

1.3 Scope

The scope of this Plan is to address the Deed and SWTC requirements related to testing and commissioning and covers all assets and systems that form part of the works.

Key requirements for Testing and Commissioning Activities are listed within SWTC Appendix C.1 (Section 17) and a full list of SWTC requirements related to the Testing and Commissioning Plan are provided in the PRD in Appendix A to this plan.

This plan is part of a suite of M&E management documents that covers all aspects of Systems Engineering, Testing & Commissioning, Transition works and Operational Readiness. Refer to Appendix D for the document hierarchy structure.

Specific sub plans have been developed for the following topics:

- OMCS and IOMCS - SICE has developed a separate suit of management and test plans to cover OMCS and IOMCS requirements and testing (refer [11], [12], [13], [14])
- Tolling – Kapsch has developed a separate suit of management and test plans to cover Tolling requirements and testing (refer [15], [16], [17], [18])
- C2C – details provided in the ICT T&C Plan
- Level 4, 5 and 6 Commissioning Test Management Plans.

The T&C Plan will ensure that ASBJV and its subcontractors will implement the Project Works in a manner that provides a system with maximum integrity, and that the works are performed safely and effectively.

Testing and commissioning will include the training and readiness evaluation of WestConnex Operators, and the verification of correct operations from the WMCC and the Disaster Recovery Centre. A separate Operational Readiness Evaluation Plan [10] and Transition Acceptance Management Plan (TAMP) [7] have been developed.

The Testing and Commissioning Plan will be reviewed, developed and updated as required by ASBJV.

1.4 Definitions & Abbreviations

Acronyms & Terminology	Definition
Assurance	Entails any or all of the following processes: Validation is performed on any Design and Construction (D&C) Deed Requirements and any Derived Requirements (for consistency etc.). Design is traced from each Requirement to all related Design Artefacts to show level of design compliance. Progressive verification throughout the Design phases DCD, SDD, FD and IFC, with traceable verification via the PRD for a minimum of SDD onwards, to demonstrate growth to full compliance of the design at FD. Progressive verification of all Requirements throughout implementation/development and phases of integration, with traceable verification of each Requirement recorded in the PRD at each of the formal Client-witnessed Acceptance Tests. Validation of the contract ICT stakeholder requirements to demonstrate final system compliance to the D&C Deed, with traceability of this validation in and reported from the PRD. Note that some verification testing where formalised as Acceptance Testing will also Validate System Stakeholder requirements.
AIS	Asset Information Systems (Transurban use the product Maximo)
C2C	Centre to Centre
Client	The WestConnex M4-M5 Asset Trustee (WCX M4M5 AT)
D&C Deed Requirement	A Requirement either directly imposed by the D&C Deed or imposed on the programme of Works by reference within the D&C Deed (e.g. Minister's Conditions of Approval)
EUC	Equipment Under Control
FAT	Factory Acceptance Testing - OMCS
FIT	Factory Integration Testing - OMCS
Formal Test	A Verification test or System Validation test whose test cases are approved by the Client and whose tests are witnessed by the Client and written test results approved by the Client.
IC	Independent certifier
IFAT	Factory Acceptance Testing - IOMCS
IFIT	Factory Integration Testing - IOMCS
IOMCS	Integrated Operations Management and Control System
ISAT	Site Acceptance Testing - IOMCS
ISIT	System Integration Testing - IOMCS
M&E	Mechanical and Electrical
NCR	Non-Conformance Report
OMCS	Operations Management and Control System including the TMCS & PMCS
OMCS1	OMCS used on M4 East Motorway
OMCS2	OMCS used on New M5 – now known as M8
RMS	Roads and Maritime Services (now TfNSW)
SAT	System Acceptance Testing - OMCS
SEMP	Systems Engineering Management Plan
SIDERA	SICE's Surveillance and Control (SCADA) system
SIT	System Integration Testing - OMCS
STF	System Test Facility – a testing facility to reduce risk in introducing modifications to the operating OMCS1 and OMCS2, and to allow thorough standalone integration testing of the OMCS3A and IOMCS.
SWTC	Scope of Works and Technical Criteria

Acronyms & Terminology	Definition
TfNSW	Transport for New South Wales
UAT	User Acceptance Testing
Validation	Process to confirm that the end product complies with the D&C Deed, SWTC and all called up requirements (i.e. “have built the correct system”). In conjunction with the Requirements Definition at the start of the Project and a CONOPS revision, the Validation will confirm the system complies with the Stakeholder intent of the Requirements.
Validation Stage	For each Stakeholder Requirement, this defines the Stage at which a Validation activity is scheduled for that Requirement to be considered Validated when successful.
Verification	Process to confirm that the build complies with the design, or the design with the originating build requirements (i.e. “are building the system correctly”)
Verification Stage	For each Stakeholder Requirement, the formal event at which the Requirement as implemented is Verified. This will be a Formal Test Stage.
WCX M4M5 AT	The WestConnex M4-M5 Asset Trustee
WCX	WestConnex

1.5 Standards, Procedures & References

The documents listed below are referenced within this plan.

Reference Number	Document Title	Document Number
1	Quality Management Plan	M4M5-LSBJ-PRW-GEN-MP01-PLN-0008
2	Document Control and Records Management Plan	M4M5-LSBJ-PRW-GEN-MP01-PLN-0014
3	System Engineering Management Plan	M4M5-LSBJ-PRW-GEN-MP01-PLN-0024
4	Integration Plan	M4M5-LSBJ-PRW-GEN-MP01-PLN-0025
5	Interface Management Plan	M4M5-LSBJ-PRW-GEN-MP01-PLN-0027
6	System Safety Program Plan (SSPP)	M4M5-LSBJ-PRW-GEN-MP01-PLN-0031
7	Transition and Acceptance Management Plan (TAMP)	M4M5-LSBJ-PRW-GEN-MP01-PLN-0040
8	Technical Review and Audit Plan (TRAP)	M4M5-LSBJ-PRW-GEN-MP01-PLN-0041
9	System Architecture	M4M5-LSBJ-PRW-MES-GE01-DIA-0001
10	User Acceptance Test & Operational Readiness Evaluation (ORE) Plan	M4M5-LSBJ-PRW-MES-MP01-PLN-0005
11	ICT Systems Project Management Plan	M4M5- SICE-PRW-MES-MP01-PLN-0001
12	ICT Configuration Management Plan	M4M5-SICE-PRW-MES-MP01-PLN-0015
13	ICT Software Development Plan	M4M5- SICE-PRW-MES-MP06-PLN-0001
14	ICT Test & Commissioning Plan	M4M5-SICE-PRW-MES-MP01-PLN-0021
15	Kapsch Project Management Plan	M4M5-KPSH-PRW-MES-MP01-PLN-0003
16	Kapsch System Engineering Management Plan	M4M5-KPSH-PRW-MES-MP01-PLN-0007
17	Kapsch Installation and Commissioning Management Plan	M4M5-KPSH-PRW-MES-MP01-PLN-0009
18	Kapsch Integration Management Plan	M4M5-KPSH-PRW-MES-MP01-PLN-0011
19	SWTC Main Body and relevant appendices	
20	MCoA	
21	Transport for NSW Specification – Motorway Systems – Motorway Control Centre	IC-D&C-TS911 Ed 1 / Rev 0
22	Transport for NSW Specification – Motorway Systems – Electronic Toll Collection System	IC-D&C-TS916 Ed 1 / Rev 0
23	Transport for NSW Specification – Motorway Systems – C2C Interface for Motorways	IC-D&C-TS917 Ed 3 / Rev 1

2. ROLE AND RESPONSIBILITIES

2.1 General

This plan provides a framework for Testing and Commissioning of the overall WestConnex Program including physical and system interfaces and its control and monitoring from a centralised IOMCS.

The direct accountability and responsibility for the successful Testing and Commissioning are project phase based (refer to Table 1 – Testing and Commissioning phases) between system engineers, installation team, commissioning team, etc. and will consequently change throughout the project life cycles. It is expected that the system engineers will have a level of involvement throughout all phases of project life cycle.

In addition to the phase-based responsibilities for specific actions, the following Organisational Responsibilities will have responsibility as outlined below:

- ASBJV
  - Identification of testing and commissioning requirements
  - Overall test lead
  - Execution lead for the Level 0 hardware FATs with support from the vendors and sub-system sub-contractors
  - Support for Level 0 software FAT/IFAT/FIT/IFIT with Execution Lead by the OMCS/IOMCS Contractor
  - Execution lead for Level 2, 3, 4, 5, 6 testing and commissioning activities with support from the OMCS/IOMCS Contractor and sub-system subcontractors
  - Defining the testing and commissioning activities across all disciplines in accordance with the SEMP
  - Support the phase delivery managers (design, construction and T&C) through the implementation activities as they relate to Testing and Commissioning
  - Ensure technical reviews are carried out to enable progressive testing and commissioning
  - Identify and report on compliance gaps
  - Develop and update the Testing and Commissioning Plan as required
  - Plan all testing and commissioning activities
  - Provide an Organisation Chart for the Testing and Commissioning Team
  - Ensure all testing is managed and conducted by a competent and authorised person
- Independent Certifier
  - The Independent Certifier will be involved in witnessing testing as required by the Independent Certifier Deed of Appointment in line with the IC's Surveillance Management Plans
  - Review and provide comment on testing documentation
  - Witness testing activities
  - Audit's as required
- WCX
  - Review and provide comment on testing documentation
  - Witness testing activities
  - Responsible to plan and manage resources, including operation and maintenance organisation mobilisation, in such a way to ensure a seamless and continuous transition of the facilities and systems from the design and construction phase activities to the O&M Work
  - Ensure relevant O&M personnel observe commissioning activities
  - Operate the OMCS and IOMCS during User Acceptance Testing in accordance with Appendix B.12 and Appendix B.31
- TfNSW
  - Review and provide comment on testing documentation
  - Witness testing activities

- Nominate personnel to be trained in aspects of operation and maintenance of the Project Works to the extent that the personnel are able to operate and maintain the Project Works without further assistance from the Project Company.

2.1.1 Resourcing Requirements

A high-level Org Chart for the ASBJV T&C team has been included in this plan. Three workstreams run in parallel, systems, devices and transition (integration). Many of the tasks are inter-related and are co-ordinated by the overall T&C manager.

For the formal testing phases consideration has been given to the overall program, the number of test cycles to complete and the level of effort required for each test phase. Test cycles are assigned to test managers who in turn manage a team of engineers to facilitate the development, review and submission of test documentation, internal testing, witness dry run testing, TRRs and formal witness testing.

Due to the complexity on integrating the Stage 3A Motorway with the two adjacent live motorways, the role of Transition Manager has been developed and the Transition team will be dedicated to managing this scope of works.

2.2 M&E T&C Manager

The M&E T&C Manager reports to the M&E Director and is responsible for the overall commissioning plan, program and budget. Primary responsibilities include;

- Manage external and internal stakeholders
- Manage T&C budget and program
- Coordinate the various subcontractor requirements related to testing and commissioning within the overall team
- Manage resourcing within the T&C team

2.3 M&E Systems Commissioning Manager

The M&E Systems Commissioning Manager reports to the M&E T&C Manager and is responsible for the overall planning, management and coordination of site-based commissioning activities performed for the Project. Primary responsibilities include:

- Accept the handover of a work area from construction
- Approve energisation permits
- Coordinate inspection requirements with stakeholders
- Commissioning signoff
- Safe performance of work
- Commissioning schedule
- Ensure equipment and systems subcontractors complete all Level 2, 3 and 4 tests for equipment and systems in their scope of work
- Manage site-based activities for SAT, SIT & UAT phase works.

2.4 Discipline Commissioning Leads

Discipline Commissioning Leads report to the M&E Systems Commissioning Manager and are responsible for the planning, management and coordination of all commissioning activities within specific disciplines (mechanical, electrical and ITS/communications). Primary responsibilities include:

- Monitor commissioning progress
- Ensure commissioning areas are kept clean and safe
- Approve and co-ordinate non-commissioning works via the Permit to Work system
- Monitor the quantity of power consumed during the commissioning process
- Complete all Level 1, 2, 3 and 4 tests for equipment and systems in the M&E scope of work

- Complete all QA documentation, including ITRs and as-built drawings for the equipment and systems in the M&E scope of work.

2.5 Commissioning Engineers

Commissioning Engineers report to the Discipline Leads and are responsible for the planning, management and coordination of activities in a specific field. Primary responsibility includes:

- Prepare and review ITRs in their specific field
- Manage and monitor the good execution of the tests by the commissioning resources
- Complete and verify QA documentation, including ITRs and as-built drawings

2.6 Permit Manager

The Permit Manager reports to the M&E Systems Commissioning Manager and is responsible for the development and implementation of the Permit to Work system.

2.7 Permit to Work Officers and Authorised Isolators

The Permit to Work Isolation Officers reports to the Permit Manager and are responsible for implementing approved Permits to Work with their associated isolations. Authorised Isolators will be responsible for implementing isolations in the field.

2.8 OMCS/IOMCS Project Manager

The OMCS/IOMCS Project Manager reports to the Project M&E T&C Manager and is responsible for the overall planning, management and coordination of commissioning activities associated with the modifications to OMCS1 & 2, testing and commissioning of OMCS3 and IOMCS. Primary responsibilities include:

- Staffing and resourcing of commissioning teams during the Levels 0, 4, 5 and 6 testing period including experienced software commissioning engineers
- Development of OMCS/IOMCS testing and commissioning procedures and documentation
- Completion of all OMCS/IOMCS tests for OMCS/IOMCS equipment and systems
- Coordination of the OMCS/IOMCS FAT and FIT including site setup and installation of all equipment, cables and services, simulation equipment, and stakeholder witness tests
- Schedule Level 5 and 6 system tests
- Provision of appropriate Level 6 tests that require witnessing by statutory authorities (Fire and Rescue NSW, Police, etc)
- Assurance that the OMCS/IOMCS work scope complies with the Project Requirements related to the OMCS and IOMCS.

2.9 OMCS/IOMCS Commissioning Engineers

The OMCS/IOMCS Commissioning Engineers report to the OMCS/IOMCS Commissioning Manager and are responsible for the technical support, problem rectification, software and hardware modifications and hands on testing for the project.

2.10 Commissioning resources

The commissioning resources consist of engineers and tradespeople for the respective engineering disciplines (i.e. mechanical, electrical, fire, communications and control systems). As the need arises, members of the workforce report to a commissioning engineer for the performance of commissioning activities. The resources will perform the commissioning activities in accordance with approved commissioning documentation to demonstrate compliance with the project requirements.

2.11 Specialised resources

Where required, commissioning crews including subcontractor specialists will be used for specific systems. Examples of these specialised resources include:

- Mechanical team to commission vent stations and the various mechanical equipment including fans, dampers and instrumentation
- A dedicated HV team to commission HV switchgear and transformers
- Specialist subcontractors for mobile phone, public address, radio rebroadcast, water treatment plant, air quality devices, axial fan VSDs, UPS equipment, AVIDs etc
- Tolling Contractor
- OMCS and IOMCS Contractor - Details of the OMCS and IOMCS resources are documented within the SICE ICT Test and Commission Plan [14].

3. TESTING AND COMMISSIONING PROCESSES

3.1 Testing and Commissioning Phases

The Project Testing and Commissioning phases are broken down as shown in Table 1.

Table 1 – Testing and Commissioning phases

Phase	Level	Test Stage	Test Stage Description	Witnessed*
Manufacturing	0	**FAT**	**Factory Acceptance Testing** The FAT is used to demonstrate all device or subsystem functionality and performance, in isolation to other subsystems. The FAT will: • Prove the compliance of the device or system to the maximum extent to minimise extent of further testing in the SAT phase, prior to delivery; • Normally be performed at the manufacturer/supplier's facilities Two Categories: • Vendor Hardware FAT: Testing of equipment manufactured specifically for the project such as transformers; distribution boards; jet fan; VMS; boom gates; pumps; smoky vehicle detection system etc. Results are stored in iTWOcx as QA records. • FAT: OMCS FAT of software-based systems and associated hardware such as servers and network equipment. JIRA will be used for these software test cycles.	Yes
	0	**IFAT**	**IOMCS Factory Acceptance Testing** The IFAT is IOMCS Factory acceptance Testing. IFAT testing is required for all IOMCS devices (e.g. servers), software and subsystems installed or configured as part of the IOMCS. This includes validation of the PMCS inter-stage algorithms (e.g. Integrated Lighting Response, Integrated Ventilation Response) and will include regression testing of changes required to be made to the Stage 1 and Stage 2 systems to facilitate integration of the three stages. JIRA will be used for these software test cycles.	Yes
	0	**FIT**	**Factory Integration Testing** The FIT is factory acceptance testing for integrated systems – or alternatively, an integrated FAT. Its purpose is to verify interfaces between subsystems. The FIT is testing of a number of separate subsystems, each of which may have completed a FAT, when combined and connected together to form part of the OMCS. The FIT: • Must demonstrate that the integration testing accounts for data loading equivalent to the final target site configuration for the relevant interfaces; • Includes Comprehensive testing of interfaces with real target production devices; • Verifies the integration of separate subsystems with SIDERA at the OMCS level; • Is primarily performed at the System Test Facility (STF). • JIRA will be used for these software test cycles.	Yes
	0	**IFIT**	**IOMCS Factory Integration Testing** The IFIT integrates IOMCS subsystems and devices and verifies interfaces at that level. The IFIT includes: • the IOMCS-OMCS interface using the M4E Motorway and the M8 Motorway OMCS replicas (including changes required for integration tested during IFAT), the 3A Motorway OMCS and examples of actual devices;	Yes

Phase	Level	Test Stage	Test Stage Description	Witnessed*
			• Integration and operation of IOMCS subsystems as a whole (e.g. CCTV, AVID, PABX). • Validation of Fire Scenarios and Normal Ventilation control of the integrated motorway The IFIT must demonstrate the IOMCS can monitor all necessary information from the OMCS and that all commands issued by the IOMCS are received and executed by the OMCS. JIRA will be used for these software test cycles.	
Installation	1	**Installation Testing**	**Installation Testing** ensures equipment has been installed in accordance with the design intent; is correctly labelled; and is correctly terminated by cabling. Activities include: • Verification of equipment installation on site, including foundations, support structures, fixing, levelling/orientation measurement; • Origin/destination tests of cables; • Insulation resistance tests of power cables; • Confirmation that cables have been terminated correctly and with integrity; • Earthing system continuity tests; • Fault loop impedance tests; • Checking of equipment and wiring labels • Completion of an ITR in Completions Connect.	No
Commissioning	2	**Energisation Testing**	**Energisation Testing** is comprised of activities performed to verify that the installed equipment can be safely energised. Energy is provided to an approved section of a system in a controlled manner. • Completion of ITR in Completions Connect. • Must be preceded by successful completion of Level 1 Testing.	No
	3	**I/O Testing**	**I/O Testing** activities are performed to verify that field cabling of digital and analogue I/O points are correctly installed end-to-end. • Communications cabling (e.g. Ethernet) / high level interface cabling (HLI) are correctly installed • I/O mapping to PLC I/O module and connected hardware being controlled / monitored is correct • Completion of an ITR in Completions Connect.	No
	4	**Device Testing**	**Device Testing** activities are performed to verify correct operation of subsystems and field devices. Part of the device testing will be done prior connection to the OMCS in order to ensure that local performances/settings are OK. Then the device testing will be finalized from the OMCS : • Check Relevant Information Data in the OMCS/IOMCS for the location of the devices, the information per device, as per design • Verification of the correct operation of equipment (individual devices and algorithms), including monitoring and control functionality checks performed end-to-end from the OMCS (typically at the WMCC). • Examples of Level 4 testing: testing of lighting switching; confirmation of CCTV camera views; operation of signs; operation of PA system; operation of individual deluge zones; operation of individual communication system components; and phone system and RRB operation from the OMCS/IOMCS. • The Level 4 commissioning process confirms each OMCS/IOMCS device is correctly mapped. • Completion of an ITR in Completions Connect.	No
	4B	**Witnessed Device Testing**	**Witnessed Device Testing** activities verify the full operation of the software functions for *each software module* in the presence of the connected field equipment, for one item of each device type.	Yes

Phase	Level	Test Stage	Test Stage Description	Witnessed*
			• Testing for relevant information and data / monitoring variables / commands / adjustable parameters / control principals / events of one item from each device type; • Witnessed testing of L4 for one of each device type; • Completion of an ITR in Completions Connect.	
	5	**SAT**	**Site Acceptance Testing** The SAT occurs after devices have been installed on site in their final position/configuration and components of a system have been tested to the previous level in a certain construction zone. The SAT is conducted on all subsystems at the OMCS level. Elements of the SAT include: • Device or subsystem functionality; • Tests defined by system engineers and clearly identify how they are tested back to functionality and requirements; • Device or subsystem performance tests in all operation modes anticipated including normal operation, emergency operation, total or partial power failures and redundancy fail overs. • Environmental and durability testing (where appropriate); • Testing of redundancy requirements, including verifying performance during changeover to a redundant system; • Functionality and performance under power failure transition to essential power supply and back after power restoration • UPS systems, where installed, under actual operating conditions for the full duration of the required standby period • Seamless selection of PA/RRB break-in messages and Traffic Sections to any required combination of locations • Correct routing of phone voice traffic (METS, FETS, IOCS) • Selection of CCTV camera views, recordings and AVIDS recordings • Implementation of traffic plans (traffic plan testing using OMCS simulators) • Completion of test cycle in JIRA	Yes
	5	**ISAT**	**IOMCS Site Acceptance Testing** IOMCS SAT is not intended to replicate all SAT cases of each OMCS, but rather to demonstrate monitoring and control from IOMCS as required by the SWTC. In the context of the IOMCS, Level 5 testing includes: • Verification of IOMCS equipment installation on site as required; • Device or subsystem functionality from the IOMCS; • IOMCS device or subsystem performance tests in all operational modes, including normal operation; emergency operation; total or partial power failures and redundancy fail overs. • Control of integrated ventilation requirements across the WestConnex Motorway • Seamless selection of PA/RRB break-in messages and Traffic Sections to any required combination of locations • Correct routing of phone voice traffic (METS, FETS, IOCS) • Selection of CCTV camera views, recordings and AVIDS recordings • Implementation of traffic plans (traffic plan testing using OMCS simulators) • Testing of C2C Interface • Modifications to the Stage 1 and Stage 2 OMCS will be tested in a standalone configuration during ISAT. • Completion of test cycle in JIRA The following test phases must be completed: i. Isolated ISAT includes testing of devices, software and subsystems within the IOMCS, including such tests that do not require access to the IOMCS-OMCS interface.	Yes

Phase	Level	Test Stage	Test Stage Description	Witnessed*
			ii. Integrated SAT (Simulated) with the IOMCS interfaced to the Main Tunnel Works OMCS, M4 Motorway OMCS and the M8 Motorway OMCS simulators and C2C test harness; **iii.** integrated SAT (Monitoring) with IOMCS interfaced to the Main Tunnel Works OMCS and in-service M4 Motorway OMCS and M8 Motorway OMCS in a monitoring only mode. **iv.** Integrated SAT (Targeted) with IOMCS interfaced to the Main Tunnel Works OMCS and in-service M4E Motorway OMCS and M8 Motorway OMCS in a targeted control mode (may require closures of M4E and M8 Motorways for testing, to be developed further in the ICT Test and Commission Plan and lower-level subsystem commissioning documents).	
Pre Opening - Final Testing	6	**SIT**	**System Integration Testing** SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The SIT demonstrates that: • all plant and traffic devices have been configured and integrated into the OMCS and operate correctly; • all external interfaces have been integrated into the OMCS and the interfaces operate correctly; • the C2C interface to the TMC and Other OMCSs has been configured and operates correctly; • the CCTV interface to the TMC and Other OMCSs has been configured and operates correctly; • This SIT is Intra Project i.e. not including external projects such as M4 and M5 assets. • Completion of test cycle in JIRA	Yes
	6	**ISIT**	**IOMCS System Integration Testing** ISIT activities verify the operation of the systems from the IOMCS using final system interfaces and verify all correct subsystem operations across all three WestConnex Stages in normal and emergency conditions against the design intent using actual system interfaces. System Integration Tests must verify that there is no adverse impact to OMCS and MNCS function and performance because of IOMCS OMCS integration. Typical examples include: • Ventilation control system to combine the operation of individual devices across multiple OMCSs to demonstrate integrated automatic operation • Incident response management - Integrated incident response testing combining the operation of individual traffic monitoring and control devices to demonstrate integrated system automatic operation across the IOMCS/OMCS subsystems. The tests are conducted using a sample of the TCPs. • Power failure tests applicable to new UPS installations at the WMCC and WDRS to demonstrate automatic changeover and recovery from an un-expected total power loss to server room. • Data links to other parties including TfNSW. • Completion of test cycle in JIRA.	Yes
	N/A	**UAT**	**User Acceptance Testing** • The final stage of testing that is done by the Operators, it occurs once all other testing has been completed. • Performed to prove that all OMCS and IOMCS components for the control of the roadside and tunnel devices operate as an integrated system. • OMCS and IOMCS UAT must demonstrate major functional areas of the motorway, including: Traffic Management and Incident Response Systems; fire protection systems in fire mode including tunnel ventilation; and tunnel ventilation plant and equipment.	Yes

Phase	Level	Test Stage	Test Stage Description	Witnessed*
			• Each of the automated processes must be tested to demonstrate the effective and integrated control and monitoring of the motorway, including: ○ automatic and manual intervention of tunnel ventilation mode controls and transition to fire mode control under fire detector input; ○ variable air quality monitoring and traffic data to produce automatic step changes in ventilation mode; ○ traffic monitoring and congestion management and Incident management responses for a variety of scenarios, including integration of Incident responses with TMC; ○ automatic changeover of all redundant IOMCS systems to redundant back-up systems where installed and defined in the Design Documentation; and ○ all TFNSW TMC interfaces specified in the SWTC including CCTV video data. The UAT for the Stage 3 OMCS and the overall motorway operation from the IOMCS will be described in the Operational Readiness Evaluation (ORE) Plan and the lower-level subsystem commissioning documents.	
Post Opening	7	**System Tuning**	Level 7 activities are those that can only be adjusted and verified following the opening of the integrated WestConnex Motorway to traffic. This is not formal testing that is attended by the client. The client will be monitoring operations, and tuning will occur for systems as required. QA will be captured. Typical examples include: • Tunnel Ventilation System Tuning (e.g. confirming effective, stable responses to live traffic patterns); • AVIDS tuning (e.g. minimise false alarming, refine parameters for detection optimization); • Travel time validation; • TIDS tuning to minimise false alarms detection.	No

*The IC shall have access to all records, artefacts and dashboards associated with the non-witnessed and witnessed works. Upon request, spot checks of non-witnessed testing can be performed.

3.2 Testing and Commissioning Overview

The test and commissioning process follows the order defined in Table 1 – Testing and Commissioning phases. This is to maintain developing integrity of the system as it is brought together. In general terms, the process follows a 'verify before use' philosophy so that large numbers of tests are performed on the individual parts of the constructed system prior to their use in larger subsystem tests. Although the levels listed appear distinct, in some cases activities may be merged into a single step.

In principal, testing phases will be executed sequentially, but entry and exit criteria will be dependent on system type and prerequisites as identified in the development of test documentation.

Leading up to, and during the testing and commissioning works, regular planning meetings will be held with ASBJV, SICE and the external stakeholder parties (AT, IC and TfNSW) to facilitate open communication around T&C topics including program updates. In accordance with the SWTC requirement, ASBJV will perform a 'Test Readiness Review' (TRR) with the external stakeholders prior to any formal witness testing (excluding hardware FATs at suppliers' facilities) where all parties will agree that the testing pre-requisites have been completed and the formal test can proceed. The formal FAT date will be formalised at the TRR.

Formal witness testing FAT, FIT, SAT, SIT and User Acceptance Test (UAT) of devices and/or systems must be undertaken with TfNSW and the Independent Certifier only after all preliminary testing has proven the devices and systems to a high degree of certainty.

The scheduled 'burn in' operation of some devices (such as LED based displays) must precede the FAT.

FAT activities will not be conducted under circumstances where device(s) or systems are still under development or subject to software programming development.

As per the SWTC Appendix B.12 Operations Management and Control Systems - Notice for the formal witness testing (FAT, FIT, SAT, SIT and UAT) must be given 21 calendar days in advance of the scheduled date of the tests. Notification of testing and submission of test documentation will be provided in iTWOcx and transmitted via Teambinder.

Test documentation must comprise without limitation the following:

- ITP - Inspection and Test Plan, which must include a test timetable;
- ITR (or ITC) - Inspection and Test Requirements (or Inspection and Test Checklists), detailing the full suite of test cases to be conducted and identifying acceptance criteria;
- any WHS requirements applicable for the testing; and
- access arrangements and a list of all attendees at the tests.

TfNSW and the Independent Certifier may review the submitted testing documentation and may submit review comments within 10 working days, when SWTC specific requirements are not covered by the testing or the testing is otherwise deemed inadequate to prove compliance. Additional testing must be included in the test schedules when required by the Independent Certifier. Comments on the test documentation will be collated by the IC and transmitted back to ASBJV via Teambinder. Further information on this process is provided in Section 6 Documentation.

3.3 Level 0: Manufacture / Factory Acceptance Testing (FAT/FIT/IFAT/IFIT)

FAT must be conducted on all devices comprising the OMCS roadside and tunnel devices and subsystems. The FAT must be conducted in the premises of the manufacturer where the devices were fabricated. Sufficient space and services must be made available for the FAT activity. Separate tables and chairs for the Independent Certifier and TfNSW attendees and lockable storage for FAT documentation must be provided when testing extends beyond one day.

The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues.

The essential elements of the FAT test must include:

- all device or subsystem functionality;
- the device or subsystem performance parameters at maximum load, and if appropriate beyond, set out in the SWTC specifications and referenced standards;
- calibration of measuring instrumentation must be prepared beforehand and certified by NATA registered laboratories;
- hardware requirements;
- environmental and durability testing where appropriate; and
- interfaces to other devices and systems as specified by data protocol specifications.

Where required, input and output interfaces may be simulated by means of simulators where large numbers of inputs and outputs are needed to prove functionality and performance under load. When simulators or other quasi-interface devices are employed for FAT testing, the application must always be realistic in the FAT context and must not be used to mask potential problems to be encountered on site.

FAT results must be recorded formally with the performance results clearly traced against comparative design criteria on the prepared FAT test results proformas or checklists, and signed off by relevant test observers as required, whether test pass or fail. Completed FAT test results must be prepared and bound into a completed FAT Report for the Motorway. Each test case must be clearly annotated to show that the test result was a pass or a fail.

FAT test results noted as failed must be repeated when the defect giving rise to the fail result has been cleared. Where a number of fail results eventuate, repeat testing must be programmed to allow re-assembling of all FAT attendees. Where required by the Independent Certifier, additional regression testing must be conducted to demonstrate that clearing the defect has not produced faults elsewhere in the device or system.

3.3.1 Vendor FAT

For most hardware procured by ASBJV, the FAT will be performed at the vendors facilities. Vendor QA documentation including ITP and test procedures will be submitted to ASBJV by the vendor via the iTWOcx Vendor Document Review (VDR) process. The documents are reviewed by ASBJV engineers until accepted. The results of the hardware FATs will be recorded in Completions Connect as part of the project QA processes. Defects will be noted on the FAT test documentation and registered in Completions Connect.

Vendor FAT witness and hold points are raised in iTWOcx and issued formally to WCX/IC/TfNSW in Teambinder. A Teams QA channel “M&E FAT Videos” will be used to inform external stakeholders of upcoming vendor FATs.

3.3.2 Software FAT/FIT/IFAT/IFIT

Software Level 0 tests are detailed in the SICE ICT Plan [14]. In general they will be performed in the project System Test Facility in Mascot or in Spain with remote witnessing capability provided for all tests.

FITs will include testing SICE software with ASBJV hardware attached where possible at the STF.

IFAT and IFIT activities will include use of Stage 1 and Stage 2 OMCS replicas or simulators and will incorporate Hardware in the Loop testing of the ventilation system algorithms during relevant testing cycles. Any regression testing required on changes to the Stage 1 and Stage 2 OMCS to facilitate integration will be tested at this stage.

The results of the software Level 0 tests will be recorded in JIRA as part of the QA processes. Defects will be noted in JIRA and a defect log provided with test documents results including evidence of retesting where appropriate. Further details of entry and exit criteria, management of defects and regression testing during software FATs is provided in the ICT Test and Commission Plan.

In accordance with the project requirements, software FAT test documents are issued to WCX/IC/TfNSW for review 3 weeks (21 calendar days) prior to the forecast test date unless agreed otherwise by the relevant parties. They are provided in both Teambinder and iTWOcx. The external stakeholders have 10 working days to comment on the test documents and return the comments via the IC to ASBJV via Teambinder.

A Test Readiness Review (TRR) is held prior to the formal test (typically 1 day prior). The TRR documentation is issued via iTWOcx and Teambinder prior to the TRR and includes closeout of any comments on the test documents and includes any post-IFC changes to the design report as part of the supporting documentation. At the TRR the documentation is reviewed, and the parties agree that the formal test can proceed.

Software FAT hold points are raised in iTWOcx and issued formally to WCX/IC/TfNSW in Teambinder 3 weeks (21 calendar days) prior to the forecast formal test date. This hold point is typically issued at the same time as the test documents.

Upon completion of the formal FAT test, the finalised test report along with relevant pack artifacts are uploaded to iTWOcx and transmitted to WCX/IT/TfNSW via Teambinder.

3.4 Level 1: Installation Testing

Level 1 activities are performed by construction personnel (including subcontractors) during the installation of equipment. This process ensures equipment has been installed in accordance with the design intent, has been correctly labelled and finally has been correctly connected by cabling. Level 1 activities include:

- Equipment installation
- Origin/destination tests of cables
- Insulation resistance tests of power cables
- Confirmation that cables have been terminated correctly
- Splicing and performance testing of optical fiber
- Earthing system continuity tests
- Fault loop impedance tests
- Checking of equipment labels
- Recording of serial numbers of ITS assets
- Cable installation and fibre splicing

- Fixings for M&E equipment
- Fire sealing and other protective functions
- Correct installation of limit switches, sensors, and indicators etc.

The completion of installation Inspection & Test Plans (ITP's) and Records (ITR's) is a prerequisite and subject to audit by the commissioning team before the start of commissioning activities. This will include (via inspection) evidence that any previously identified non-conformance items have been rectified.

Pending a satisfactory audit, the completed installation works will be handed over from construction to commissioning. Outstanding defects or punch list items will be referred to the M&E Test and Commissioning Manager, who will agree a practical means with the M&E Project Manager for a resolution.

Audit will evaluate the completeness of installation works and ability to commence energisation and commissioning.

When handover is complete, the M&E Test and Commissioning Manager will issue a Commissioning Notice to the project stakeholders the area is now under the control of commissioning with any remaining installation works requiring a Permit to Work that will be issued and controlled by commissioning.

Completed Level 1 test ITRs and punch items will be stored in Completions Connect.

3.5 Level 2: Energisation Testing

Level 2 activities are performed by commissioning personnel once an area is under the control of commissioning.

Level 2 will perform initial energisation and LV electrical testing utilising temporary or permanent power to the LV distribution boards located in the Electrical Equipment Rooms. Power will be maintained in these areas to complete Level 2 Testing and subsequent testing. If temporary power is used to start testing it shall be switched to permanent power prior level 5. Level 2 activities may include:

- Energisation of individual Electrical Equipment Rooms (EER) using temporary power (if permanent power not available)
- Power up lighting, cross passage and tunnel equipment including ITS equipment
- HV auditing or statutory inspections
- HV electrical system testing – to ensure integrity prior to energisation including supply authority protection testing where required
- LV electrical system testing – to ensure integrity prior to energisation
- HV energisation
- LV energisation.
- Powering up PLC I/O networks and checking individual nodes for connectivity

The first phase in the energisation of the permanent or temporary power supply within the surface substations is the powering of essential support systems such as battery chargers, protection systems and feeder tripping supplies. This is followed by energisation of the HV equipment through to the incoming feeders at the LV switchboards.

Energisation of the HV and LV switchboards and associated infrastructure will then follow to verify the correct phase rotation and voltages. It results in the introduction of power past the switchboard's main incoming air circuit breakers onto each busbar and subsequently out to each distribution board/electrical panel.

This level of activity is the first time that power is supplied to project equipment. Commissioning notices will be issued to the project advising which sections of the project are to be treated as live and that any work in those areas will be subject to isolation procedures and permit to work systems.

Completed Level 2 test ITRs and punch items will be stored in Completions Connect.

3.6 Level 3: I/O Testing

The OMCS contains a significant number of high-level interfaces, discrete and analogue I/O points. The Level 3 activities are performed to:

- Verify that field cabling associated with the I/O points has been correctly installed & terminated and to ensure that the I/O mapping to the programmable logic controller (PLC) I/O module and the connected hardware being controlled or monitored is correct.
- To perform localised point to point testing of ITS equipment and other high-level interface equipment, such as variable speed drives, to confirm the correct addressing and communication.

A portion of I/O testing is performed as part of the Level 0 FAT process so only the items that have not been tested or those with field wiring need to be tested during this level e.g. Circuit breaker monitoring, and moveable median vendor package I/O would have been tested in the factory.

PLC I/O testing associated with field wiring is carried out using computers connected to the respective I/O nodes and/or PLCs, to prove the operation of the devices under commissioning. In this series of tests, output points are energised via the PLC using I/O tag names, causing equipment to operate (e.g. lights to turn on or off, dampers to open or close.).

As equipment operates there will generally be other signals generated (and received at panels) to confirm operation. These signals will in turn be monitored to conform they have operated as required.

Testing within this phase of equipment will utilise local interfaces to verify correct operation and configuration.

Level 3 tests can be performed locally at a panel or remotely from a substation or the WestConnex Motorway Control Centre (WMCC) (pending the availability of communication networks). The testing is valid regardless of the location from which the testing is performed.

Portable PLC suitcases may be required to facilitate early level 3 testing prior to the permanent PLC hardware being available.

Completed Level 3 test ITRs and punch items will be stored in Completions Connect.

3.7 Level 4: Device Testing

Level 4 activities verify the correct operation of the final sub-circuit equipment and will generally require permanent communications and power to the local equipment. It includes ‘power on’ and mechanical testing. It is at this stage of testing that equipment comes under control of the OMCS.

Some level 4 activities such as mechanical tests on plant can be performed under temporary power and without permanent communications in place. This may include tests such as;

- Vibration checks on rotating plant
- Flow tests on pumps and fans
- Setting of damper limit switches
- Flushing deluge zones and setting deluge valves
- Mapping of Linear Heat Detection (LHD) cable to controllers
- Configuration of the fire detection system
- Tuning tunnel PA speakers
- Site calibration of measuring instruments (e.g. level sensors and air speed sensors)
- Setting up smart motor relays and variable speed drives

Generally, these tests are performed local to the asset and do not require the OMCS to be operational to perform.

The remaining level 4 activities verify correct operation of equipment and are performed using the OMCS and related head end equipment, completing the end to end testing for the first time.

Testing covered by this category includes:

- Checking local HMI and Remote SCADA have correct representation and operator controllability

- Checking direction and operating parameters of all rotating equipment and smart equipment (e.g. smart motor managers & variable speed drives)
- Testing of lighting switching
- Confirming CCTV camera views
- Operating signs, boom gates, moveable medians and other ITS equipment
- Operating PA systems
- Operating individual communication systems components
- Testing of phone system and radio rebroadcast operation
- Checking the fire detection system operation between fire panels and the OMCS

Level 4 tests will generally be unwitnessed (unless requested by the client parties) but as a minimum one of each type of device will be witness tested at level 4 (referred to as a Level 4B test).

Level 4 test ITRs and related punch items will be stored in Completions Connect. If a punch item relates to a software defect it will be copied to KNOSSOS by the OMCS/IOMCS Engineer and managed through the standard software defect process. Once closed in KNOSSOS the punch item can be closed in Completions Connect.

Level 4B testing will be performed in JIRA and software defects managed using the same process as Level 0 software testing.

Level 4 testing will be managed by ASBJV commissioning engineers with support from the OMCS/IOMCS contractor. Prior to a set of Level 4B tests being formally witnessed, the ASBJV and OMCS/IOMCS Contractor engineers will successfully complete internal testing. ASBJV will issue the test documents (ITR) to the stakeholders for review via iTWOcx and Teambinder. The date for the Level 4B test will be agreed between the stakeholders at the regular coordination meetings to align with availability and site activities.

Validation of project Software Requirement Specifications and project requirements can occur at both level 4 and Level 5. For further details, refer to the section below on Level 5 SAT.

Level 4 testing will primarily be performed from the WMCC with remote witnessing made available.

3.8 Level 5: Site Acceptance Testing (SAT/ISAT)

Level 5 testing will be managed by ASBJV commissioning engineers with support from the OMCS/IOMCS contractor. ASBJV will lead the SATs and develop the sub-system test documentation with input from the OMCS engineers for software related test steps. System capacity and end to end system function steps that are not related to the OMCS will be documented by the ASBJV engineers whereas the operation and function of the OMCS will be documented by the OMCS engineers. These will be combined into a set of test documents related to the system.

The list of Level 5 SATs is included in Section 3.8.1 and Appendix B of this document and has been developed to ensure full coverage of the Software and Project requirements for testing at this phase of the project.

In Site Acceptance Testing (SAT) of PMCS and some TMCS systems, all Software Requirement Specifications will be analysed and where applicable, will be allocated to Level 4 (Level 4B or Level 4A) or Level 5 testing phases for validation.

Additionally, project requirements as allocated to relevant M&E packages during the design phase (Project Requirement Database or PRD) will be reviewed and where applicable will be allocated to Level 4 or Level 5 testing phases for validation.

If a Software Requirement or a Project Requirement are allocated to Level 4 or Level 5, testing of that requirement is deemed necessary in those phases and hence, a test case is created to validate the successful compliance to that requirement.

Specifically in Level 5, test cases that validate Software Requirements are captured in Software ITRs and test cases that validate Project Requirements are captured in Plant/Performance ITRs. With each of the applicable test documentations, two schedules will be submitted with details of V&V Method, V&V Phase, ITR Name and Test Case ID for each of the requirements. This forms the baseline of the coverage for SAT. These details are recorded and kept in JIRA, ASBJV's requirement management tool and will constitute the project Requirement Traceability and Verification Matrix for the project.

Specifically, for PMCS Software Systems and Tunnel Closure Software, the SAT testing coverage is split between Level 4B and Level 5 phases. All software modules in these packages (Device Modules and Algorithms as listed in the relevant design packages) are allocated to L4B and L5 cycles.

3 weeks' notice (21 calendar days) will be provided for an upcoming Level 5 test. This will include submission of the test documents via iTWOcx and Teambinder related to the Level 5 test, and the formal hold point notification of the upcoming test. All Level 5 test documentation will be structured around the sub-system being tested.

The test documentation submission will include the following;

- Test Procedure (or Test Plan) and review comment sheet
- Software and Project Requirement Traceability Verification Matrix Extracts (RTVM)
- Test cases
- Supporting documentation (Witness Dry Run results, Product Configuration Baseline, Software Build Report)
- L4 Results and Status Report
- Outstanding defect list (L0/L4/L5)

The Test Procedure will describe the scope of the testing activities to be undertaken to demonstrate compliance with functional and performance requirements and to validate the system design. The approach to testing, resources required, and schedule of the testing activities will be described.

For complex SATs, the overall test may be broken into sub-cycles to allow for early commencement of the testing. If this approach is taken for the system, each sub-system will be detailed in the test procedure.

The Test Procedure will cover Test Readiness Review Artefacts (Entry Criteria), test Exit Criteria, WHS requirements, constraints on the test, test environment and procedure steps.

Prior to commencement of the SAT, a Test Readiness Review will be held with all relevant parties. Prior to the TRR, a TRR pack submission will be made via Teambinder and will include all relevant test artefacts described in the test procedure.

SATs will be performed from the WMCC with remote witnessing made available for each test.

Test cases will be run from JIRA (Zephyr). All defects will be managed in JIRA with any software related defects transferred to KNOSSOS and managed in the same manner as the Level 0 FAT software testing. Any non-software defects will be managed in JIRA.

Upon completion of the formal SAT, the finalised test report along with relevant pack artifacts are uploaded to iTWOcx and transmitted to WCX/IT/TfNSW via Teambinder.

3.8.1 SAT

The following section provides specific requirements related to SAT testing as described in the SWTC Appendix B.12 with further project specific details included.

Upon completion of all installation works in a particular construction zone and the provision of all necessary power supplies and communications services, SAT shall be conducted on all devices comprising the OMCS roadside and tunnel devices and IOMCS devices. The SAT shall be conducted on site in a location where the devices are installed and where test observers have unobstructed vision of the test performance.

The SAT arrangements shall be well clear of adjacent construction or installation activity. A clear area shall be established on site for the testing and separate tables and chairs for the Independent Certifier and TfNSW attendees and lockable storage for SAT documentation shall be provided in the site office when testing extends beyond one day.

The objectives of the SAT shall be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test shall include:

- verification of the equipment installation on site including foundations, support structures, fixing, etc. and measurement as required of levelling and orientation of devices. This will have been evidenced by completed Level 1 installation ITRs;
- all device or subsystem functionality. This will have been evidenced by formal witnessing of each type of Level 4 test referred to as a Level 4B test or review of completed level 4 ITRs;

- the device or system performance parameters at maximum load, and if appropriate beyond, as set out in the SWTC specifications and referenced standards;
- the device or subsystem performance tests in all operational modes that are anticipated including, without limitation
  - normal operation,
  - emergency operation,
  - total or partial power failures and
  - redundancy fail overs.
- Consideration must be given to interruption to electricity supply and communication facilities and the consequent effect on electrical and electronic equipment. Commissioning procedures must be implemented to determine the effect on installed systems under such conditions;
- Where redundancy forms part of the design of any system, this aspect must be fully tested and commissioned including removing the active component from service under the most arduous conditions that are likely to occur in practice, and verifying performance of the device or system during changeover to a redundant device or system redundancy operation as configured. This includes functionality and performance under power failure transition to essential power supply and back after power restoration;
- The UPS systems, where installed, must be commissioned under actual operating conditions for the full duration of the required stand-by period;
- Where applicable, calibration of measuring instrumentation must be prepared beforehand and certified by NATA registered laboratories;
- SAT hardware requirements;
- Environmental and durability testing where appropriate; and
- interfaces to other devices and systems as specified by data protocol specifications.

All input and output interfaces must be available to prove functionality and performance, under various load scenarios. This is generally tested prior under level 3.

SAT results must be recorded formally with the performance results clearly traced against comparative design criteria on the prepared SAT test results proformas or checklists, and signed off by relevant test observers as required, whether the test result is pass or fail. Completed SAT test results must be prepared and bound into a completed SAT report for the Motorway. Each test must be clearly annotated to show that the test result was a pass or a fail.

SAT test results noted as failed must be repeated when the defect or non-compliance giving rise to the fail result has been cleared. Where several fail results eventuate, repeat testing must be programmed to allow re-assembling of all SAT attendees. Where required by the Independent Certifier, additional regression testing must be conducted to demonstrate that clearing the defect or non-compliance has not produced faults elsewhere in the device or subsystem.

Level 5 activities verify, and close requirements documented during the design. Formal Level 5 SAT will demonstrate the various system performance criteria are met for the OMCS and non-OMCS systems through the following test phases;

3.8.1.1 OMCS Software Traffic Systems

- TMCS Tunnel Closure Systems SAT
- TMCS Vehicle Monitoring and Control Systems SAT
- TMCS Video Surveillance Systems SAT
- TMCS Voice Communications (RRB/PA) SAT
- TMCS Voice Communications (Telephones) SAT
- TMCS Driver Advisory Systems SAT
- OMCS Training & Development Systems
- OMCS SIDERA Core Functionality SAT
- OMCS C2C E2E SAT including the testing requirements of TS917
- IBM Maximo Interface SAT (OMCS)

3.8.1.2 OMCS Hardware ICT Systems

- MNCS SAT
- AVIDS SAT
- OMCS Hardware SAT

3.8.1.3 PMCS Software Plant Systems

- PMCS Architecture SAT
- OMCS PMCS Electrical SAT
- OMCS PMCS Fire SAT
- OMCS PMCS Hydraulics SAT
- OMCS PMCS Lighting SAT
- OMCS PMCS MVAC SAT
- OMCS PMCS Ventilation SAT

3.8.1.4 Non-OMCS SAT Tests

- HV System SAT
- Fire System SAT
- Mobile Phone System SAT
- Public Address System SAT
- Radio Rebroadcast System SAT
- O&M Radio Operation SAT
- Water Treatment Plant SAT
- Smokey Vehicle Detection System SAT
- Tolling System SAT (refer Kapsch T&C plan and test procedures)

3.8.2 IOMCS SAT

The following section provides specific requirements related to ISAT testing as described in the SWTC Appendix B.31 with further project specific details included.

IOMCS SAT (ISAT) is not intended to replicate all SAT cases of each OMCS, but rather to demonstrate monitoring and control from IOMCS as required by the SWTC. Due to the requirement to minimise the disruption of the live motorways of the M4 Motorway and M8 Motorway, ISAT activities will be undertaken in several steps as outlined below. These will maximise use of the unopened Motorway and the fully commissioned and proven simulators of the M4 Motorway and M8 Motorway, combined with monitoring tests and equivalence demonstrations using live OMCS data and targeted control testing using in-service systems.

Testing of the C2C interface will be carried out at this time. Scheduling of testing activity must be agreed with the RMS, TfNSW TMC and Other OMCS operators to ensure successful end-to-end Testing. the C2C test cases and testing platform is provided by TfNSW.

Testing will be located according to witnessing requirements and systems under the test. Access to areas required for testing will be coordinated by the M&E Systems Commissioning Manager and relevant isolations for permits in place to allow testing to occur.

During ISAT but prior to the targeted ISAT phase detailed below, the modifications to the Stage 1 OMCS and Stage 2 OMCS required for integration will be made and tested in standalone mode. The works will be managed by the Transition Working Group and the COES process as described in the D&C Deed.

This will require updating the Stage 1 OMCS and Stage 2 OMCS and performing a series of tests to ensure stability of the updates prior to returning to a non-integrated state. This will likely be performed on night shift and may require shutdowns of the other stage motorways. Further details of this stage of testing will be provided in the ICT Test and Commission Plan and the lower-level subsystem test documentation.

Isolated Site Acceptance Testing

This testing includes devices, software and subsystems within the IOMCS, including such tests that do not require access to the IOMCS-OMCS interface. Successful FAT test cases do not need to be re-tested except as examples that show that the site installation is fully functional.

Integrated Site Acceptance Testing (Simulators)

This phase will use OMCS replicas or off-line OMCS for in-service motorways (M4 Motorway and the New M5 Motorway) and the Main Tunnel Works OMCS.

This phase will demonstrate full operation of the (replicated/off-line) OMCSs from the IOMCS, demonstrating full replication of OMCS data at IOMCS as required for integrated operations.

The replica M4 and M8 OMCS and any other simulator used in this stage of testing will be proven and version controlled. Further detail of the setup including any equipment specifications will be provided in the lower-level test documentation prior to commencement of this phase of testing.

Integrated Site Acceptance Testing (Monitoring)

This phase requires the IOMCS to be connected to the Motorway OMCS and all operational OMCS, but in the monitoring state only.

The monitoring phase must demonstrate the full capability of the IOMCS to monitor the WestConnex Motorway and meet functional and performance requirements.

Integrated SAT will be conducted over a contiguous period of at least seven days to demonstrate system stability and reliability.

Integrated Site Acceptance Testing (Targeted)

This phase requires the IOMCS to be connected to the Stage 3A Motorway OMCS, the Stage 1 OMCS and Stage 2 OMCS and be in full control. The Stage 1 OMCS and Stage 2 OMCS configuration will be enabled for full integration of the relevant subsystems and will allow for a level of testing required to ensure that all prior simulated testing is valid. This ISAT Targeted testing will need to be performed on night shift and may require motorway closures. During this stage of testing, the integrated ventilation operation will be tested and will require aerodynamically connecting the adjacent stages to stage 3A via opening the installed commissioning doors. At the end of the test, the doors can be closed, and control handed back to the Motorway operators.

Other systems to be tested during Targeted ISAT include MVAC (cross passage pressurisation in cross boundary fires), emergency exit lighting, tunnel closure systems, fire systems, DAS and vehicle monitoring and control.

Once the targeted ISAT is further developed this phase of testing may be reassigned to Level 6 ISIT to minimise impact on the other motorways. Further details will be provided in the TAMP and the Level 5 test plans and procedures.

Formal Level 5 ISAT will demonstrate the various system performance criteria are met for the IOMCS through the following test phases;

3.8.2.1 IOMCS Software ISAT

- IOMCS Voice Communications Integration - Software Component ISAT
- IOMCS Training and Development Systems ISAT
- IOMCS C2C E2E ISAT including the testing requirements of TS917
- IBM Maximo Interface ISAT (just IOMCS)
- IOMCS Configuration Management ISAT
- IOMCS OMCS Interface ISAT

3.8.2.2 IOMCS Hardware ISAT

- IOMCS Network ISAT
- IOMCS Servers ISAT + IOMCS Control Room + Video Wall Architecture ISAT
- IOMCS DVMS Architecture & AVIDS ISAT

3.8.2.3 PMCS Software ISAT

- IOMCS PMCS Fire ISAT
- IOMCS PMCS Lighting ISAT
- IOMCS PMCS Ventilation ISAT
- IOMCS PMCS MVAC ISAT

3.8.2.4 Non IOMCS ISAT

- Tolling System ISAT (refer Kapsch T&C plan and test procedures)
- Fire Detection System ISAT – Due to the limited number of tests, this will be included in the SAT of the Fire Detection System non-OMCS test cycle

3.9 Level 6: System Integration Testing (SIT/ISIT)

Level 6 testing will be managed by ASBJV commissioning engineers with support from the OMCS/IOMCS contractor. ASBJV will lead the SITs and develop the test documentation with input from the OMCS engineers for software related test steps. These will be combined into a set of test documents related to the system.

3 weeks' notice (21 calendar days) will be provided for an upcoming Level 6 test. This will include submission of the test documents via iTWOcx and Teambinder related to the Level 6 test, and the formal hold point notification of the upcoming test.

The test documentation submission will include the following;

- Test Procedure (or Test Plan) and review comment sheet
- Software and Project Requirement Traceability Verification Matrix Extracts (RTVM)
- Test cases
- Supporting documentation (Witness Dry Run results, Product Configuration Baseline, Software Build Report)
- L4 and L5 Results and Status Report
- Outstanding defect list (L0/L4/L5/L6)

The Test Procedure will describe the scope of the testing activities to be undertaken to demonstrate compliance with functional and performance requirements and to validate the system design. The approach to testing, resources required, and schedule of the testing activities will be described.

The Test Procedure will cover Test Readiness Review Artefacts (Entry Criteria), test Exit Criteria, WHS requirements, constraints on the test, test environment and procedure steps.

Prior to commencement of the SIT, a Test Readiness Review will be held with all relevant parties. Prior to the TRR, a TRR pack submission will be made via Teambinder and will include all relevant test artefacts described in the test procedure.

SITs will be performed from the WMCC with remote witnessing made available for each test.

Test cases will be run from JIRA (Zephyr). All defects will be managed in JIRA with any software related defects transferred to KNOSSOS and managed in the same manner as the Level 0 FAT software testing. Any non-software defects will be managed in JIRA.

Upon completion of the formal SIT, the finalised test report along with relevant pack artifacts are uploaded to iTWOcx and transmitted to WCX/IT/TfNSW via Teambinder.

System Integration Testing will be performed to prove that all OMCS and IOMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites will be satisfied prior to the commencement of the final SIT:

- all installation and SATs have been completed satisfactorily;
- cabling to complete all communication networks have been installed and commissioned;
- the WMCC, DRS and WDRS have been completed with the control rooms fully operational (note that this does not include reconfiguration of the WDRS TCR which occurs after opening);
- main control system servers and peripheral controllers are fully operational;
- all sub-system interfaces have been configured and are operational;
- the C2C interface has been configured and is operational;
- external interface companies, systems and support are available and configured for SIT; and
- external interfaces to TMC and other systems are completed.

The OMCS and IOMCS SIT must demonstrate that:

- all OMCS and IOMCS sub-systems have been integrated and the OMCS and IOMCS functions as an integrated system;
- all plant and traffic devices have been configured and integrated into the OMCS and IOMCS and the IOMCS-OMCS interface and operate correctly;
- all external interfaces have been integrated into the OMCS and IOMCS and the interfaces operate correctly;
- the C2C interface to the TMC and Other OMCSs has been configured and operates correctly including compliance with the testing requirements of TS917; and
- the CCTV interface to the TMS and Other OMCSs has been configured and operates correctly.

Each of the interfaces must be fully tested to demonstrate the full range of interface functionality and performance.

Formal Level 6 SIT will demonstrate the various system performance criteria are met for the OMCS and IOMCS through the following test phases;

- IMS SIT
    - Scenario 1 – Vehicle accident, hydrocarbon and fire
    - Scenario 2 – Congestion, stop vehicle and fire
    - Scenario 3 – Tunnel flooding and dangerous driving
    - Scenario 4 – Stationary vehicle and air quality
    - Scenario 5 – Overheight vehicle detection and entry ramp closure
    - Scenario 6 – Automated system trending log checks
    - Scenario 7 – Fire in locations
    - Scenario 8 – Electrical failover
    - Scenario 9 - Evacuation
- OMCS failover scenarios SIT

3.10 User Acceptance Testing

The final UAT must be performed to prove that all OMCS and IOMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:

- SIT has been completed satisfactorily;
- the WMCC, DRS and WDRS have been completed with the control room fully operational (note that the WDRS control room will not be reconfigured as this occurs after opening);
- Control Room Operator workstations are SAT tested and completed with all Control Room Operator GUI screens available and fully operational;
- event and alarm logging are fully operational;

- all OMCSs are fully configured and operational;
- the C2C interface has been configured and is operational including testing in compliance with TS917;
- external interface companies, systems and support are available and configured for UAT; and
- external interfaces to TMC and other systems are completed.

The OMCS and IOMCS UATs must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:

- Traffic Management and Incident Response Systems;
- Fire protection systems in fire mode including tunnel ventilation and egress pressurisation control;
- Air quality monitoring and reporting;
- Hydraulics and water treatment plant;
- Lighting, including emergency lighting; and
- Tunnel ventilation plant and equipment.

Each of the automated processes must be fully tested to demonstrate effective and integrated control and monitoring of the Motorway, and specific testing must be performed for the following functional components:

- automatic and manual intervention of tunnel ventilation mode controls and transition to fire mode control under fire detector input;
- automatic egress pressurisation of egress passages in the least advantageous locations;
- variable air quality monitoring and traffic data to produce automatic step changes in ventilation mode;
- air quality exposure reporting and impact of stopped vehicle for motorist exposure monitoring;
- tunnel lighting responding to the variable portal photometer luminance ranging to set appropriate lighting levels;
- tunnel emergency lighting responding to various incident point alerts;
- traffic monitoring and congestion management and incident management responses for a variety of scenarios, including integration of incident responses with TMC;
- automatic control and management of water discharge from drainage sumps and the water treatment plant;
- automatic changeover of all redundant systems to redundant back-up systems where installed and defined in the Design Documentation;
- all RMS TMC interfaces specified in the SWTC including CCTV video data;
- all interfaces with Other OMCSs including CCTV video data; and
- remote control of vehicle cross passageways.

3.11 Level 7: System tuning

Level 7 activities are those that can only be adjusted and verified following the opening of the integrated WestConnex Motorway to traffic. Typical examples of these tests include:

- Tunnel ventilation system tuning (e.g. confirmation of responses to live traffic patterns)
- Automatic video incident detection system and traffic detection (loops) tuning (e.g. false alarming and traffic statistics)
- Roadside tolling system under live traffic conditions – Operations Acceptance Testing as per SWTC Appendix B.10.

4. TRANSITION AND OPERATIONAL READINESS

4.1 Transition

The Transition and Acceptance Management Plan (TAMP) [7] is a separate plan to this Testing and Commissioning Plan as required under B.14 in the SWTC. The below is a brief summary of the transition period requirements with further detailed requirements provided in the TAMP.

As per the SWTC the transition period includes:

- Testing and commissioning activities;
- Delivery of final versions of all O&M manuals, plans and procedures and other documentation required for operation and maintenance of the Motorway;
- Configuration and population of the AIS;
- Recruitment and training of all O&M personnel, to the required level of competency;
- Mobilisation of O&M plant, equipment and other resources;
- Training of external personnel, including emergency services, as necessary to facilitate effective response to Motorway incidents and emergencies; and
- An ORE.

The Project Company (ASBJV) must provide:

- Access to the construction works for O&M personnel for project familiarisation and training;
- Access to systems and equipment for O&M personnel for training, drills and competency assessments, prior to the Date of Opening Completion;
- All O&M Manuals, information and training for O&M personnel to prepare their management plans and operational procedures in sufficient time to meet the requirements of the Project Deed and this SWTC; and
- All asset information, including type, class, nature, location, composition, value and maintenance requirements, to enable the Asset Information System (AIS) to be configured and fully populated prior to the Date of Completion.

The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to TfNSW:

- O&M Manuals, completed to the extent defined in SWTC Appendix C.2 (Project Company Documentation Schedule), Section 5 (O&M Manuals), paragraph d).;
- Fully developed training programs to be used for training of operation and maintenance personnel;
- A detailed plan for training of all O&M personnel, including 'live system' training and drills, major emergency exercises, and provision for ongoing training of O&M personnel;
- A detailed Operational Readiness Evaluation (ORE) plan to the satisfaction of the Independent Certifier, having regard to the opinions of relevant representatives of TfNSW, TMC, Fire and Rescue NSW and NSW Police Force; and
- Details of the Permit to Work system which is to be implemented from the Date of Opening Completion to control and manage all work to be undertaken on the Motorway during the O&M Phase, including completion of any outstanding construction or defect rectification work which may be necessary.

The Project Company must ensure that training of operation and maintenance personnel commences no later than twelve weeks prior to the Date for Opening Completion.

4.2 Operational Readiness Evaluation (ORE)

The purpose of the ORE is to ensure that all the Motorway physical assets, people and documented processes function seamlessly and correctly to facilitate safe traffic operations, including prompt and effective management of incidents and emergencies. Also, that TfNSW, TMC and all relevant agencies involved in responding to incidents are fully aware of the Motorway layout and access routes, and the processes, communications, systems and equipment available to support them in carrying out their roles.

All system and equipment testing and commissioning activities, plus all training activities, must be satisfactorily completed prior to the commencement of the ORE.

The Project Company must ensure that an ORE is completed to the satisfaction of the Independent Certifier, having regard to the opinions of relevant representatives of TfNSW, TMC, Fire and Rescue NSW and NSW Police Force.

The User Acceptance Test & Operational Readiness Evaluation (ORE) Plan [10] will be provided separate to this Testing and Commissioning Plan that describe the methods, systems and processes whereby the Project Company will ensure that all the Motorway physical assets, people and documented processes function seamlessly and correctly to facilitate safe traffic operations.

The Operational Readiness Evaluation Plan shall be developed in consultation with, and to the satisfaction of, relevant representatives of RMS, TfNSW (TMC), Fire and Rescue NSW, NSW Police Force and the Independent Certifier.

The Operational Readiness Evaluation Plan shall include:

- roles and responsibilities of various stakeholders with regard to operational readiness;
- key risks to achievement of operational readiness and appropriate management measures;
- list of prerequisites prior to commencement of the ORE;
- detailed evaluation criteria for ORE;
- detailed schedule of ORE activities;
- identification of persons with responsibilities for observing and assessing ORE activities; and
- process for determining successful completion of ORE activities prior to the commencement of traffic operations.

An Initial Operational Readiness Evaluation Plan will be submitted at least six months prior to the planned commencement of Level 5 Site Acceptance Testing.

The final Operational Readiness Evaluation Plan will be submitted at least three months prior to the planned commencement of Level 5 Site Acceptance Testing.

5. PROGRAMME

Testing and Commissioning must be programmed and coordinated with the OMCS and IOMCS systems development in accordance with the SEMP, which has superseded Appendix E.11 and verified stages in the V model process for systems development.

The Overall D&C Program and Project Quality Plan must show all stages of manufacturing, installation and commissioning works in relation to testing. The Factory Acceptance Testing (FAT) must be completed sufficiently in advance before installation and commissioning on site, which must be undertaken in a logical sequence to ensure readiness of the OMCS systems for the formal witness testing phases.

Refer to latest Project Program for details of activities that have been planned as part of the Testing and Commissioning.

6. DOCUMENTATION

6.1 Documentation Types

Project documentation and processes are summarised below:

- Level 0 (Hardware FAT) – this follows the Project QA processes, including the Vendor Document Review (VDR), ITC/ITR and Hold points and Witness points notifications, these are raised in iTWOcx and sent formally through TeamBinder. In addition to this due to Covid19, Microsoft Teams has been utilised to assist with attendance, notifications and documentation.
- Level 0 (Software FAT) – this follows the SICE ICT Testing and Commissioning Plan. Test cycles and defects are performed in JIRA with formal test documentation provided to the client and IC 21 days prior to the commencement of testing via Teambinder.
- Level 1 (Installation) –follows Project QA processes. Installation Completion Certificate (ICC) – This will be provided from construction to commissioning once all relevant level 1 ITR's have been completed within Completions Connect for the defined energisation zone.
- Level 2 – 4 (Energisation, I/O Testing and Device Testing) –follows Project QA processes. Two different Level 4 ITRs will be created for each in-scope device type: Device Testing ITR (Part A); Full Functionality Testing ITR (Part B). Completions Connect will be the ASBJV tool chosen to manage the ITRs (execution, punch list items and records) except for the L4Bs which will be managed in JIRA/Zephyr along with their associated defects.
- Level 5 & 6 – SAT/ISAT and SIT/ISIT Test documentation will be within JIRA/Zephyr and extracted and submitted formally in work packs for review via Teambinder. Further details on the development and submission of this documentation will be provided in the ongoing working groups with the stakeholders. As required, technical memos can be provided to document the agreed processes.

ITPs and ITRs shall be developed in accordance with the requirements and referenced standards in the SEMP, which has superseded Appendix E.11.

Inspection and Test Plan – ITP. This is the high-level plan of what test documents will be produced at which stage of testing.

OMCS and IOMCS documentation and processes are defined within relevant ICT Test & Commissioning Plan.

Tolling documentation and processes are defined within relevant Tolling Testing and Commissioning Plan.

6.2 Witness Points and Hold Points

Witness Points and Hold Points for testing activities are documented within the Master Hold Point / Witness Point Register - M4M5-LSBJ-PRW-QM-HP01-REG-000. The information in the register has been extracted from all relevant standards including the relevant TfNSW specifications and has been submitted to the IC/WCX/TfNSW for review and comment. It is regularly transmitted to the stakeholders via Teambinder for Information.

The WP/HP nominated in the TfNSW specifications and SWTC appendices that relate to testing are transferred to the WP/HP register. Within the register, the Nominated Authority has been agreed between the stakeholders and in many instances multiple parties are the nominated authority.

There is one type of Hold Point related to submission of test documentation prior to testing for the OMCS, TMCS and PMCS as called up in TS911, TS912 and TS913. The main Witness Points are in relation to the notice period to be provided prior to testing being 21 calendar days. Hold points for submission of test documentation are raised in iTWOcx and transmitted via Teambinder.

Witness points specific to device FATs are covered in the relevant device FAT documentation as part of the QA process.

6.3 Punch Lists/Defects

6.3.1 Punch Items

The ASBJV completions system Completions Connect contains a comprehensive punch listing facility. Punch list items are created during construction verification or testing and commissioning activities and are classified 'A', 'B' or 'C' according to severity, as defined below:

A Item – Safety impact. The next stage of commissioning cannot commence until the punch item is rectified. Tunnel cannot open until the punch item is rectified. Example – Installed equipment not terminated in Level 1 → Level 2 cannot commence; both duty and standby pumps are not operational in Level 4 → Level 5 cannot commence; automatic control of jet fans does not work in Level 5 → Level 6 cannot commence.

B Item – Process impact. The next stage of commissioning can commence with the punch item still open. A risk assessment to be performed prior to tunnel opening to determine if safe to operate with existing B punch items in place. Example – Cable tray is installed blocking sight line of tunnel sign in Level 1; standby axial fan is not operational in level 4 but all other axial fans are operational; PTZ camera in plant room not operational; grout not installed under bracket.

C Item – Cosmetic impact. No impact on next stage of commissioning. Can be rectified under DLP period. Label not installed; Defect on paint or galvanising.

The Commissioning Manager is required to review any open punch items from Level 1 prior to accepting the commissioning area and commencing Level 2 works. The commissioning manager can change the severity of a punch item if required or delay the handover of the area if too many punch items are outstanding. This decision is at the discretion of the Commissioning Manager. The relevant construction discipline will be required to close the Level 1 construction punch items prior to hand over or under a Permit to Work once the area is handed over to the T&C team. Partial handover may occur where only certain asserts within an area are handed over. Not all works need to be completed and A punch items may still exist in an area for a partial handover to occur.

The commissioning manager will be responsible for managing and closing all open punch items associated with T&C works. Any defects found during initial T&C works in an area will require investigation and where related to the installation works, a punch item will be raised against the asset in Completions Connect and assigned to the relevant construction discipline. If related to T&C works, the punch item will be managed by the T&C team to close.

If a project wide issue is discovered, a Non-Conformance Report (NCR) will be raised in iTWOcx. The NCR will be raised against the subcontractor responsible for the installation or against the design if the issue is design related.

6.3.2 Defects

Defects found during Level 0/5/6 testing will be recorded in Zephyr. If related to the IOMCS or OMCS they will be recorded in Knossos from the information captured in Zephyr and processed in accordance with the ICT Test and Commission Plan and the internal SICE Issues Management Procedure. If related to system performance, they will be managed by the post-IFC design change process by the ASBJV engineering team. If required as part of the defect closure, retesting of the system (including any required regression testing) will be performed as part of the witnessed tests.

Further details on the software defect management can be found in the ICT Test and Commission Plan: M4M5-SICE-PRW-MES-MP01-PLN-0021 and the lower-level sub-system commissioning documentation.

6.4 Handover final documentation format

All documentation will be available in the completions system and then later copied to the Document Control System. This will be further defined in the Project Completions plans and processes.

6.5 JIRA

JIRA is used as a requirements management tool on WCX 3A project, in line with Systems Engineering requirements management processes. In addition to this JIRA and plugins such as Zephyr will be used for Testing and Commissioning, specifically related to performing test executions and for defect management of software tests.

6.5.1 Requirements

A high-level explanation of requirements has been provided here for context only. The 'Client Requirements' have been imported in JIRA. These are the 'Allocated' requirements and from these allocations 'Design Packages Compliances' (DPC's) are created and linked back to the Client Requirements through the allocation. The System Requirements issue type is used by SICE to define the functional specification requirements and linked to DPC.

The Document Compliances are used when a requirement is met by inclusion in a project plan or document.

6.5.2 Testing

Some requirements require testing, and others do not, such as document compliance. For requirements that require testing for Level 0 (software), level 5 and 6 these will be documented, performed and recorded utilising JIRA, specifically the Zephyr Plugin.

Test issues are part of the Zephyr add-on. They are used to record test steps, and as part of Zephyr test executions are used to record test results.

Tests are generally imported into Jira using the Test Case Template Excel file, as detailed in the Testing and Defect Management with JIRA and Zephyr instructions.

The tests are arranged by Test Cycle in Jira, with individual test executions assigned folders for classification and organisation of the tests.

Defects are created during the test execution as part of the defect management process from within the Jira test execution. Dashboards within Jira allow for tracking of defects, with direct linking to the requirements against which tests were performed. Close-out or verification of defect resolution will be performed within Jira by the IC.

6.5.3 Workflows

JIRA uses customised workflows to transition issues through the Requirements Management process. The workflows are used to set permissions and conditions for progressing and / or resolving and issue.

An example workflow (for the Design Package Compliance issue type) is detailed in Figure 2. All details of live workflows are located within JIRA, this is an example that has been included to provide context of details that are within JIRA system.

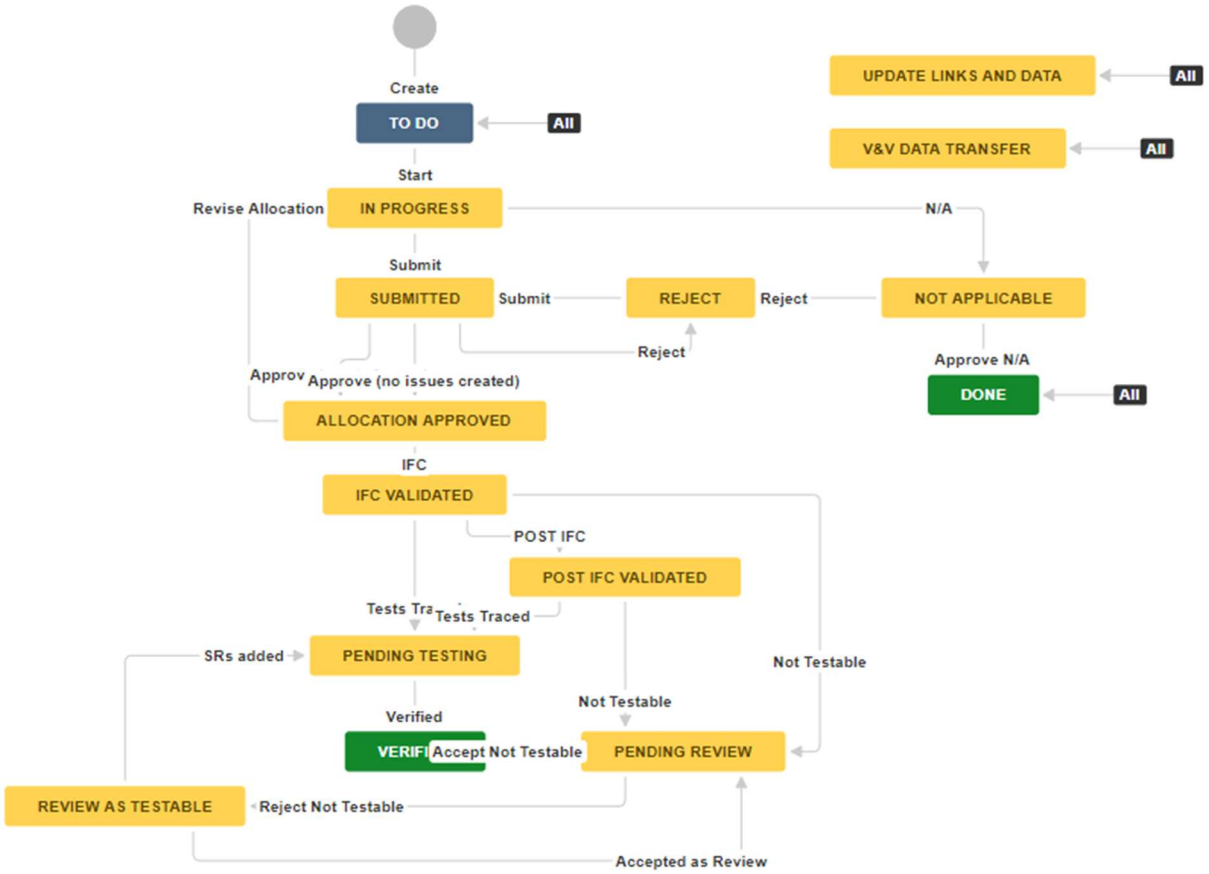

Figure 2 – Example Workflow from JIRA

6.6 Completions Connect

For projects with thousands of tests across commissionable assets such as instruments, motors, lights, VMS etc., there is a need to effectively manage the large amount of certification and commissioning data while maintaining traceability. For this, ASBJV use a Certification and Completions Management database system, this system is called Completions Connect.

All installation activities will have quality control check sheets, which will form the basis of Installation and Test Report (ITR). These will be generated by the completions software using preloaded ITR templates. Once the activity has been completed, the ITR will also be completed in the field via a tablet, forming part of the quality control for that exercise. This ITR will then be uploaded into the completions system and the status of that test/inspection will change from outstanding to complete. A copy of all completed uploaded sheets will then available within the completions system. When all ITRs are complete for a defined subsystem, that subsystem will be deemed complete and can at that stage be handed over for pre-commissioning.

7. TEST AND COMMISSIONING CONTROLS

7.1 Discipline Construction Handovers

The construction, and commissioning intended methodology is broken into 480m tunnel section lengths, this allows different phases of work to occur in different sections. The intention is that once Tunnelling have completed their works, they will handover to Civil fit out. Once Civil fit out have completed their works they will handover to M&E fit out. Once M&E fit out has completed its works it will have over to the M&E Commissioning Team.

Regarding the M&E handovers this will be detailed in the Tunnel Handover Procedure and will use Completions Certificates to clearly document completed works.

7.2 M&E Construction Handover to Commissioning

Tunnel and surface M&E / ITS equipment is to be handed from the construction team to the commissioning team in distinct packages. The definition of these packages has been designed such that geographic areas can be converted to 'commissioning zones', ensuring that installation work in these areas has been completed and provides early access to the commissioning team for safe energisation and testing of equipment while installation works continue outside of these areas.

The packages to be used for handover are to be shown as Installation Completion Certificate (ICC) milestones on the programme. Completing all ITRs associated with each ICC milestone will allow the issuing of an ICC certificate, conversion of the given area into a commissioning zone and handover of the area to the commissioning team by the Construction Project Manager.

Following conversion of an area into a commissioning zone, no further installation works will be allowed to take place in that zone without the permission of the Commissioning Manager. The permission will be in the form of a completed and authorised Permit to Work (PTW).

Exceptions to the handover of a piece of equipment or subsystem will be shown on the ICC. These areas will be electrically and mechanically disconnected from sources of supply and not form part of the handover

Non-commissioning work on any equipment within a commissioning zone will require a PTW signed off by the Commissioning Manager (or delegate). An isolation permit will also be required for any work which is to be carried out in the vicinity of equipment which poses a danger if energised.

7.3 Commissioning Safety

The construction and commissioning phases are a significantly hazardous risk period, due to the nature, number and variety of the activities as well as changes to the status of the plant. In many situations and for good reasons, commissioning trials will be carried out which are unique and not consistent with the way the particular part of plant will operate when in actual operation. Commissioning is typically also a period of very high activity, involving many people working on different items in close proximity.

Safety procedures will be devised before commissioning commences. The procedures will be practised before the plant is turned on and before energy, water or chemicals are introduced. Equipment should be tested with innocuous materials prior to the introduction of hazardous ones. Safety systems must be commissioned before the system they are required for is commissioned.

All reference to 'power' in this plan is meant to convey the use of HV or LV power typically 33 kV, 415 V and 240 V AC and generally all voltages greater than 50V AC; or 120 V ripple free DC connected to permanent installed equipment.

Commissioning isolation procedures will not apply to temporary construction supplies and distribution which are covered by the Tunnel Isolation and Out of Service Tagging Procedure and will not apply to extra-low voltage circuits (less than 50 V AC and 120 V DC).

7.5 Commissioning Induction / Training

All personnel who will be working within a commissioning zone will have to attend an additional commissioning induction to familiarise them with extra precautions that are required to be taken. This will apply to members of the commissioning team and individuals working under a PTW system within a commissioning area.

Personnel working within the commissioning team will have their credentials checked via training and testing regime to ensure they are able to perform their duties with the competence required. This will be defined in the commissioning team challenge test document. This testing will be targeted via vocational discipline, e.g. Electrical, Mechanical.

7.6 Commissioning Notices

7.6.1 Energisation Bulletin

Prior to any energisations a simple bulletin in layman's terms will be issued and read out in the prestart for the day explaining what is being energised and where it is. This process must be completed in tandem with the Notice of Energisation being issued and placed on relevant notice boards

7.6.2 Notice of Energisation

A Notice of Energisation (NoE) is necessary to enhance the PTW system when energy sources are introduced to the project for commissioning and operational purposes. This occurs when the project moves from a de-energised construction site to a potentially energised commissioning area. Prior to issuing a NoE, and ICC is required. The general rule for this process is 'those who introduce the hazard must control the hazard', therefore the Commissioning/Energisation teams are responsible.

7.7 Commissioning Work Method Statement

Commissioning Work Method Statements (CWMS) will be generated for the commissioning activities to be performed.

These will contain the required documentation to complete the commissioning work within the procedures, and structures required by the project.

The documentation within the work may include:

Activity Scope & Location; Schedule; Safe Work Method Statements (SWMS); Stake Holder Notifications; Isolation of Services; Temporary Works Design; Work Interface / Simultaneous Operation; Environmental Management Planning; Resourcing Requirements; Permits / Approvals; Survey / Testing Requirements; Drawing / Specifications; Verification (ITP and ITR details); Notifications; Comments / Additional Actions; Work Pack Briefing (and sign on by the crew); Work Pack Completion Record

7.8 Non-Conformance Report (NCR)

Non- conformances will be categorised and managed via the Non-Conformance Reporting (NCR) Process in iTWOcx.

7.9 Impact on Existing Road Users

In line with the Traffic Management and Safety Plan for the project, existing road users and traffic conditions will be considered in Testing and Commissioning activities. Impacts to Existing Road Users will be mitigated SFAIRP.

7.10 Commissioning Spares

Each discipline lead will liaise with the commissioning team to create a list of suggested 'Commissioning Spares' for the relevant discipline.

Operational spares are not part of the commissioning process and will be documented separately in alignment with contractual obligations.

Details of make/model/part number have been provided to WCX to allow WCX to assess what operational spares that they require based their current spares from other parts of WCX projects. As part of these discussions WCX has agreed that operational spares could be used as commissioning spares if they are replaced.

Appendix A

Project Requirement Database (PRD)

Appendix A Project Requirement Database (PRD)

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-210401	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.2. g) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.2. g) (iv)	Notice for the formal witness testing (FAT, SAT, SIT and UAT) must be given 21 days in advance of the scheduled date of the tests. The Project Company must supply all copies of the proposed test documentation at least 21 days before the proposed date for the tests. Test documentation must be in hard copy form and in electronic form via the Project Documentation system. Test documentation must comprise without limitation the following:	access arrangements and a list of all attendees at the tests.	Approved	Fully Complies	Section 3.2 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0001	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210402	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.2. h)	SWTC Appendix B.12 Operations Management and Control Systems	12.2. h)	-	ITPs, ITRs/ITCs must be developed in accordance with the requirements and referenced standards in Appendix E.11.	Approved	Fully Complies	Section 5 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210403	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.2. i)	SWTC Appendix B.12 Operations Management and Control Systems	12.2. i)	-	RMS and Independent Certifier may review the submitted testing documentation and may submit review comments within 10 working days, when SWTC specific requirements are not covered by the testing or the testing is otherwise deemed inadequate to prove compliance. Additional testing must be included in the test schedules when required by the Independent Certifier.	Approved	Fully Complies	Section 3.2 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210404	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.2. j)	SWTC Appendix B.12 Operations Management and Control Systems	12.2. j)	-	All testing must be managed and conducted by a competent and authorised officer in the supplier's organisation or the nominated Quality Manager.	Approved	Fully Complies	Section 2 Roles and Responsibiliteis	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210405	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3.	SWTC Appendix B.12 Operations Management and Control Systems	12.3.	-	Factory Acceptance Testing for Devices and Sub-Systems	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210406	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. a)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. a)	-	FAT must be conducted on all devices comprising the OMCS roadside and tunnel devices and subsystems. The FAT must be conducted in the premises of the manufacturer where the devices were fabricated. Sufficient space and services must be made available for the FAT activity. Separate tables and chairs for the Independent Certifier and RMS attendees and lockable storage for FAT documentation must be provided when testing extends beyond one day.	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210407	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b)	-	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210408	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (i)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	all device or subsystem functionality;	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210409	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (ii)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	the device or subsystem performance parameters at maximum load, and if appropriate beyond, set out in the SWTC specifications and referenced standards;	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210410	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (iv)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	calibration of measuring instrumentation must be prepared beforehand and certified by NATA registered laboratories;	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210411	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (v)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (v)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	hardware requirements;	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210412	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (vi)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (vi)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	environmental and durability testing where appropriate; and	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210413	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. b) (vii)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. b) (vii)	The objectives of the FAT must be to prove the compliance of the device or system under test to the maximum extent in order to minimise the extent of further testing in the SAT phase, other than to address the site environmental, installation cabling, loading and capacity and local interface issues. The essential elements of the FAT test must include:	interfaces to other devices and systems as specified by data protocol specifications.	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210380	Document Compliance	Document Compliance | SWTC Appendix B12 Clause : 12.3. c)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. c)	-	The scheduled 'burn in' operation of some devices (such as LED based displays) must precede the FAT.	To Do	<Select Compliance>	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210414	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. d)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. d)	-	Where required, input and output interfaces may be simulated by means of simulators where large numbers of inputs and outputs are needed to prove functionality and performance under load. When simulators or other quasi-interface devices are employed for FAT testing, the application must always be realistic in the FAT context and must not be used to mask potential problems to be encountered on site.	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-210415	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. e)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. e)	-	FAT results must be recorded formally with the performance results clearly traced against comparative design criteria on the prepared FAT test results proformas or checklists, and signed off by relevant test observers as required, whether test pass or fail. Completed FAT test results must be prepared and bound into a completed FAT Report for the Motorway. Each test case must be clearly annotated to show that the test result was a pass or a fail.	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210416	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. f)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. f)	-	FAT test results noted as failed must be repeated when the defect giving rise to the fail result has been cleared. Where a number of fail results eventuate, repeat testing must be programmed to allow re-assembling of all FAT attendees. Where required by the Independent Certifier, additional regression testing must be conducted to demonstrate that clearing the defect has not produced faults elsewhere in the device or system.	Approved	Fully Complies	Section 3.4 FAT - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210417	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.3. g)	SWTC Appendix B.12 Operations Management and Control Systems	12.3. g)	-	The FAT Test Report must be prepared and be available for reference at future SAT activity.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210418	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.4. a)	SWTC Appendix B.12 Operations Management and Control Systems	12.4. a)	-	These requirements apply for FAT test programs where a number of separate subsystems, each of which may have completed a FAT, are combined and connected together to form the whole or a part of the OMCS.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210419	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.4. b)	SWTC Appendix B.12 Operations Management and Control Systems	12.4. b)	-	This section incorporates all the requirements of the above section Factory Acceptance Testing for devices and sub-systems.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210420	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.4. c)	SWTC Appendix B.12 Operations Management and Control Systems	12.4. c)	-	The Inspection and Test Plan must show the level of integration being attempted by Integration FAT activity. The ITP must show how interfacing is achieved to integrate all the systems under test and demonstrate the equivalence or any compromise applying to the test setup.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210421	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.4. d)	SWTC Appendix B.12 Operations Management and Control Systems	12.4. d)	-	The Integration FAT ITP must demonstrate that the integration testing accounts for data loading equivalent to the final target site configuration.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210422	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.4. e)	SWTC Appendix B.12 Operations Management and Control Systems	12.4. e)	-	The Integration FAT ITP must include for comprehensive testing of all the interfaces within the integrated test set-up.	Approved	Fully Complies	Section 3.3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210423	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. a)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. a)	-	Upon completion of all installation works and the provision of all necessary power supplies and communications services, SAT must be conducted on all devices comprising the OMCS roadside and tunnel devices. The SAT must be conducted on site in a location where the devices are installed and that test observers have unobstructed vision of the test performance.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210424	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. b)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. b)	-	The SAT arrangements must be well clear of adjacent construction or installation activity. A clear area must be established on site for the testing and separate tables and chairs for the Independent Certifier and RMS attendees and lockable storage for SAT documentation must be provided in the site office when testing extends beyond one day.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210425	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c)	-	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210426	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (i)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	verification of the equipment installation on site including foundations, support structures, fixing, etc. and measurement as required of levelling and orientation of devices;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210427	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (ii)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	all device or subsystem functionality;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210428	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (iii)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (iii)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	the device or system performance parameters at maximum load, and if appropriate beyond, as set out in the SWTC specifications and referenced standards;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210429	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (iv)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	the device or subsystem performance tests in all operational modes that are anticipated including, without limitation, normal operation, emergency operation, total or partial power failures and redundancy fail overs. Consideration must be given to interruption to electricity supply and communication facilities and the consequent effect on electrical and electronic equipment. Commissioning procedures must be implemented to determine the effect on installed systems under such conditions;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210430	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (ix)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (ix)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	environmental and durability testing where appropriate; and	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210431	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (vii)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (vii)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	calibration of measuring instrumentation must be prepared beforehand and certified by NATA registered laboratories;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210432	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (viii)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (viii)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	SAT hardware requirements;	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210433	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. c) (x)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. c) (x)	The objectives of the SAT must be to prove the compliance of the device or subsystem under test to the requirements of the design reports and the SWTC. The essential elements of the SAT test must include:	interfaces to other devices and systems as specified by data protocol specifications.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210434	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. d)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. d)	-	All input and output interfaces must be available to prove functionality and performance, under various load scenarios.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

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WCX3A-210435	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. e)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. e)	-	SAT results must be recorded formally with the performance results clearly traced against comparative design criteria on the prepared SAT test results proformas or checklists, and signed off by relevant test observers as required, whether the test result is pass or fail. Completed SAT test results must be prepared and bound into a completed SAT report for the Motorway. Each test must be clearly annotated to show that the test result was a pass or a fail.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210436	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. f)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. f)	-	SAT test results noted as failed must be repeated when the defect or non-compliance giving rise to the fail result has been cleared. Where a number of fail results eventuate, repeat testing must be programmed to allow re-assembling of all SAT attendees. Where required by the Independent Certifier, additional regression testing must be conducted to demonstrate that clearing the defect or non-compliance has not produced faults elsewhere in the device or subsystem.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210437	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.5. g)	SWTC Appendix B.12 Operations Management and Control Systems	12.5. g)	-	The SAT test report must be prepared and distributed.	Approved	Fully Complies	Section 3.8 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210438	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a)	-	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210439	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (i)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	all OMCS sub-systems have been integrated and the OMCS functions as an integrated system;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210440	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (i)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	all installation and SATs has been completed satisfactorily;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210442	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (ii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	cabling to complete all communication networks have been installed and commissioned;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210441	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (ii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	all plant and traffic devices have been configured and integrated into the OMCS and operate correctly;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210444	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (iii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (iii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	the MCC (WMCC) and DRS have been completed with the control rooms fully operational;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210443	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (iii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (iii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	all external interfaces have been integrated into the OMCS and the interfaces operate correctly;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210445	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (iv)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	the C2C interface to the TMC and Other OMCSs has been configured and operates correctly; and	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210446	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (iv)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	main control system servers and peripheral controllers are fully operational;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210448	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (v)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (v)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	all sub-system interfaces have been configured and are operational;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210447	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (v)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (v)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	the CCTV interface to the TMS and Other OMCSs has been configured and operates correctly.	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210449	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (vi)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (vi)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	the C2C interface has been configured and is operational;	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210450	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (vii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (vii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	external interface companies, systems and support are available and configured for SIT; and	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

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WCX3A-210451	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) (viii)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) (viii)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	external interfaces to TMC and other systems are completed.	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210452	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. a) b)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. a) b)	SIT must be performed to prove that all OMCS components and all external interfaces are integrated and perform in accordance with the relevant interface specifications and designs. The following pre-requisites must be satisfied prior to the commencement of the final SIT:	The OMCS SIT must demonstrate that:	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210453	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.6. c)	SWTC Appendix B.12 Operations Management and Control Systems	12.6. c)	-	Each of the interfaces must be fully tested to demonstrate the full range of interface functionality and performance.	Approved	Fully Complies	Section 3.9 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210454	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a)	-	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210455	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (i)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	SIT has been completed satisfactorily;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210456	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (ii)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	the MCC (WMCC) and DRS have been completed with the control room fully operational;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210457	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (iii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (iii)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	Control Room Operator workstations are SAT tested and completed with all Control Room Operator GUI screens available and fully operational;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210458	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (iv)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	event and alarm logging is fully operational;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210459	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (v)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (v)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	all OMCSs are fully configured and operational;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210460	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (vi)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (vi)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	the C2C interface has been configured and is operational;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210461	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (vii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (vii)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	external interface companies, systems and support are available and configured for UAT; and	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210462	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. a) (viii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. a) (viii)	The final UAT must be performed to prove that all OMCS components for the control of the roadside and tunnel devices operate as an integrated system in accordance with the functional and performance requirements of the SWTC. The following pre-requisites must be satisfied prior to the commencement of the final UAT:	external interfaces to TMC and others systems are completed.	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210463	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b)	-	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210464	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (i)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (i)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	Traffic Management and Incident Response Systems;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210465	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (ii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (ii)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	fire protection systems in fire mode including tunnel ventilation and egress pressurisation control;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210466	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (iii)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (iii)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	air quality monitoring and reporting;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210467	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (iv)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (iv)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	hydraulics and water treatment plant;	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-210468	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (v)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (v)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	lighting, including emergency lighting; and	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-210469	Document Compliance	Document Compliance | Appendix B.12 Clause : 12.7. b) (vi)	SWTC Appendix B.12 Operations Management and Control Systems	12.7. b) (vi)	The OMCS UAT must demonstrate that the major functional areas of the Motorway controls provide the Control Room Operators with the means to manage:	tunnel ventilation plant and equipment.	Approved	Fully Complies	Section 3.10 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259074	Document Compliance	MP - Management Plans | Document Compliance | Appendix B.31 | Clause : 13.2 f)	SWTC Appendix B.31 Integrated Operations Management and Control Systems	13.2 f)	-	Formal witness testing (FAT), SAT, Site Integration Test (SIT) and User Acceptance Test (UAT)) of devices and/or systems must be undertaken with RMS and the Independent Certifier only after all preliminary testing has proven the devices and systems to a high degree of certainty.	To Do	Partially Complies	Section 3.2 - Testing and Commissioning Process Compliance information is in JIRA. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003 Section 1.4 Details 'Formal test' Definition.	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259075	Document Compliance	MP - Management Plans | Document Compliance | Appendix B.31 | Clause : 13.2 g)	SWTC Appendix B.31 Integrated Operations Management and Control Systems	13.2 g)	-	FAT activities must not be conducted under circumstances where device(s) or systems are still under development or subject to software programming development.	To Do	Partially Complies	Section 3.2 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259076	Document Compliance	MP - Management Plans | Document Compliance | Appendix B.31 | Clause : 13.2 h) (i)	SWTC Appendix B.31 Integrated Operations Management and Control Systems	13.2 h) (i)	The following IOMCS test phases must be completed:	FAT for all devices, software and subsystems installed or configured as part of the IOMCS;	To Do	Partially Complies	Section 1.5 - Standards Procedures and References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259078	Document Compliance	MP - Management Plans | Document Compliance | Appendix B.31 | Clause : 13.2 m) (ii)	SWTC Appendix B.31 Integrated Operations Management and Control Systems	13.2 m) (ii)	Test documentation must comprise without limitation the following:	ITR (or ITC) - Inspection and Test Requirements (or Inspection and Test Checklists), detailing the full suite of test cases to be conducted and identifying acceptance criteria;	To Do	Partially Complies	Section 1.5 - Standards Procedures and References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180820	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 a)	SWTC Appendix C.1 Project Plan Requirements	17 a)	-	A Testing and Commissioning Plan must be prepared covering all assets and systems that form part of the Project Company's Work.	Approved	Fully Complies	refer to Testing and Commissioning Plan	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180821	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b)	SWTC Appendix C.1 Project Plan Requirements	17 b)	-	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	Approved	Fully Complies	Compliance information is in JIRA. Testing and Commissioning Plan has been written and documents requirements.	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180822	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (i)	SWTC Appendix C.1 Project Plan Requirements	17 b) (i)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	SWTC, Section 6.20 'Testing and Commissioning' and SWTC Sections 2.6.1 'Transition Requirements', 2.6.2 'Transition Period' and 2.6.3 'Operational Readiness Evaluation; and	Approved	Fully Complies	Compliance information is in JIRA. Testing and Commissioning Plan has been written and documents requirements. Transition information has been provided.	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180823	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (ii)	SWTC Appendix C.1 Project Plan Requirements	17 b) (ii)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	SWTC Appendix B.12 'Operations Management and Control Systems', including but not limited to:	Approved	Fully Complies	Section 1.5 - Standards Procedures and References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180824	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (iii)	SWTC Appendix C.1 Project Plan Requirements	17 b) (iii)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	Section 12 'Installation, Testing and Commissioning Requirements';	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180825	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (iv)	SWTC Appendix C.1 Project Plan Requirements	17 b) (iv)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	Section 11.1.6 'Test Plan'; and	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180826	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (v)	SWTC Appendix C.1 Project Plan Requirements	17 b) (v)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	Section 11.1.7. 'Test Specifications'.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180827	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (vi)	SWTC Appendix C.1 Project Plan Requirements	17 b) (vi)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	SWTC Appendix B.10 'Toll Collection Systems', including but not limited to section 5.3 'Testing, Commissioning and Acceptance' of Attachment B.10-1; and	Approved	Fully Complies	Section 1.2 - Purpose Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180828	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (vii)	SWTC Appendix C.1 Project Plan Requirements	17 b) (vii)	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum:	SWTC Appendix B.31 'Integrated Operations Management and Control Systems', including but not limited to:	Approved	Fully Complies	Section 1.5 - Standards Procedures and References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180829	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (vii) A.	SWTC Appendix C.1 Project Plan Requirements	17 b) (vii) A.	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum: SWTC Appendix B.31 'Integrated Operations Management and Control Systems', including but not limited to:	Section 8.1 'Traffic Incident Detection Requirements'; and	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180830	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 b) (vii) B.	SWTC Appendix C.1 Project Plan Requirements	17 b) (vii) B.	The Testing and Commissioning Plan must comply with the requirements of the Deed and SWTC and be to a standard that satisfies all relevant Authorities. The Testing and Commissioning Plan must address, as a minimum: SWTC Appendix B.31 'Integrated Operations Management and Control Systems', including but not limited to:	Section 10.2.1.5 'Testing and Commissioning of the Data Communications Protocol'.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180831	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 c)	SWTC Appendix C.1 Project Plan Requirements	17 c)	-	The requirements of items (b)(ii) and (b)(iii) above must be addressed in separate sub-plans within the Testing and Commissioning Plan.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180832	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 d)	SWTC Appendix C.1 Project Plan Requirements	17 d)	-	The Testing and Commissioning Plan must be prepared in accordance with all relevant Standards and Specifications, including but not limited to the relevant Codes and Standards listed in:	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003 Compliance information is in JIRA.	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180833	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 d) (i)	SWTC Appendix C.1 Project Plan Requirements	17 d) (i)	The Testing and Commissioning Plan must be prepared in accordance with all relevant Standards and Specifications, including but not limited to the relevant Codes and Standards listed in:	Annexure 1 to Appendix B.12; and	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Section 3 - Testing and Commissioning Process Compliance information is in JIRA. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180834	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 d) (ii)	SWTC Appendix C.1 Project Plan Requirements	17 d) (ii)	The Testing and Commissioning Plan must be prepared in accordance with all relevant Standards and Specifications, including but not limited to the relevant Codes and Standards listed in:	Appendix D.4.	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Section 3 - Testing and Commissioning Process Compliance information is in JIRA. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-180835	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 e) (i)	SWTC Appendix C.1 Project Plan Requirements	17 e) (i)	The Testing and Commissioning Plan must be regularly reviewed, developed and updated:	to address changes in the design and construction process including the use of and development of new designs and materials; and	Approved	Fully Complies	Section 2 - Organisational Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180836	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 e) (ii)	SWTC Appendix C.1 Project Plan Requirements	17 e) (ii)	The Testing and Commissioning Plan must be regularly reviewed, developed and updated:	to address design and construction processes requiring documentation which the existing Testing and Commissioning Plan does not address.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Compliance information is in JIRA. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180837	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 f)	SWTC Appendix C.1 Project Plan Requirements	17 f)	-	The Testing and Commissioning Plan must be submitted to RMS 180 Business Days prior to the Date for Completion or at least 180 Business Days prior to the Date of Completion, whichever is the earlier.	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180838	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 g)	SWTC Appendix C.1 Project Plan Requirements	17 g)	-	The Project Company must not, except as expressly permitted under the Deed, commence any testing and commissioning work until the Testing and Commissioning Plan has been submitted to RMS, and RMS has not given a notice under clause 2(a)(ii) of Schedule 18 to the Deed.	Approved	Fully Complies	Section 2 - Organisational Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-180839	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 17 h)	SWTC Appendix C.1 Project Plan Requirements	17 h)	-	The initial Testing and Commissioning Plan is Appendix E.17 to the SWTC.	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-204447	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 18 d)	SWTC Appendix C.1 Project Plan Requirements	18 d)	-	An Initial Operational Readiness Evaluation Plan must be submitted to RMS at least six months prior to the planned commencement of testing and commissioning.	Approved	Fully Complies	Section 4.3 - ORE Plan Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-204448	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix C.1 Project Plan Requirements Clause: 18 e)	SWTC Appendix C.1 Project Plan Requirements	18 e)	-	The final Operational Readiness Evaluation Plan must be submitted to RMS at least three months prior to the planned commencement of testing and commissioning.	Approved	Fully Complies	Section 4.3 - ORE Plan Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-209057	Document Compliance	Document Compliance | SWTC Appendix B.14 Clause : 2.2 c)(iv)	SWTC Appendix B.14	2.2 c)(iv)	The PMP plan must act as the high-level overarching plan covering all the project's main elements. The following subordinate plans must be produced providing further detail supporting the PMP:	Testing and Commissioning Plan - provided in accordance with SWTC- Appendix C1 Project Plan Requirements;	Approved	Fully Complies	Compliance information is in JIRA. Testing and Commissioning Plan has been written and documents requirements. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203200	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 a)	SWTC - Main Body	2.6.1 a)	-	The Project Company must plan and manage resources, including operation and maintenance organisation mobilisation, in such a way to ensure a seamless and continuous transition of the facilities and systems from the design and construction phase activities to the O&M Work.	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203201	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 b) (i)	SWTC - Main Body	2.6.1 b) (i)	The Project Company must provide:	access to the construction works for O&M personnel for project familiarisation and training;	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203202	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 b) (ii)	SWTC - Main Body	2.6.1 b) (ii)	The Project Company must provide:	access to systems and equipment for O&M personnel for training, drills and competency assessments, prior to the Date of Opening Completion;	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203203	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 b) (iii)	SWTC - Main Body	2.6.1 b) (iii)	The Project Company must provide:	all O&M Manuals, information and training for O&M personnel to prepare their management plans and operational procedures in sufficient time to meet the requirements of the Project Deed and this SWTC; and	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203204	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 b) (iv)	SWTC - Main Body	2.6.1 b) (iv)	The Project Company must provide:	all asset information, including type, class, nature, location, composition, value and maintenance requirements, to enable the Asset Information System (AIS) to be configured and fully populated prior to the Date of Completion.	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203205	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 c) (i)	SWTC - Main Body	2.6.1 c) (i)	The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to RMS:	O&M Manuals, completed to the extent defined in SWTC Appendix C.2 (Project Company Documentation Schedule), Section 5 (O&M Manuals), paragraph d).;	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203206	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 c) (ii)	SWTC - Main Body	2.6.1 c) (ii)	The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to RMS:	fully developed training programs to be used for training of operation and maintenance personnel;	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203207	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 c) (iv)	SWTC - Main Body	2.6.1 c) (iv)	The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to RMS:	a detailed plan for training of all O&M personnel, including 'live system' training and drills, major emergency exercises, and provision for ongoing training of O&M personnel;	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203208	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 c) (v)	SWTC - Main Body	2.6.1 c) (v)	The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to RMS:	a detailed Operational Readiness Evaluation (ORE) plan to the satisfaction of the Independent Certifier, having regard to the opinions of relevant representatives of RMS, TMC, Fire and Rescue NSW and NSW Police Force; and	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203209	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 c) (vi)	SWTC - Main Body	2.6.1 c) (vi)	The Project Company must at least three months prior to the planned commencement of the testing and commissioning process, provide to RMS:	details of the Permit to Work system which is to be implemented from the Date of Opening Completion to control and manage all work to be undertaken on the Motorway during the O&M Phase, including completion of any outstanding construction or defect rectification work which may be necessary.	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203210	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 d)	SWTC - Main Body	2.6.1 d)	-	The Project Company must ensure that training of operation and maintenance personnel commences no later than twelve weeks prior to the Date for Opening Completion.	Approved	Fully Complies	Section 2 - Role and Responsibilities Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203211	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.1 e)	SWTC - Main Body	2.6.1 e)	-	The Project Company must ensure that an ORE is completed to the satisfaction of the Independent Certifier, having regard to the opinions of relevant representatives of RMS, TMC, Fire and Rescue NSW and NSW Police Force.	Approved	Fully Complies	Section 3.4 ORE	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259261	Document Compliance	Document Compliance | SWTC - Main Body Clause: 2.6.2 a) (i)	SWTC - Main Body	2.6.2 a) (i)	The transition period includes:	testing and commissioning activities;	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259263	Document Compliance	Document Compliance | SWTC - Main Body Clause: 2.6.2 a) (ii)	SWTC - Main Body	2.6.2 a) (ii)	The transition period includes:	delivery of final versions of all O&M manuals, plans and procedures and other documentation required for operation and maintenance of the Motorway;	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0004	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259260	Document Compliance	Document Compliance | SWTC - Main Body Clause: 2.6.2 a) (iii)	SWTC - Main Body	2.6.2 a) (iii)	The transition period includes:	configuration and population of the AIS;	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0005	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259267	Document Compliance	Document Compliance | SWTC - Main Body 2.6.2 a) (iv)	SWTC - Main Body	2.6.2 a) (iv)	The transition period includes:	recruitment and training of all O&M personnel, to the required level of competency;	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0006	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259264	Document Compliance	Document Compliance | SWTC - Main Body 2.6.2 a) (v)	SWTC - Main Body	2.6.2 a) (v)	The transition period includes:	mobilisation of O&M plant, equipment and other resources;	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0007	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259262	Document Compliance	Document Compliance | SWTC - Main Body 2.6.2 a) (vi)	SWTC - Main Body	2.6.2 a) (vi)	The transition period includes:	training of external personnel, including emergency services, as necessary to facilitate effective response to Motorway incidents and emergencies; and	Approved	Fully Complies	Section 4 - Transition Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0008	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-259265	Document Compliance	Document Compliance | SWTC - Main Body 2.6.2 a) (vii)	SWTC - Main Body	2.6.2 a) (vii)	The transition period includes:	an ORE.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-203212	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 b)	SWTC - Main Body	2.6.3 b)	-	All system and equipment testing and commissioning activities, plus all training activities, must be satisfactorily completed prior to the commencement of the ORE.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203213	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (i)	SWTC - Main Body	2.6.3 c) (i)	The ORE is to be conducted in three phases as follows:	ORE Phase 1; to be conducted prior to transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR, to evaluate operational readiness to manage the M4 Motorway, New M5 Motorway and M5 East Motorway from this location using the I-OMCS and associated systems and equipment;	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203214	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (ii)	SWTC - Main Body	2.6.3 c) (ii)	The ORE is to be conducted in three phases as follows:	ORE Phase 2; to be conducted prior to the Date of Opening Completion, to evaluate operational readiness to conduct traffic operations on the Motorway and the combined WestConnex Motorways. ORE Phase 2 must include a minimum five-day period following satisfactory transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR. This period shall include:	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203215	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (ii) A.	SWTC - Main Body	2.6.3 c) (ii) A.	The ORE is to be conducted in three phases as follows: ORE Phase 2; to be conducted prior to the Date of Opening Completion, to evaluate operational readiness to conduct traffic operations on the Motorway and the combined WestConnex Motorways. ORE Phase 2 must include a minimum five-day period following satisfactory transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR. This period shall include:	continuous (24 hour) operation of motorway systems as would be required for normal traffic operations (external signage which may cause distraction or confusion to motorists on the adjacent road network is to be covered during this period);	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203216	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (ii) B.	SWTC - Main Body	2.6.3 c) (ii) B.	The ORE is to be conducted in three phases as follows: ORE Phase 2; to be conducted prior to the Date of Opening Completion, to evaluate operational readiness to conduct traffic operations on the Motorway and the combined WestConnex Motorways. ORE Phase 2 must include a minimum five-day period following satisfactory transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR. This period shall include:	final assessment of the suitability of the documented O&M processes;	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203217	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (ii) C.	SWTC - Main Body	2.6.3 c) (ii) C.	The ORE is to be conducted in three phases as follows: ORE Phase 2; to be conducted prior to the Date of Opening Completion, to evaluate operational readiness to conduct traffic operations on the Motorway and the combined WestConnex Motorways. ORE Phase 2 must include a minimum five-day period following satisfactory transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR. This period shall include:	evaluation of all O&M personnel performing their various incident response roles in a range of incident scenarios; and	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203218	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (ii) D.	SWTC - Main Body	2.6.3 c) (ii) D.	The ORE is to be conducted in three phases as follows: ORE Phase 2; to be conducted prior to the Date of Opening Completion, to evaluate operational readiness to conduct traffic operations on the Motorway and the combined WestConnex Motorways. ORE Phase 2 must include a minimum five-day period following satisfactory transfer of operational control of the M4 Motorway, New M5 Motorway and M5 East Motorway to the WMCC TCR. This period shall include:	at least one major emergency field simulation which requires attendance by all emergency services agencies and activation of a major incident command and control centre.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203219	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii)	SWTC - Main Body	2.6.3 c) (iii)	The ORE is to be conducted in three phases as follows:	ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203220	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii) A.	SWTC - Main Body	2.6.3 c) (iii) A.	The ORE is to be conducted in three phases as follows: ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	transfer operational control of WestConnex Motorways from the WMCC TCR to the WDRS TCR;	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203221	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii) B.	SWTC - Main Body	2.6.3 c) (iii) B.	The ORE is to be conducted in three phases as follows: ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	sustain normal traffic operations for the WestConnex Motorways from the WDRS TCR; and	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203222	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii) C.	SWTC - Main Body	2.6.3 c) (iii) C.	The ORE is to be conducted in three phases as follows: ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	revert operational control of WestConnex Motorways from the WDRS TCR back to the WMCC TCR.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203223	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii) d)	SWTC - Main Body	2.6.3 c) (iii) d)	The ORE is to be conducted in three phases as follows: ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	ORE phases 1 and 2 are to be conducted using the IOMCS and controlled from the WMCC TCR.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203224	Document Compliance	Document Compliance | SWTC - Main Body Clause : 2.6.3 c) (iii) e)	SWTC - Main Body	2.6.3 c) (iii) e)	The ORE is to be conducted in three phases as follows: ORE Phase 3; to be conducted prior to the Date of Completion, to evaluate operational readiness to:	ORE phase 3 is to be conducted using the IOMCS and controlled from the WMCC TCR and WDRS TCR as appropriate.	Approved	Fully Complies	ORE Section 3.3 - Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-204450	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix B.14 Clause 3.10 h)(i)	SWTC Appendix B.14	3.10 h)(i)	The Project Company must develop the following:	Testing and Commissioning Plan - provided in accordance with SWTC - Appendix C1 Project Plan Requirements, section 17;	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-204446	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC Appendix B.14 Clause: 3.12 b)(iii)	SWTC Appendix B.14	3.12 b)(iii)	The Project Company must produce the following:	testing and commissioning documentation as outlined in Appendix B.12 Operations and Management and Control Systems and Appendix B31 Integrated Operations and Management and Control Systems.	Approved	Fully Complies	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203226	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 a)	SWTC - Main Body	6.20.1 a)	-	The Project Company must undertake comprehensive testing and commissioning of the Project Works and Temporary Works to ensure that the Project Works comply with the requirements of the Project Deed.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203227	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 b)	SWTC - Main Body	6.20.1 b)	-	Testing must be carried out progressively throughout the construction of the Project Works and the Temporary Works.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Issue Key	Issue Type	Summary	Contract Document	Clause	Preamble	Description	Current Status	Compliance Status	Compliance Statement	Reference
WCX3A-204445	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 c)	SWTC - Main Body	6.20.1 c)	-	Off-site manufactured equipment must be tested at the point of manufacture prior to delivery wherever this is practical and further on-site tests carried out during commissioning.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203228	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 d)	SWTC - Main Body	6.20.1 d)	-	The commissioning of plant must be carried out in a progressive manner during the construction phase to determine whether there are any shortcomings in performance of any part of the plant, equipment or installation.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203229	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 e)	SWTC - Main Body	6.20.1 e)	-	Commissioning procedures must include full operational tests in all modes that are anticipated during operation of the Motorway, including:	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203230	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 e) (i)	SWTC - Main Body	6.20.1 e) (i)	Commissioning procedures must include full operational tests in all modes that are anticipated during operation of the Motorway, including:	normal operation, for varying periods;	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203231	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 e) (ii)	SWTC - Main Body	6.20.1 e) (ii)	Commissioning procedures must include full operational tests in all modes that are anticipated during operation of the Motorway, including:	emergency operation; and	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203232	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 e) (iii)	SWTC - Main Body	6.20.1 e) (iii)	Commissioning procedures must include full operational tests in all modes that are anticipated during operation of the Motorway, including:	total and partial power failure.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203233	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 f)	SWTC - Main Body	6.20.1 f)	-	Consideration must be given to interruption to electricity supply and communication facilities and the consequent effect on electrical and electronic equipment. Commissioning procedures must be implemented to determine the effect on installed systems under such conditions.	Not Applicable	Partially Complies	Reference added to Testing and Commissioning Plan, as not process. Section 3 Predominatly should be Electrical Testing	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203234	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 g)	SWTC - Main Body	6.20.1 g)	-	The UPS systems must be commissioned under actual operating conditions for the full duration of the required stand-by period.	Not Applicable	Partially Complies	Reference added to Testing and Commissioning Plan, as not process. Section 3 Predominatly should be Electrical Testing	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203235	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 h)	SWTC - Main Body	6.20.1 h)	-	Where redundancy forms part of the design of any system, this aspect must be fully tested and commissioned including removing the active component from service under the most arduous conditions that are likely to occur in practice.	Not Applicable	Partially Complies	Reference added to Testing and Commissioning Plan, as not process. Section 3 Predominatly should be Electrical and Comms Testing	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203236	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 i)	SWTC - Main Body	6.20.1 i)	-	All commissioning operations must be documented with the performance results clearly recorded against comparative design criteria.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203237	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 k)	SWTC - Main Body	6.20.1 k)	-	The OMCS, Electronic Toll Collection and other systems (including all associated hardware, software, network and devices/equipment) must be installed, tested and commissioned in accordance with Appendices B.12, B.14 and E.11.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203238	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 l)	SWTC - Main Body	6.20.1 l)	-	The Project Company must prepare a Testing and Commissioning Plan in accordance with the requirements of Appendix C.2 and must undertake testing and commissioning in accordance with the Testing and Commissioning Plan. The Testing and Commissioning Plan must program testing and commissioning activities to ensure that testing and commissioning is commenced and completed in accordance with the requirements of Appendix B.12 and Appendix B.31.	Approved	Fully Complies	Section 1.5 - Standards, Procedures & References Section 3 - Testing and Commissioning Process Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203239	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 m)	SWTC - Main Body	6.20.1 m)	-	The TCR operators must operate the OMCS during User Acceptance Testing in accordance with Appendix B.12 and Appendix B.31.	Approved	Fully Complies	Section 3 - Testing and Commissioning Process and Section 2 Roles and Responsibilites Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203240	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 n)	SWTC - Main Body	6.20.1 n)	-	Relevant O&M personnel must observe all commissioning activities.	Approved	Partially Complies	D&C Contractor has no control over ensuring O&M staff from another organisation attend Testing. Other organisations will be invited to attend testing but it is their responsibility to ensure they get whichever staff they would like to attend. Section 2 Roles and Responsibilities - details this expectation/requirement of WCX/AT.	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003
WCX3A-203241	Document Compliance	T&C Plan \ MP - Management Plans \ SWTC - Main Body Clause: 6.20.1 o)	SWTC - Main Body	6.20.1 o)	-	If required by RMS, prior to the Date of Opening Completion the Project Company must ensure that personnel nominated by RMS are trained in all aspects of operation and maintenance of the Project Works to the extent that the personnel are able to operate and maintain the Project Works without further assistance from the Project Company.	Approved	Partially Complies	Section 2 role and Repsonsibilies - RMS/TfNSW	Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003

Appendix B

Test Document Matrix

Appendix B Test Document Matrix

The following matrix is draft only and will be developed further during the detailed planning of each stage.

M4M5-LSBJ-PRW-MES-GE01-MAT-0004 [A.3]

M&E Testing and Commissioning Documentation Matrix

Document Control

Version	Description	Author(s)	Date
A.1	Document Created for Review and error checking	(ASBJV) Scott Chivers (ASBJV) Rashid Ahwazian (SICE) Ana Esteban	2/02/2021
A.2	Minor updates for review and checking	(ASBJV) Scott Chivers (SICE) Ana Esteban	12/09/2021
A.3	Update to include L2 and L3 ITR list. Minor updates to SAT and SIT docs	(ASBJV) Daniel Washburn	31/05/2022

Document Notes

Version	Notes for the version
A.1	> L6 UAT and L7 System Tuning phases will be updated in next revisions.
A.2	L2 and L3 to be updated
A.3	L2 and L3 ITR list included. Minor updates to SAT and SIT docs

Test Cycle	Test Procedure document name	DPK	Test Procedure Title	Test Plan ID ITP	Test Procedure ID PRC	Test Cases ID ITR
FAT - OMCS				M4M5-SICE-PRW-MES-GE01-ITP-1001	1001	1001
CCTV FAT	CCTV FAT Test Procedure	IT20	CCTV FAT Test Procedure	-	M4M5-SICE-PRW-MES-IT20-PRC-1001	M4M5-SICE-PRW-MES-IT20-ITR-1001
MNCS FAT	MNCS FAT Test Procedure	OM05	MNCS FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM05-PRC-1001	M4M5-SICE-PRW-MES-OM05-ITR-1001
Telephone FAT	Telephone FAT Test Procedure	CM04	Telephone FAT Test Procedure	-	M4M5-SICE-PRW-MES-CM04-PRC-1001	M4M5-SICE-PRW-MES-CM04-ITR-1001
OMCS Hardware FAT	OMCS Hardware FAT Test Procedure	OM01	OMCS Hardware FAT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-1011	M4M5-####-PRW-MES-GE01-ITR-1011
PMCS Architecture FAT	PMCS Architecture FAT Test Procedure	OM02	PMCS Architecture FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM02-PRC-1001	M4M5-SICE-PRW-MES-OM02-ITR-1001
TMCS Functionality - Driver Advisory Systems FAT	TMCS Functionality - Driver Advisory Systems FAT Test Procedure	IT24,OM21, OM26	TMCS Functionality - Driver Advisory Systems FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM21-PRC-1001	M4M5-SICE-PRW-MES-OM21-ITR-1001
TMCS Functionality - Vehicle Monitoring and Control Systems FAT	TMCS Functionality - Vehicle Monitoring and Control Systems FAT Test Procedure	IT25,OM22,OM26	TMCS Functionality - Vehicle Monitoring and Control Systems FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM22-PRC-1001	M4M5-SICE-PRW-MES-OM22-ITR-1001
TMCS Functionality - Video Surveillance Systems FAT	TMCS Functionality - Video Surveillance Systems FAT Test Procedure	OM23	TMCS Functionality - Video Surveillance Systems FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM23-PRC-1001	M4M5-SICE-PRW-MES-OM23-ITR-1001
TMCS Functionality - Tunnel Closure Systems FAT	TMCS Functionality - Tunnel Closure Systems FAT Test Procedure	OM24,OM26	TMCS Functionality - Tunnel Closure Systems FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM24-PRC-1001	M4M5-SICE-PRW-MES-OM24-ITR-1001
TMCS Functionality - Voice Communications FAT	TMCS Functionality - Voice Communications FAT Test Procedure	OM25	TMCS Functionality - Voice Communications FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM25-PRC-1001	M4M5-SICE-PRW-MES-OM25-ITR-1001
OMCS Training & Development Systems FAT	OMCS Training & Development Systems Test Procedure	OM18	OMCS Training & Development Systems Test Procedure	-	M4M5-SICE-PRW-MES-OM18-PRC-1001	M4M5-SICE-PRW-MES-OM18-ITR-1001
OMCS SIDERA Core Functionality FAT	OMCS SIDERA Core Functionality FAT Test Procedure	OM17, OM10, OM11	OMCS SIDERA Core Functionality FAT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-2012	M4M5-####-PRW-MES-GE01-ITR-2012
OMCS SIDERA Core IMS FAT	OMCS SIDERA Core Functionality FAT Test Procedure	OM17,OM10	OMCS SIDERA Core Functionality FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM17-PRC-1001	M4M5-SICE-PRW-MES-OM17-ITR-1001
SIDERA Operational Displays	SIDERA Operational Displays FAT Test Procedure	OM19	SIDERA Operational Displays FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM19-PRC-1001	M4M5-SICE-PRW-MES-OM19-ITR-1001
OMCS C2C FAT	OMCS C2C FAT Test Procedure	OM13,OM26,OM10	OMCS C2C FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM13-PRC-1001	M4M5-SICE-PRW-MES-OM13-ITR-1001
OMCS IOMCS Interface FAT	OMCS IOMCS Interface FAT Test Procedure	OM14	OMCS IOMCS Interface FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM14-PRC-1001	M4M5-SICE-PRW-MES-OM14-ITR-1001
OMCS PMCS Ventilation FAT (Algorithms)	OMCS PMCS Ventilation FAT (Algorithms) Test Procedure	OM30	OMCS PMCS Ventilation FAT (Algorithms) Test Procedure	-	M4M5-SICE-PRW-MES-OM30-PRC-1001	M4M5-SICE-PRW-MES-OM30-ITR-1001
OMCS PMCS Ventilation FAT (Devices)	OMCS PMCS Ventilation FAT (Devices) Test Procedure	OM30	OMCS PMCS Ventilation FAT (Devices) Test Procedure	-	M4M5-SICE-PRW-MES-OM30-PRC-1002	M4M5-SICE-PRW-MES-OM30-ITR-1002
OMCS PMCS Fire FAT	OMCS PMCS Fire FAT Test Procedure	OM31	OMCS PMCS Fire FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM31-PRC-1001	M4M5-SICE-PRW-MES-OM31-ITR-1001
OMCS PMCS Hydraulics FAT	OMCS PMCS Hydraulics FAT Test Procedure	OM32	OMCS PMCS Hydraulics FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM32-PRC-1001	M4M5-SICE-PRW-MES-OM32-ITR-1001
OMCS PMCS Electrical FAT	OMCS PMCS Electrical FAT Test Procedure	OM33	OMCS PMCS Electrical FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM33-PRC-1001	M4M5-SICE-PRW-MES-OM33-ITR-1001
OMCS PMCS Lighting FAT	OMCS PMCS Lighting FAT Test Procedure	OM34	OMCS PMCS Lighting FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM34-PRC-1001	M4M5-SICE-PRW-MES-OM34-ITR-1001
OMCS PMCS MVAC FAT	OMCS PMCS MVAC FAT Test Procedure	OM35	OMCS PMCS MVAC FAT Test Procedure	-	M4M5-SICE-PRW-MES-OM35-PRC-1001	M4M5-SICE-PRW-MES-OM35-ITR-1001
IFAT - IOMCS				M4M5-SICE-PRW-MES-GE01-ITP-2001	2001	2001
IOMCS Internal Network IFAT	IOMCS Internal Network IFAT Test Procedure	OM97, OM96	IOMCS Internal Network IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM97-PRC-2001	M4M5-SICE-PRW-MES-OM97-ITR-2001
I-NMS Architecture IFAT	I-NMS Architecture IFAT Test Procedure	OM85	I-NMS Architecture IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM85-PRC-2001	M4M5-SICE-PRW-MES-OM85-ITR-2001
IOMCS Servers IFAT + IOMCS Control Room	IOMCS Servers IFAT + IOMCS Control Room Test Procedure	OM91, OM92	IOMCS Servers IFAT + IOMCS Control Room Test Procedure	-	M4M5-SICE-PRW-MES-OM91-PRC-2001	M4M5-SICE-PRW-MES-OM91-ITR-2001
IOMCS DVMS Architecture IFAT	IOMCS DVMS Architecture IFAT Test Procedure	OM81	IOMCS DVMS Architecture IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM81-PRC-2001	M4M5-SICE-PRW-MES-OM81-ITR-2001
IOMCS PABX Architecture IFAT	IOMCS PABX Architecture IFAT (MFT + GUI) Test Procedure		IOMCS PABX Architecture IFAT (MFT + GUI) Test Procedure	-	M4M5-SICE-PRW-MES-OM83-PRC-2001	M4M5-SICE-PRW-MES-OM83-ITR-2001
IOMCS Voice Communications Integration IFAT	IOMCS Voice Communications Integration IFAT Test Procedure	OM83+OM87	IOMCS Voice Communications Integration IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM87-PRC-2001	M4M5-SICE-PRW-MES-OM87-ITR-2001
IOMCS Training and Development Systems IFAT	IOMCS Training and Development Systems IFAT Test Procedure	Fire System Interface	IOMCS Training and Development Systems IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM64-PRC-2001	M4M5-SICE-PRW-MES-OM64-ITR-2001
IOMCS SIDERA Core Functionality IFAT	IOMCS SIDERA Core Functionality IFAT Test Procedure	OM63, OM61, OM62, OM72	IOMCS SIDERA Core Functionality IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM63-PRC-2001	M4M5-SICE-PRW-MES-OM63-ITR-2001
IOMCS SIDERA Core IMS IFAT	IOMCS SIDERA Core IMS IFAT Test Procedure	OM63	IOMCS SIDERA Core IMS IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM63-PRC-2001	M4M5-SICE-PRW-MES-OM63-ITR-2001
IOMCS C2C IFAT	IOMCS C2C IFAT Test Procedure	OM71, OM72	IOMCS C2C IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM71-PRC-2001	M4M5-SICE-PRW-MES-OM71-ITR-2001
WCX SIDERA Operational Displays IFAT	WCX SIDERA Operational Displays IFAT Test Procedure	OM65	WCX SIDERA Operational Displays IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM65-PRC-2001	M4M5-SICE-PRW-MES-OM65-ITR-2001
IOMCS Configuration Management IFAT	IOMCS Configuration Management IFAT Test Procedure	OM50	IOMCS Configuration Management IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM50-PRC-2001	M4M5-SICE-PRW-MES-OM50-ITR-2001
IOMCS OMCS Interface IFAT	IOMCS OMCS Interface IFAT Test Procedure	OM66	IOMCS OMCS Interface IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM66-PRC-2001	M4M5-SICE-PRW-MES-OM66-ITR-2001
IOMCS PMCS Fire IFAT	IOMCS PMCS Fire IFAT Test Procedure	OM31	IOMCS PMCS Fire IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM31-PRC-2001	M4M5-SICE-PRW-MES-OM31-ITR-2001
IOMCS PMCS Lighting IFAT	IOMCS PMCS Lighting IFAT Test Procedure	OM34	IOMCS PMCS Lighting IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM34-PRC-2001	M4M5-SICE-PRW-MES-OM34-ITR-2001
IOMCS PMCS Ventilation IFAT	IOMCS PMCS Ventilation IFAT Test Procedure	OM30	IOMCS PMCS Ventilation IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM30-PRC-2001	M4M5-SICE-PRW-MES-OM30-ITR-2001

Test Cycle	Test Procedure document name	DPK	Test Procedure Title	Test Plan ID ITP	Test Procedure ID PRC	Test Cases ID ITR
IOMCS PMCS MVAC IFAT	IOMCS PMCS MVAC IFAT Test Procedure	OM35	IOMCS PMCS MVAC IFAT Test Procedure	-	M4M5-SICE-PRW-MES-OM35-PRC-2001	M4M5-SICE-PRW-MES-OM35-ITR-2001
FIT - OMCS				M4M5-SICE-PRW-MES-GE01-ITP-1002		
OMCS Software FIT (Part A) ICT Systems					1002	1002
OMCS Hardware FIT	ICT System FIT Test Procedure	OM01, OM10	ICT System FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1002	M4M5-SICE-PRW-MES-GE01-ITR-1002
MNCS FIT	ICT System FIT Test Procedure	OM05	ICT System FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1002	M4M5-SICE-PRW-MES-GE01-ITR-1002
CCTV FIT	ICT System FIT Test Procedure	IT20,OM23, OM10	ICT System FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1002	M4M5-SICE-PRW-MES-GE01-ITR-1002
AVIDS FIT	ICT System FIT Test Procedure	IT21,OM23	ICT System FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1002	M4M5-SICE-PRW-MES-GE01-ITR-1002
Telephones FIT	ICT System FIT Test Procedure	CM04,OM25	ICT System FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1002	M4M5-SICE-PRW-MES-GE01-ITR-1002
OMCS Software FIT (Part B) Traffic Systems Hardware					1003	1003
TMCS Functionality - Driver Advisory Systems FIT	TMCS Interface FIT Test Procedure	IT24,OM21, OM26	TMCS Interface FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1003	M4M5-SICE-PRW-MES-GE01-ITR-1003
TMCS Functionality - Vehicle Monitoring and Control Systems FIT	TMCS Interface FIT Test Procedure	IT25,OM22,OM26	TMCS Interface FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1003	M4M5-SICE-PRW-MES-GE01-ITR-1003
TMCS Functionality - Voice Communications (PA/RRB) FIT	TMCS Interface FIT Test Procedure	OM25	TMCS Interface FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1003	M4M5-SICE-PRW-MES-GE01-ITR-1003
IBM Maximo Interface FIT	IBM Maximo Interface FIT Test Procedure	OM86	IBM Maximo Interface FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1006	M4M5-SICE-PRW-MES-GE01-ITR-1006
OMCS Software FIT (Part C) Plant Systems Hardware					1004	1004
OMCS Software FIT (Part D) IMS					1005	1005
IMS FIT	IMS FIT Test Procedure	OM17,OM26,OM24, OM31,OM32,OM34, OM35,OM30,IT22,IT23	IMS FIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-1005	M4M5-SICE-PRW-MES-GE01-ITR-1005
IFIT - IOMCS				M4M5-SICE-PRW-MES-GE01-ITP-2002		
IOMCS Software IFIT (Part A) ICT Systems					2002	2002
IOMCS Servers IFIT	ICT System IFIT Test Procedure	OM91	ICT System IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2002	M4M5-SICE-PRW-MES-GE01-ITR-2002
IOMCS Internal Network IFIT	ICT System IFIT Test Procedure	OM97, OM96	ICT System IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2002	M4M5-SICE-PRW-MES-GE01-ITR-2002
I-NMS IFIT	ICT System IFIT Test Procedure	OM85	ICT System IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2002	M4M5-SICE-PRW-MES-GE01-ITR-2002
DVMS IFIT	ICT System IFIT Test Procedure	OM81	ICT System IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2002	M4M5-SICE-PRW-MES-GE01-ITR-2002
AVIDS FIT	ICT System IFIT Test Procedure	OM82	ICT System IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2002	M4M5-SICE-PRW-MES-GE01-ITR-2002
IOMCS Software IFIT (Part B) Traffic Systems Hardware					2003	2003
Driver Advisory Systems IFIT	TMCS Interface IFIT Test Procedure	OM63	TMCS Interface IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2003	M4M5-SICE-PRW-MES-GE01-ITR-2003
Vehicle Monitoring and Control Systems IFIT	TMCS Interface IFIT Test Procedure	OM63	TMCS Interface IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2003	M4M5-SICE-PRW-MES-GE01-ITR-2003
Voice Communications Integration IFIT	TMCS Interface IFIT Test Procedure	OM83+OM87	TMCS Interface IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2003	M4M5-SICE-PRW-MES-GE01-ITR-2003
IOMCS Software IFIT (Part C) Plant Systems Hardware					2004	2004
IOMCS Software IFIT (Part D) IMS					2005	2005
IMS IFIT	IMS IFIT Test Procedure	OM63,OM31,OM32, OM34,OM35,OM30	IMS IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2005	M4M5-SICE-PRW-MES-GE01-ITR-2005
IOMCS Configuration Management (Part E)					2007	2007
IOMCS Configuration Management IFIT	IOMCS Configuration Management IFIT Test Procedure	OM50	IOMCS Configuration Management IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2007	M4M5-SICE-PRW-MES-GE01-ITR-2007
IOMCS Software IFIT (Part F)					2006	2006
IBM Maximo Interface IFIT (OMCS+IOMCS)	IBM Maximo Interface IFIT Test Procedure	OM86	IBM Maximo Interface IFIT Test Procedure	-	M4M5-SICE-PRW-MES-GE01-PRC-2006	M4M5-SICE-PRW-MES-GE01-ITR-2006

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	EQUIPMENT TYPE	ASSET SUB-TYPES			
	Project Wide				
	I/O Test	MULTIPLE			M4M5-~~####~~-PRW-MESV-MES-GE01-ITR-1011
ES01	**High Voltage Power Devices**				
ES01	11kV High Voltage Switchboard	HVS_33K	M4M5-LSBJ-PRW-MES-ELQA-ITR-0001 M4M5-LSBJ-PRW-MES-ELQA-ITR-0013	M4M5-LSBJ-PRW-MES-ELQA-ITR-0136	M4M5-LSBJ-PRW-MES-ELQA-ITR-0161 M4M5-LSBJ-PRW-MES-ELQA-ITR-0167
ES01	11kV/690V/415V Dry Type Transformer (2 WINDING)	TRX_HV0	M4M5-LSBJ-PRW-MES-ELQA-ITR-0003	M4M5-LSBJ-PRW-MES-ELQA-ITR-0135	M4M5-LSBJ-PRW-MES-ELQA-ITR-0164
ES01	11kV/690V/415V Dry Type Transformer (3 WINDING)	TRX_HV1	M4M5-LSBJ-PRW-MES-ELQA-ITR-0003	M4M5-LSBJ-PRW-MES-ELQA-ITR-0135	M4M5-LSBJ-PRW-MES-ELQA-ITR-0164
ES01	High Voltage Control Panel	HCP_000	COVERED AT HVS FAT	M4M5-LSBJ-PRW-MES-ELQA-ITR-0151	
ES01	Battery Charger (110VDC)	BCH_110	M4M5-LSBJ-PRW-MES-ELQA-ITR-0007	M4M5-LSBJ-PRW-MES-ELQA-ITR-0149	M4M5-LSBJ-PRW-MES-ELQA-ITR-0150
ES02	**LV Power Devices**				
ES02	690V/415V Bus Duct	BDL_000 BDM_000	M4M5-LSBJ-PRW-MES-ELQA-ITR-0010	M4M5-LSBJ-PRW-MES-ELQA-ITR-0142	
ES02	Dry Type Transformer 690V / 433V	TXE_200 TXG_050 TXG_100 TXG_250 TXU_050	M4M5-LSBJ-PRW-MES-ELQA-ITR-0004	M4M5-LSBJ-PRW-MES-ELQA-ITR-0140 M4M5-LSBJ-PRW-MES-ELQA-0171 to 0174	
ES02	Low Voltage Switchboards	MCS_000 LVS_000 PFC_200 PFC_400	M4M5-LSBJ-PRW-MES-ELQA-ITR-0012	M4M5-LSBJ-PRW-MES-ELQA-ITR-0141	M4M5-LSBJ-PRW-MES-ELQA-ITR-0162
ES04	**LV Power Devices**				
ES04	Distribution Board	DDB_BDG EDB_400 EDB_690 GDB_BDG GDB_MLN GDB_PTL_WST GDB_PTL_SPI TDB_000 UDB_MLN UDB_PTL UDB_BDG	M4M5-LSBJ-PRW-MES-ELQA-ITR-0002	M4M5-LSBJ-PRW-MES-ELQA-ITR-0147	M4M5-LSBJ-PRW-MES-ELQA-ITR-0163
ES04	UPS	UPS_100 UPS_160 UPS_502	M4M5-LSBJ-PRW-MES-ELQA-ITR-0005	M4M5-LSBJ-PRW-MES-ELQA-ITR-0148	
ES04	Variable Speed Drive	VSD_EP1 VSD_EP2 VSD_XF1 VSD_XF2 VSD_XF3	M4M5-LSBJ-PRW-MES-ELQA-ITR-0006 M4M5-LSBJ-PRW-MES-ELQA-ITR-0014	M4M5-LSBJ-PRW-MES-ELQA-ITR-0143	
ES05	**Earthing**				
ES05	Surface Earthing	ERP_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0104	
ES05	Earth Cabling	EPB - MULTIPLE		M4M5-LSBJ-PRW-MES-ELQA-ITR-0101	
ES05	Earth Bar	EEB_000 TEB_000 MEB_000 SEB_000 LEB_000 HEB_000 HSB_000 VEB_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0102	
ES05	Neutral Bar			M4M5-LSBJ-PRW-MES-ELQA-ITR-0139	
ES05	Lightning Protection 1m Air Terminal	LAT_000 LAT_004		M4M5-LSBJ-PRW-MES-ELQA-ITR-0175	
LI01	**Lighting Devices**	**Fire System Interface**			

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	EQUIPMENT TYPE	ASSET SUB-TYPES			
LI01	Tunnel Lighting	LCU_6MD LCU_6MX LEA_4MD LEA_4MX LEC_6MD LEC_6MX LEM_8MD LEU_4MD LEU_4MX LEZ_8SD LEZ_18MD LMU_8MD SLU_2MD SVL_2MD	M4M5-LSBJ-PRW-MES-ELQA-ITR-0008	M4M5-LSBJ-PRW-MES-ELQA-ITR-0165	M4M5-LSBJ-PRW-MES-ELQA-ITR-0157
LI01	Photometer Luminescence Detector	PHM_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0176	
LI01	Emergency Exit Lighting	DXE_000 EES_SWL EES_SWR EXL_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0165	M4M5-LSBJ-PRW-MES-ELQA-ITR-0157
LI01	General Building Lighting	GLE_CLM GLE_WLM GLE_LPS GLS_CLM GLS_WLM GLS_LPS PLE_000 PLS_000 RLE_000 RLS_000 LSW_PUL LSW_1WY LSW_2WY		M4M5-LSBJ-PRW-MES-ELQA-ITR-0165	M4M5-LSBJ-PRW-MES-ELQA-ITR-0157
LI01	Emergency Exit Lighting non PMCS controlled	ECL_00A ECL_00B EEL_DCA EEL_DSA EEL_LPS EEL_SCL EEL_SCM EEL_SCR EEL_SSM EEL_SSL EEL_SSR EEL_SWL EEL_SWM EEL_SWR		M4M5-LSBJ-PRW-MES-ELQA-ITR-0165	M4M5-LSBJ-PRW-MES-ELQA-ITR-0157
LI01	Lighting Control Panel	LCP_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0151	M4M5-LSBJ-PRW-MES-ELQA-ITR-0157
IT01	**Traffic Control Devices - Tunnel Wide**				
IT01	Integrated Speed Limit and Lane Usage Sign	ISL_00B ISL_00C	M4M5-LSBJ-PRW-MES-CNQA-ITR-0001	M4M5-LSBJ-PRW-MES-CNQA-ITR-0101	
IT01	ISLUS Speed Controller	SCI_00A SCI_SEC	M4M5-LSBJ-PRW-MES-CNQA-ITR-0001		
IT01	Tunnel Message Sign	TMS_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0002	M4M5-LSBJ-PRW-MES-CNQA-ITR-0102	
IT01	Tunnel Message Sign Controller	SCT_00A	M4M5-LSBJ-PRW-MES-CNQA-ITR-0002		
IT01	Changeable Message Sign	CMS_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0006	M4M5-LSBJ-PRW-MES-CNQA-ITR-0111	
IT01	Changeable Message Sign Controller	SCC_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0006		
IT01	Variable Message Sign	VMS_00B VMS_NM5	M4M5-LSBJ-PRW-MES-CNQA-ITR-0007	M4M5-LSBJ-PRW-MES-CNQA-ITR-0112	
IT01	Variable Message Sign Controller	SCV_00A	M4M5-LSBJ-PRW-MES-CNQA-ITR-0007		
IT01	Boom Gate	BGA_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0008	M4M5-LSBJ-PRW-MES-CNQA-ITR-0113	
IT01	Traffic Light 3 Aspect	TFL_200 TFL_300 TFL_RMT	M4M5-LSBJ-PRW-MES-CNQA-ITR-0013	M4M5-LSBJ-PRW-MES-CNQA-ITR-0114	
IT01	Backlit Signs	BLS_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0014	M4M5-LSBJ-PRW-MES-CNQA-ITR-0114	
IT01	Prepare to Stop Sign	PSS_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0013	M4M5-LSBJ-PRW-MES-CNQA-ITR-0114	
IT01	Door Switch	EDS_000 RDS_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0154	

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	EQUIPMENT TYPE	ASSET SUB-TYPES			
IT01	Motorist Emergency Telephone	FET_000 FET_001 MET_000 MET_001 MET_00B MET_002 MET_003 IOC_000 IOC_001		M4M5-LSBJ-PRW-MES-CNQA-ITR-0116	
IT01	Video Incident Detection Controller	IVX_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0012		
IT01	Intelligent Vehicle Loop Detector Controller	IVD_000 IVD_SMW	M4M5-LSBJ-PRW-MES-CNQA-ITR-0012		
IT01	SCATS Controller for Ramp Metering	SCA_000			
IT01	CCTV	PTZ_000 PTZ_00A PTZ_00B TVC_000 TVI_000 TVI_00B TVT_000		M4M5-LSBJ-PRW-MES-CNQA-ITR-0103	
IT01	Traffic Loop	TLP_BGT TLP_000 TLP_SCA TLP_OHD TLP_MBL		M4M5-LSBJ-PRW-MES-CNQA-ITR-0105	
IT02	**Traffic Control Devices - SPI**				
IT02	Over-height Vehicle Detection	OHD_000 OWS_000 VDO_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0015	M4M5-LSBJ-PRW-MES-CNQA-ITR-0109 M4M5-LSBJ-PRW-MES-CNQA-ITR-0110	
IT03	**Traffic Control Devices - WST**				
IT03	Moveable Median Strip	MMS_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0005	M4M5-LSBJ-PRW-MES-CNQA-ITR-0108	
IT04	**Traffic Enforcement Devices**				
IT04	Smoky Vehicle	SVB_000 SVC_000 SVD_000 SVH_000 SVI_000 SVO_001 SVM_000 SVS_000 SVU_000 TTL_000 SEP_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0004	M4M5-LSBJ-PRW-MES-CNQA-ITR-0106	
IT05	**Westconnex Motorway Control Facilities**				
IT05	Emergency Closure Button	EXB_000			
OM98	**Traffic Cabinets**				
OM98	Speed Enforcement Cabinet	SET_000 SET_00B		M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
OM98	Substation OMCS Cabinet	ITC_PLC ITC_MNC ITC_PMC ITC_TMC ITC_PM2	M4M5-LSBJ-PRW-MES-CNQA-ITR-0009	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
OM98	RMS Cabinet	RCR_000		M4M5-LSBJ-PRW-MES-CNQA-ITR-0116	
OM98	Surface Roadside Cabinet	RSC_000 RSC_00M	M4M5-LSBJ-PRW-MES-CNQA-ITR-0009	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
OM98	Smart Motorways Tunnel Cabinet	STC_000 STC_00N		M4M5-LSBJ-PRW-MES-CNQA-ITR-0116	
OM98	Cross Passage PMCS Cabinet	XPC_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0011	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
OM98	Cross Passage TMCS Cabinet	XTC_000 XTC_00B	M4M5-LSBJ-PRW-MES-CNQA-ITR-0011	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
OM98	Training Simulator Cabinet	TRN_000		M4M5-LSBJ-PRW-MES-CNQA-ITR-0116	
OM98	Media Extender Cabinet	MED_000	M4M5-LSBJ-PRW-MES-CNQA-ITR-0011	M4M5-LSBJ-PRW-MES-CNQA-ITR-0116	
OM98	Multi-Function Telephone	MFT_000			
OM98	Remote Input/Output	RIO_000			
OM98	1794-IB16-16 Way Digital Input Card	RIO_IB16			
OM98	1794-IB32-32 Way Digital Input Card	RIO_IB32			
OM98	1794-OB32-32 Way Digital Output Card	RIO_OB32			
OM98	1794-IE08 8 Way Analogue Input Card	RIO_IE08			
OM98	1794-IR08 8 Way RTD Input Card	RIO_IR08			

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	**EQUIPMENT TYPE**	**ASSET SUB-TYPES**			
OM98	1794-IE12 Way Analogue Input Card	RIO_IE12			
ME02	**Ventilation Devices**				
ME02	Actuator - Damper	ACT_DMP	M4M5-LSBJ-PRW-MES-MEQA-ITR-0005		
ME02	Limit Switch - Vent Damper	LIM_DMP	M4M5-LSBJ-PRW-MES-MEQA-ITR-0005		
ME02	Air Quality Sensors	AQS_REC		M4M5-LSBJ-PRW-MES-MEQA-ITR-0105	
ME02	Air Velocity Sensors	AVS_REC		M4M5-LSBJ-PRW-MES-MEQA-ITR-0107	
ME02	Jet Fan - Uni-directional - Reversible	JFN_REV JFN_UNI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0001	M4M5-LSBJ-PRW-MES-MEQA-ITR-0103	
ME02	Outlet Air Monitoring	OAM_GAS		M4M5-LSBJ-PRW-MES-MEQA-ITR-0118	
ME02	Sound Attenuator	SAT_PRV SAT_SPI XAT_PRV XAT_SPI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0004 M4M5-LSBJ-PRW-MES-MEQA-ITR-0007	M4M5-LSBJ-PRW-MES-MEQA-ITR-0113 M4M5-LSBJ-PRW-MES-MEQA-ITR-0114	
ME02	Fire Isolation Damper	SFD_PRV SFD_SPI XFD_PRV XFD_SPI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0005	M4M5-LSBJ-PRW-MES-MEQA-ITR-0124	
ME02	Axial Fan	SFN_PRV SFN_SPI XFN_PRV XFN_SPI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0002	M4M5-LSBJ-PRW-MES-MEQA-ITR-0111	
ME02	Damper Control Panel	XDB_XFN XDB_SFN	M4M5-LSBJ-PRW-MES-MEQA-ITR-0002	M4M5-LSBJ-PRW-MES-ELQA-ITR-0151	
ME02	Transition Duct	STR, XTR		M4M5-LSBJ-PRW-MES-MEQA-ITR-0115	
ME02	Outlet Damper	XOD_SPI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0005	M4M5-LSBJ-PRW-MES-MEQA-ITR-0112	
ME02	Tunnel Isolation Damper	XTD_PRV XTD_SPI	M4M5-LSBJ-PRW-MES-MEQA-ITR-0005	M4M5-LSBJ-PRW-MES-MEQA-ITR-0112	
ME03	**Tunnel Ventilation Control**				
ME03	System/Software Module: Hardware In the Loop Testing (HIL)	System Level Test	M4M5-LSBJ-PRW-MES-MEQA-ITR-0008		
ME04	**Air Quality Monitoring Devices**				
ME04	Air Quality Monitoring Station	AQM_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0159	
ME05	**MVAC Devices**				
ME05	Fan Coil Unit	FCU_000 EFU_000 CRC_FLM		M4M5-LSBJ-PRW-MES-MEQA-ITR-0120	
ME05	Condensor Unit	ACU_000 ACU_COR ECU_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0121	
ME05	Non-Return Damper	NRD_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0122	
ME05	Pressure Relief Damper	PRD_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0123	
ME05	Fire Isolation Damper	FDL_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0124	
ME05	Motorised Fire Damper	MFS_000 MFS_SSS MID_000 MID_SSS		M4M5-LSBJ-PRW-MES-MEQA-ITR-0125	
ME05	Volume Control Damper	VCD_000 VCD_SSS		M4M5-LSBJ-PRW-MES-MEQA-ITR-0123	
ME05	MVAC Fan	EAF_000 EAF_BAT EPF_000 EPF_0XP EPF_LEP RFN_000 SSF_000 SSF_MVA ISF_000 ISP_000 ISX_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0126	
ME06	Sump Vent Fan	SVF_EXP		M4M5-LSBJ-PRW-MES-MEQA-ITR-0126	
ME05	Ductwork	RAG_000 SAG_000 ATT_000 ATT_SSS		M4M5-LSBJ-PRW-MES-MEQA-ITR-0127	
ME05	Instrumentation	ATS_000 DPS_000 DPT_000 MGS_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0116	
ME05	Roof Top Package	RTP_000 ISR_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0135	

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	EQUIPMENT TYPE	ASSET SUB-TYPES			
ME05	Control Panel	ACP_000		M4M5-LSBJ-PRW-MES-MEQA-ITR-0151	
ME06	**Drainage Devices**				
ME06	Pumps	GWP_VT4 GWP_MFS PMP_WPS SWP_HFS	M4M5-LSBJ-PRW-MES-MEQA-ITR-0003	M4M5-LSBJ-PRW-MES-MEQA-ITR-0130	
ME06	LPS Local Pump Control Station	LCS_LPS	M4M5-LSBJ-PRW-MES-MEQA-ITR-0003	M4M5-LSBJ-PRW-MES-MEQA-ITR-0151	
ME06	LPS Pump Control Panel	PCP_LPS	M4M5-LSBJ-PRW-MES-MEQA-ITR-0003	M4M5-LSBJ-PRW-MES-MEQA-ITR-0151	
ME06	Hydraulic Instrument Control Panel	ICP_LPS	M4M5-LSBJ-PRW-MES-MEQA-ITR-0003	M4M5-LSBJ-PRW-MES-MEQA-ITR-0151	
ME06	Instrumentation	PIS_MFS PIS_HFS USL_MFS USL_HFS VPM_MFS VPM_HFS FLM_LPS FSW_MFS FSW_HFS HCC_LPS HCD_LPS HCD_MFS HCD_VXD	M4M5-LSBJ-PRW-MES-MEQA-ITR-0003	M4M5-LSBJ-PRW-MES-MEQA-ITR-0116	
ME06	Foam Supression Skid	FSK_MFS		Y - ME06 Design Package - RSGx to agree with LSBJV on ITR details	
ME06	Groundwater Valve	GWV_MFS		M4M5-LSBJ-PRW-MES-FSQA-ITR-0110	
ME06	Stormwater Valve	SWV_HFS		M4M5-LSBJ-PRW-MES-FSQA-ITR-0110	
ME06	Sub Fire Panel - Low Point Sump	SFP_LPS	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0134	M4M5-LSBJ-PRW-MES-FSQA-ITR-0138
ME06	Smoke Detector	SKD_LPR SKD_LPS			
ME06	**Water Treatment Plant**				
ME06	Water Treatment Plant	WCP_000	M4M5-LSBJ-PRW-MES-MEQA-ITR-0006	M4M5-LSBJ-PRW-MES-MEQA-ITR-0132	
FS01	**Fire Supression Devices**				
FS01	Fire Pumps	DFP_ELC DFP_DSL DJP_ELC HFP_ELC HFP_DSL HJP_ELC	M4M5-LSBJ-PRW-MES-FSQA-ITR-0001	M4M5-LSBJ-PRW-MES-FSQA-ITR-0108	
FS01	Emergency Equipment Point	BEP_TYP FEP_000 FEP_PRV MEP_TYP	M4M5-LSBJ-PRW-MES-FSQA-ITR-0002	M4M5-LSBJ-PRW-MES-FSQA-ITR-0104	
FS01	Deluge and Hydrant Control Panels	DPC_DSL DPC_ELC DPC_JKY HPC_DSL HPC_ELC HPC_JKY	M4M5-LSBJ-PRW-MES-FSQA-ITR-0001	M4M5-LSBJ-PRW-MES-FSQA-ITR-0118	
FS01	Vehicle Cross Passage Door	VXD_000		M4M5-LSBJ-PRW-MES-ELQA-ITR-0178	
FS01	Valves	DAB_MON DAT_MON DMI_MON DMI_MOT DVA_DIA FML_PIT FML_MOT HIV_MOT HIV_MON	M4M5-LSBJ-PRW-MES-FSQA-ITR-0006		
FS01	Manifolds	LPV_TYP XPV_TYP	M4M5-LSBJ-PRW-MES-FSQA-ITR-0003	M4M5-LSBJ-PRW-MES-FSQA-ITR-0101	M4M5-LSBJ-PRW-MES-FSQA-ITR-0112
FS01	Valves and pipework	Above Manifold and Hydrant		M4M5-LSBJ-PRW-MES-FSQA-ITR-0103	M4M5-LSBJ-PRW-MES-FSQA-ITR-0112
FS01	Instrumentation - Fire Pressure Switch	WPS_TYP SOL_TYP		M4M5-LSBJ-PRW-MES-MEQA-ITR-0116	
FS01	Tunnel Deluge Zone	DZN_201 - 214 DZN_301 - 313 DZN_401 - 410 DZN_501 - 512 DZN_J01 - J34		M4M5-LSBJ-PRW-MES-FSQA-ITR-0107	
FS02	**Fire Detection Devices**				

	Level Description		EQUIPMENT FAT	INSTALLATION LEVEL	FINAL INSTALLATION LEVEL
	Level Number		LEVEL 0	LEVEL 1	LEVEL 1B
	Software System		Completions Connect	Completions Connect	Completions Connect
DESIGN PACKAGE	EQUIPMENT TYPE	ASSET SUB-TYPES			
FS02	Break Glass Unit	BGU_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0133	
FS02	Data Gathering Unit	DGU_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0131 M4M5-LSBJ-PRW-MES-FSQA-ITR-0133 M4M5-LSBJ-PRW-MES-FSQA-ITR-0134 M4M5-LSBJ-PRW-MES-FSQA-ITR-0138	
FS02	Fire Detection Graphic User Interface	GUI_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-CNQA-ITR-0119	
FS02	Fire Detection Strobe Light	FDS_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0131	
FS02	Fire Alarm Sounder Alarm	FSS_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0131	
FS02	Heat Detector	HTD_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0133	
FS02	Loud Speaker	LSP_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0130	
FS02	Fire Panel	MFP_000 SFP_00A SFP_00C SFP_00E	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0134	M4M5-LSBJ-PRW-MES-FSQA-ITR-0138
FS02	Smoke Detector	SDP_000 SKD_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0133	
FS02	Smoke Detector with Built-in Sounder Base and Strobe Light	SDS_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-FSQA-ITR-0131	
FS02	Linear Heat Equipment	LHC_000 LHR_000	M4M5-LSBJ-PRW-MES-FSQA-ITR-0007	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101 M4M5-LSBJ-PRW-MES-CMQA-ITR-0102 M4M5-LSBJ-PRW-MES-FSQA-ITR-0137	
CM01	**Mobile Phone System**				
CM01	Mobile Master Unit	MMU_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0001	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
CM01	Mobile Remote Unit	MRU_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0001	M4M5-LSBJ-PRW-MES-CMQA-ITR-0103	
CM01	Mobile Rectifiers and Batteries	MRB_MRO MRB_MRT MRB_MRP MRB_MRV		M4M5-LSBJ-PRW-MES-ELQA-ITR-0149	M4M5-LSBJ-PRW-MES-ELQA-ITR-0150
CM02	**Radio Rebroadcast**				
CM02	Radio Rebroadcast Cabinet	RRC_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0003 M4M5-LSBJ-PRW-MES-CMQA-ITR-0004 M4M5-LSBJ-PRW-MES-CMQA-ITR-0005 M4M5-LSBJ-PRW-MES-CMQA-ITR-0006 M4M5-LSBJ-PRW-MES-CMQA-ITR-0007	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
CM02	Computer Server	SRV_001		M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	
CM02	Radio UHF Cabinet	UHR_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0005	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
CM02	Antenna	ANT_000 ANT_001 ANT_002 ANT_003 ANT_004		M4M5-LSBJ-PRW-MES-CMQA-ITR-0106 M4M5-LSBJ-PRW-MES-CMQA-ITR-0107	
CM03	**Public Address System**				
CM03	Public Address Cabinet	PAC_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0101	
CM03	Public Address Network Controller	NCO_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	
CM03	Public Address Omneo Interface	OMN_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	
CM03	Public Address Amplifier	PAA_125 PAA_250	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	
CM03	Public Address Qsys Server	QSS_000	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	
CM03	Public Address Speaker	PAS_000 PAS_EOL PAL_000 PAL_EOL PAX_000 PAL_EOL	M4M5-LSBJ-PRW-MES-CMQA-ITR-0002	M4M5-LSBJ-PRW-MES-CMQA-ITR-0114	
CM03	Rack Mounted Server	RMS_000		M4M5-LSBJ-PRW-MES-CMQA-ITR-0102	

L2/3 Test Record Number	Test Record Description	Document Control Document Number	Associated Asset
ELECTRICAL- COMMISSIONING			
EL201	HV Transformer Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0201	TRX
EL202	HV Switchboard Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0202	HVS
EL203	HV Protection Panel & IED Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0203	HCP
EL204	Battery Charger Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0204	M4M5-####-PRW-MES-GE01-PRC-1011
EL205	HV Functional Test	M4M5-LSBJ-PRW-MES-ELQA-ITR-0205	HVS
EL207	Busduct Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0207	BDL,BDM
EL208	Energisation from a Temporary Supply	M4M5-LSBJ-PRW-MES-ELQA-ITR-0208	ENZ
EL209	LVS Main Switchboard Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0209	LVS/MCS
EL210	Earthing System Current Injection Test	M4M5-LSBJ-PRW-MES-ELQA-ITR-0210	HEB2xxxxA
EL211	Distribution Board Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0211	EDB,GDB,UDB,XDB
EL212	LV Transformer Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0212	M4M5-####-PRW-MES-GE01-PRC-2012
EL215	Lighting Energisation	M4M5-LSBJ-PRW-MES-ELQA-ITR-0215	LCT
EL216	Final Sub Circuit Energisation	M4M5-LSBJ-PRW-MES-ELQA-ITR-0216	CCT,PCT
EL217	Final Sub Circuit with VSD	M4M5-LSBJ-PRW-MES-ELQA-ITR-0217	VCT/VXT
EL220	24VDC Distribution Board Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0220	DDB
EL221	Vendor Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0221	UPS
EL222	Temporay Commissioning Supply Circuit	M4M5-LSBJ-PRW-MES-ELQA-ITR-0222	TCT
EL225	HV Switchboard Wiring Modification Commissioning	M4M5-LSBJ-PRW-MES-ELQA-ITR-0225	
EL230	Circuit IR Test	M4M5-LSBJ-PRW-MES-ELQA-ITR-0230	Case by Case
EL232	HV Cable Insulation Resistance Test	M4M5-LSBJ-PRW-MES-ELQA-ITR-0232	
EL250	Sump Distribution Board Commissioning	M4M5-RSGX-TUN-MES-ME06-ITR-0250	GDB_LPS,UDB_LPS
EL251	Digital Loop Check	M4M5-RSGX-TUN-MES-ME06-ITR-0251	DPS,EDS,GWV,LSW,PIS,SWV,VPM
EL252	Flow Meter Commissioning	M4M5-RSGX-TUN-MES-ME06-ITR-0252	FLM
EL253	Sump ITC Cabinet Commissioning	M4M5-RSGX-TUN-MES-ME06-ITR-0253	not used
EL254	Sump Light & Small Power Commissioning	M4M5-RSGX-TUN-MES-ME06-ITR-0254	LSC
EL255	Pump Control Panel Commissioning	M4M5-RSGX-TUN-MES-ME06-ITR-0255	PCP
EL256	Instrument Loop Check Analogue ITR	M4M5-RSGX-TUN-MES-ME06-ITR-0256	FSW

L2/3 Test Record Number	Test Record Description	Document Control Document Number	Associated Asset
CONTROL - COMMISSIONING			
CN201	XTC Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0201	XTC
CN202	XPC Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0202	XPC
CN203	MED Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0203	MED
CN206	RCR Cabinet Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0206	RCR
CN207	Substation TMCS-PMCS-PLC Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0207	ITC_PLC/LPS/PM2/PMC/TMC
CN208	Substation PLC (ITC-M) Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0208	ITC_IMN,ITC_MNC
CN210	RSC Cabinet Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0210	RSC
CN211	Training Cabinet (TRN)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0211	TRN
CN214	Movable Median Strip	M4M5-LSBJ-PRW-MES-CNQA-ITR-0214	MMS
CN215	BLS Energisation	M4M5-LSBJ-PRW-MES-CNQA-ITR-0215	BLS
CN216	Boom Gates Energisation	M4M5-LSBJ-PRW-MES-CNQA-ITR-0216	BGA
CN218	Vendor L2 Commissioning (Video Wall)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0218	VLOT
CN301	Electronic Sign Test (ISLUS)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0301	ISL
CN302	Electronic Sign Test (TMS)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0302	TMS
CN303	PTZ Camera	M4M5-LSBJ-PRW-MES-CNQA-ITR-0303	PTZ
CN304	Fixed AVID Camera	M4M5-LSBJ-PRW-MES-CNQA-ITR-0304	TVI
CN305	Fixed Thermal Camera	M4M5-LSBJ-PRW-MES-CNQA-ITR-0305	TVT
CN306	Fixed Security Camera	M4M5-LSBJ-PRW-MES-CNQA-ITR-0306	TVC
CN307	TPL (Vehicle Detection Loop) Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0307	VDS, TLP216001A, TLP240009, TLP240011
CN308	Tunnel Telephone	M4M5-LSBJ-PRW-MES-CNQA-ITR-0308	FET/IOC/MET (except Master)
CN309	Traffic Signals	M4M5-LSBJ-PRW-MES-CNQA-ITR-0309	TFL
CN311	Variable Message Sign	M4M5-LSBJ-PRW-MES-CNQA-ITR-0311	VMS
CN312	Overheight Vehicle Detector	M4M5-LSBJ-PRW-MES-CNQA-ITR-0312	OHD
CN313	Over height warning sign	M4M5-LSBJ-PRW-MES-CNQA-ITR-0313	AWS/OWS
CN314	Movable Median Strip (MMS)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0314	MMS
CN315	Changeable Message Sign (CMS)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0315	CMS
CN316	Boom Gates	M4M5-LSBJ-PRW-MES-CNQA-ITR-0316	BGA
CN318	Vendor L3 Commissioning (Video Wall)	M4M5-LSBJ-PRW-MES-CNQA-ITR-0318	VLOT
CN319	Prepare to Stop sign	M4M5-LSBJ-PRW-MES-CNQA-ITR-0319	PSS
CN320	Control Room Furniture	M4M5-LSBJ-PRW-MES-CNQA-ITR-0320	OCD
CN322	Phone Master Station	M4M5-LSBJ-PRW-MES-CNQA-ITR-0322	FET/IOC/MET (Master)
CN324	MNCS-PMCS Access switch	M4M5-LSBJ-PRW-MES-CNQA-ITR-0324	AST
CN325	MNCS Distribution switch	M4M5-LSBJ-PRW-MES-CNQA-ITR-0325	DSW
CN326	SICE OMCS Network	M4M5-LSBJ-PRW-MES-CNQA-ITR-0326	OSR20101O/2O/3O & 26001O/2O/3O
CN327	SICE I-OMCS Network	M4M5-LSBJ-PRW-MES-CNQA-ITR-0327	OSR20101I/2I/3I
CN331	ISLUS Controller Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0331	SCI
CN332	TMS Controller Test	M4M5-LSBJ-PRW-MES-CNQA-ITR-0332	SCT
CN399	Lot I/O Tests	M4M5-LSBJ-PRW-MES-CNQA-ITR-0399	LOT
COMMUNICATIONS - COMMISSIONING			

L2/3 Test Record Number	Test Record Description	Document Control Document Number	Associated Asset
CM201	PA cabinet Commissioning	M4M5-LSBJ-PRW-MES-CMQA-ITR-0201	PAC
CM202	PA Headend Configuration	M4M5-LSBJ-PRW-MES-CMQA-ITR-0202	RMS
CM203	RRB Cabinet energisation	M4M5-LSBJ-PRW-MES-CMQA-ITR-0203	RRC, UHR
CM204	MRU Energisation	M4M5-LSBJ-PRW-MES-CMQA-ITR-0204	MRU
CM205	Mobile Head End energisation	M4M5-LSBJ-PRW-MES-CMQA-ITR-0205	MMU
CM206	PA Speaker channel commissioning	M4M5-LSBJ-PRW-MES-CMQA-ITR-0206	PAC
CM207	RRB Headend Configuration	M4M5-LSBJ-PRW-MES-CMQA-ITR-0207	RMS26001

L2/3 Test Record Number	Test Record Description	Document Control Document Number	Associated Asset
FIRE - COMMISSIONING			
FS201	Ring Main & Manifold Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0201	LPV, XPV, HSP
FS202	Deluge Manifold Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0202	LPV, XPV
FS203	Deluge Zone Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0203	DZN
FS204	Pressure Relief Valve Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0204	PRV, RED
FS205	Motorised Valve Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0205	DMI_MOT, FML_MOT, HIV_MOT
FS206	Foam suppression system commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0206	FSK
FS207	Fire cabinet commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0207	BEP, FEP
FS208	Fire Hydrant Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0208	HLV
FS209	Electric Fire pump Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0209	DFP_ELC, HFP_ELC
FS210	Diesel Fire Pump Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0210	DFP_DSL, HFP_DSL
FS211	Fire Jacking Pump Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0211	DJP, HJP
FS212	Sprinkler System Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0212	SAV
FS213	Flow meter Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0213	FLM_FPR
FS215	Booster Assembly Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0215	HBA
FS218	Fire Pump Line Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0218	LIN (selective only)
FS251	Data Gathering Unit Commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0251	DGU
FS252	Sub fire panel & device commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0252	SFP
FS253	Main fire panel commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0253	MFP
FS254	Fire GUI commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0254	GUI
FS255	Linear heat controller commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0255	LHC
FS256	Motorised valve panel commissioning	M4M5-LSBJ-PRW-MES-FSQA-ITR-0256	MVP

L2/3 Test Record Number	Test Record Description	Document Control Document Number	Associated Asset
MECHANICAL - COMMISSIOING			
ME201	Water Treatment Plant Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0201	ACF, BLR, CMR, IXV, LIT, LTM, MFR, MTR, MXR, PIP, PIT, PMW, TNK, WAE, WAI, WAP, WAT, WFE, WFM, WHR, WLS, WPI, WPP, WPR, WPW, WSP, WSS, WZT
ME207	LPS Ventilation Fan Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0207	SVF
ME209	Exhaust_Supply Fan Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0209	EAF, SSF
ME210	Cooling System Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0210	CRC, RTP
ME211	Differential Pressure Switch Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0211	DPS
ME212	Differential Pressure Transducer Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0212	DPT
ME213	Motorised Damper Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0213	MFS, MID
ME214	XP Pressurisation Fan Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0214	EPF
ME215	Air Conditioning Unit Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0215	ECU
ME216	Air Temperature Sensor Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0216	ATS
ME217	EER Ventilation Fan Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0217	RFN
ME220	Jet Fan Commissioning - Mechanical	M4M5-LSBJ-PRW-MES-MEQA-ITR-0220	JFN
ME222	Air Speed Sensor Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0222	AVS_TXM
ME223	Air Quality Sensor Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0223	AQS_TXM
ME230	Axial Fan Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0230	SFN, XFN
ME232	Fan and Outlet damper XOD/XFD/SFD Commmissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0232	XOD, XFD, SFD
ME233	Tunnel isolation damper XTD Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0233	XTD
ME240	Air Quality Monitoring Station Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0240	AQM
ME251	Hydraulic Pipework Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0251	HPP
ME252	Groundwater Pump Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0252	GWP
ME253	Stormwater Pump Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0253	SWP
ME254	Flow Meter Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0254	FLM_LPS
ME255	Float Switch Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0255	FSW
ME256	Pressure Switch Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0256	PIS
ME258	Ultrasonic Level Sensor Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0258	USL
ME259	Valve Position Monitoring Commissioning	M4M5-LSBJ-PRW-MES-MEQA-ITR-0259	VPM

L4 PMCS Devices				
SUBSYSTEM	**DEVICE TYPE**	**DESCRIPTION**	**ITR L4 A**	**ITR L4 B**
OM02 - Hardware	DLR	Device Level Ring	M4M5-SICE-PRW-MES-SIQA-ITR-4001	M4M5-SICE-PRW-MES-SIQA-ITR-4002
	PLT	TMCS PLC	M4M5-SICE-PRW-MES-SIQA-ITR-4003	M4M5-SICE-PRW-MES-SIQA-ITR-4004
	PMCS_PLC	PMCS PLC	M4M5-SICE-PRW-MES-SIQA-ITR-4005	M4M5-SICE-PRW-MES-SIQA-ITR-4006
	PRM	PLC Redundancy Module	M4M5-SICE-PRW-MES-SIQA-ITR-4007	M4M5-SICE-PRW-MES-SIQA-ITR-4008
	RIO	Remote Input/Output	M4M5-SICE-PRW-MES-SIQA-ITR-4009	M4M5-SICE-PRW-MES-SIQA-ITR-4010
OM24 - Tunnel Closure and Overheight	BGA	Boom Gate	M4M5-SICE-PRW-MES-SIQA-ITR-4011	M4M5-SICE-PRW-MES-SIQA-ITR-4012
	ESI	External Switch Input	M4M5-SICE-PRW-MES-SIQA-ITR-4013	M4M5-SICE-PRW-MES-SIQA-ITR-4014
	FTR	Feature Lighting	M4M5-SICE-PRW-MES-SIQA-ITR-4015	M4M5-SICE-PRW-MES-SIQA-ITR-4016
	MMS	Moveable Median	M4M5-SICE-PRW-MES-SIQA-ITR-4017	M4M5-SICE-PRW-MES-SIQA-ITR-4018
	OHD	Over Height Detector	M4M5-SICE-PRW-MES-SIQA-ITR-4019	M4M5-SICE-PRW-MES-SIQA-ITR-4020
	OWS	Overheight Warning Sign	M4M5-SICE-PRW-MES-SIQA-ITR-4021	M4M5-SICE-PRW-MES-SIQA-ITR-4022
	PSS	Prepare to Stop Signs	M4M5-SICE-PRW-MES-SIQA-ITR-4023	M4M5-SICE-PRW-MES-SIQA-ITR-4024
	RAMP METERING	Ramp Metering	M4M5-SICE-PRW-MES-SIQA-ITR-4025	M4M5-SICE-PRW-MES-SIQA-ITR-4026
	RSC	Roadside Cabinet	M4M5-SICE-PRW-MES-SIQA-ITR-4027	M4M5-SICE-PRW-MES-SIQA-ITR-4028
	TFL	Traffic Light Signals	M4M5-SICE-PRW-MES-SIQA-ITR-4029	M4M5-SICE-PRW-MES-SIQA-ITR-4030
	EXB	Emergency Closure Button	M4M5-SICE-PRW-MES-SIQA-ITR-4031	M4M5-SICE-PRW-MES-SIQA-ITR-4032
	VDO	Vehicle Detector for Overheight	M4M5-SICE-PRW-MES-SIQA-ITR-4033	M4M5-SICE-PRW-MES-SIQA-ITR-4034
OM30 - Ventilation System	AFN	Axial Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4035	M4M5-SICE-PRW-MES-SIQA-ITR-4036
	AQA	Air Quality Analyser	M4M5-SICE-PRW-MES-SIQA-ITR-4037	M4M5-SICE-PRW-MES-SIQA-ITR-4038
	AQS	Air Quality Sensors	M4M5-SICE-PRW-MES-SIQA-ITR-4039	M4M5-SICE-PRW-MES-SIQA-ITR-4040
	AVS	Air Velocity Sensors	M4M5-SICE-PRW-MES-SIQA-ITR-4041	M4M5-SICE-PRW-MES-SIQA-ITR-4042
	JFN	Jet Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4043	M4M5-SICE-PRW-MES-SIQA-ITR-4044
	MOD	Modulating Damper	M4M5-SICE-PRW-MES-SIQA-ITR-4045	M4M5-SICE-PRW-MES-SIQA-ITR-4046
	NMD	Non-Modulating Damper	M4M5-SICE-PRW-MES-SIQA-ITR-4047	M4M5-SICE-PRW-MES-SIQA-ITR-4048
OM31 - Fire System	ASE	Alarm Signalling Equipment	M4M5-SICE-PRW-MES-SIQA-ITR-4049	M4M5-SICE-PRW-MES-SIQA-ITR-4050
	CDS	Cabinet Door Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4051	M4M5-SICE-PRW-MES-SIQA-ITR-4052
	CIE	Control and Indicating Equipment	M4M5-SICE-PRW-MES-SIQA-ITR-4053	M4M5-SICE-PRW-MES-SIQA-ITR-4054
	DZN		M4M5-SICE-PRW-MES-SIQA-ITR-4055	M4M5-SICE-PRW-MES-SIQA-ITR-4056
	FP	Fire Pump	M4M5-SICE-PRW-MES-SIQA-ITR-4057	M4M5-SICE-PRW-MES-SIQA-ITR-4058
	FSI	Fire System Interface	M4M5-SICE-PRW-MES-SIQA-ITR-4059	M4M5-SICE-PRW-MES-SIQA-ITR-4060
	FSS	Foam Suppression System	M4M5-SICE-PRW-MES-SIQA-ITR-4061	M4M5-SICE-PRW-MES-SIQA-ITR-4062
	HGD	Hydrocarbon Gas Detector	M4M5-SICE-PRW-MES-SIQA-ITR-4063	M4M5-SICE-PRW-MES-SIQA-ITR-4064
	IV	Isolation Valve	M4M5-SICE-PRW-MES-SIQA-ITR-4065	M4M5-SICE-PRW-MES-SIQA-ITR-4066
	LHD	Linear Heat Detector	M4M5-SICE-PRW-MES-SIQA-ITR-4067	M4M5-SICE-PRW-MES-SIQA-ITR-4068
	MIV	Motorised Isolation Valve	M4M5-SICE-PRW-MES-SIQA-ITR-4069	M4M5-SICE-PRW-MES-SIQA-ITR-4070
	PDZ	Point Detector Zone	M4M5-SICE-PRW-MES-SIQA-ITR-4071	M4M5-SICE-PRW-MES-SIQA-ITR-4072
	VXP	Vehicle Cross Passage Door	M4M5-SICE-PRW-MES-SIQA-ITR-4073	M4M5-SICE-PRW-MES-SIQA-ITR-4074
	FLS	Sprinkler Flow Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4075	M4M5-SICE-PRW-MES-SIQA-ITR-4076
OM32 - Hydraulics System	FT	Flow Transmitter	M4M5-SICE-PRW-MES-SIQA-ITR-4077	M4M5-SICE-PRW-MES-SIQA-ITR-4078
	LS	Level Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4079	M4M5-SICE-PRW-MES-SIQA-ITR-4080
	LT	Level Transmitter	M4M5-SICE-PRW-MES-SIQA-ITR-4081	M4M5-SICE-PRW-MES-SIQA-ITR-4082
	PMP	Pump	M4M5-SICE-PRW-MES-SIQA-ITR-4083	M4M5-SICE-PRW-MES-SIQA-ITR-4084
	PS	Pressure Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4085	M4M5-SICE-PRW-MES-SIQA-ITR-4086
	VPM	Valve Position Monitoring	M4M5-SICE-PRW-MES-SIQA-ITR-4087	M4M5-SICE-PRW-MES-SIQA-ITR-4088
	WTP	Water Treatment Plant	M4M5-SICE-PRW-MES-SIQA-ITR-4089	M4M5-SICE-PRW-MES-SIQA-ITR-4090
	BCH	Battery Charger and Distribution Board	M4M5-SICE-PRW-MES-SIQA-ITR-4091	M4M5-SICE-PRW-MES-SIQA-ITR-4092
	HCP	High Voltage Control Panel	M4M5-SICE-PRW-MES-SIQA-ITR-4093	M4M5-SICE-PRW-MES-SIQA-ITR-4094
	HSE	High Voltage Bus Earth switch	M4M5-SICE-PRW-MES-SIQA-ITR-4095	M4M5-SICE-PRW-MES-SIQA-ITR-4096

L4 PMCS Devices				
OM33 - Electrical System (HV)	HSI	High Voltage Incomer Isolator	M4M5-SICE-PRW-MES-SIQA-ITR-4097	M4M5-SICE-PRW-MES-SIQA-ITR-4098
	HVCB	High Voltage Circuit Breaker	M4M5-SICE-PRW-MES-SIQA-ITR-4099	M4M5-SICE-PRW-MES-SIQA-ITR-4100
	PQM	HV Power Quality Meter	M4M5-SICE-PRW-MES-SIQA-ITR-4101	M4M5-SICE-PRW-MES-SIQA-ITR-4102
	TRX_HV	High Voltage Transformer	M4M5-SICE-PRW-MES-SIQA-ITR-4103	M4M5-SICE-PRW-MES-SIQA-ITR-4104
OM33 - Electrical System (LV)	UPS	Uninterruptible Power Supply	M4M5-SICE-PRW-MES-SIQA-ITR-4105	M4M5-SICE-PRW-MES-SIQA-ITR-4106
	ACS	Automatic Changeover Controller	M4M5-SICE-PRW-MES-SIQA-ITR-4107	M4M5-SICE-PRW-MES-SIQA-ITR-4108
	CAB	OMCS Cabinet	M4M5-SICE-PRW-MES-SIQA-ITR-4109	M4M5-SICE-PRW-MES-SIQA-ITR-4110
	DBS	Distribution Boards & Control Panels	M4M5-SICE-PRW-MES-SIQA-ITR-4111	M4M5-SICE-PRW-MES-SIQA-ITR-4112
	DDB	Switchboard Auxiliary DC Power Supply	M4M5-SICE-PRW-MES-SIQA-ITR-4113	M4M5-SICE-PRW-MES-SIQA-ITR-4114
	LVPQM	LV Power Quality Meter	M4M5-SICE-PRW-MES-SIQA-ITR-4115	M4M5-SICE-PRW-MES-SIQA-ITR-4116
	MCCB	Moulded Case Circuit Breaker	M4M5-SICE-PRW-MES-SIQA-ITR-4117	M4M5-SICE-PRW-MES-SIQA-ITR-4118
	PFC	Power Factor Correction	M4M5-SICE-PRW-MES-SIQA-ITR-4119	M4M5-SICE-PRW-MES-SIQA-ITR-4120
	RRC	Radio Rebroadcast Cabinet	M4M5-SICE-PRW-MES-SIQA-ITR-4121	M4M5-SICE-PRW-MES-SIQA-ITR-4122
	TRX_LV	Isolation Transformers	M4M5-SICE-PRW-MES-SIQA-ITR-4123	M4M5-SICE-PRW-MES-SIQA-ITR-4124
	UHR	Radio UHF Cabinets	M4M5-SICE-PRW-MES-SIQA-ITR-4125	M4M5-SICE-PRW-MES-SIQA-ITR-4126
OM34 - Lighting System	DS	Door Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4127	M4M5-SICE-PRW-MES-SIQA-ITR-4128
	DXE	Directional Exit Sign	M4M5-SICE-PRW-MES-SIQA-ITR-4129	M4M5-SICE-PRW-MES-SIQA-ITR-4130
	EXL	Emergency Exit Sign	M4M5-SICE-PRW-MES-SIQA-ITR-4131	M4M5-SICE-PRW-MES-SIQA-ITR-4132
	GLB	General Lighting in Buildings	M4M5-SICE-PRW-MES-SIQA-ITR-4133	M4M5-SICE-PRW-MES-SIQA-ITR-4134
	GLP	General Lighting in Passages	M4M5-SICE-PRW-MES-SIQA-ITR-4135	M4M5-SICE-PRW-MES-SIQA-ITR-4136
	LCU	Lighting Contactor Unit	M4M5-SICE-PRW-MES-SIQA-ITR-4137	M4M5-SICE-PRW-MES-SIQA-ITR-4138
	PHM	Photometer	M4M5-SICE-PRW-MES-SIQA-ITR-4139	M4M5-SICE-PRW-MES-SIQA-ITR-4140
OM35 - MVAC System	ACU	Air-Cooled Condenser Unit	M4M5-SICE-PRW-MES-SIQA-ITR-4141	M4M5-SICE-PRW-MES-SIQA-ITR-4142
	ATS	Air Temperature Sensor	M4M5-SICE-PRW-MES-SIQA-ITR-4143	M4M5-SICE-PRW-MES-SIQA-ITR-4144
	DPS	Differential Pressure Switch	M4M5-SICE-PRW-MES-SIQA-ITR-4145	M4M5-SICE-PRW-MES-SIQA-ITR-4146
	DPT	Differential Pressure Transducer	M4M5-SICE-PRW-MES-SIQA-ITR-4147	M4M5-SICE-PRW-MES-SIQA-ITR-4148
	EAF	Exhaust Air Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4149	M4M5-SICE-PRW-MES-SIQA-ITR-4150
	ECU	EER Condenser Unit	M4M5-SICE-PRW-MES-SIQA-ITR-4151	M4M5-SICE-PRW-MES-SIQA-ITR-4152
	EPF	Egress Pressurisation Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4153	M4M5-SICE-PRW-MES-SIQA-ITR-4154
	MFS	Motorised Fire & Smoke Damper	M4M5-SICE-PRW-MES-SIQA-ITR-4155	M4M5-SICE-PRW-MES-SIQA-ITR-4156
	MGS	Methane Gas Sensor	M4M5-SICE-PRW-MES-SIQA-ITR-4157	M4M5-SICE-PRW-MES-SIQA-ITR-4158
	MID	Motorised Isolation Damper	M4M5-SICE-PRW-MES-SIQA-ITR-4159	M4M5-SICE-PRW-MES-SIQA-ITR-4160
	RFN	Room Ventilation Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4161	M4M5-SICE-PRW-MES-SIQA-ITR-4162
	SAF	Supply Air Fan	M4M5-SICE-PRW-MES-SIQA-ITR-4163	M4M5-SICE-PRW-MES-SIQA-ITR-4164

L4 PMCS ALGORITHMS/VIRTUAL DEVICES					
SUBSYSTEM	**SUBSYSTEM**	**ALGORITHM/VIRTUAL DEVICE TYPE**	**DESCRIPTION**	**ITR L4 A**	**ITR L4 B**
OM30 - Ventilation System		ALG_FDC	Fan/Damper Control Module	M4M5-SICE-PRW-MES-SIQA-ITR-4165	M4M5-SICE-PRW-MES-SIQA-ITR-4166
		ALG_FIFO	Motor Control Centre First in First Out	M4M5-SICE-PRW-MES-SIQA-ITR-4167	M4M5-SICE-PRW-MES-SIQA-ITR-4168
		ALG_PA	Public Address	M4M5-SICE-PRW-MES-SIQA-ITR-4169	M4M5-SICE-PRW-MES-SIQA-ITR-4170
		ALG_VSC	Ventilation Segment Controller	M4M5-SICE-PRW-MES-SIQA-ITR-4171	M4M5-SICE-PRW-MES-SIQA-ITR-4172
		AQVLT	Air Quality in Route	M4M5-SICE-PRW-MES-SIQA-ITR-4173	M4M5-SICE-PRW-MES-SIQA-ITR-4174
		AVC	Air Velocity Checking	M4M5-SICE-PRW-MES-SIQA-ITR-4175	M4M5-SICE-PRW-MES-SIQA-ITR-4176
OM31 - Fire System		ALG_FIRE	Tunnel Fire Algorithm	M4M5-SICE-PRW-MES-SIQA-ITR-4177	M4M5-SICE-PRW-MES-SIQA-ITR-4178
OM35 - MVAC System		ALG_AC	A/C Controller	M4M5-SICE-PRW-MES-SIQA-ITR-4179	M4M5-SICE-PRW-MES-SIQA-ITR-4180
		ALG_ESS	Substation Air Exchange	M4M5-SICE-PRW-MES-SIQA-ITR-4181	M4M5-SICE-PRW-MES-SIQA-ITR-4182
		ALG_FPR	Fire Pump Room	M4M5-SICE-PRW-MES-SIQA-ITR-4183	M4M5-SICE-PRW-MES-SIQA-ITR-4184
		ALG_SUMP_LP	Low Point Sump Ventilation	M4M5-SICE-PRW-MES-SIQA-ITR-4185	M4M5-SICE-PRW-MES-SIQA-ITR-4186
		ALG_XP_TUN	Cross Passage Egress Pressurisation Controller	M4M5-SICE-PRW-MES-SIQA-ITR-4187	M4M5-SICE-PRW-MES-SIQA-ITR-4188

L4 TMCS DEVICES				
SUBSYSTEM	**DEVICE TYPE**	**DESCRIPTION**	**ITR L4 A**	**ITR L4 B**
OM01	SAN	OMCS Storage Array	M4M5-SICE-PRW-MES-SIQA-TMP-4238	M4M5-SICE-PRW-MES-SIQA-TMP-4239
	SRV	OMCS Physical Server	M4M5-SICE-PRW-MES-SIQA-TMP-4244	M4M5-SICE-PRW-MES-SIQA-TMP-4245
	VSRV	OMCS Virtual Server	M4M5-SICE-PRW-MES-SIQA-TMP-4266	M4M5-####-PRW-MES-GE01-PRC-1011
OM05	ASP	PMCS Access Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4200	M4M5-SICE-PRW-MES-SIQA-TMP-4201
	AST	TMCS Access Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4202	M4M5-SICE-PRW-MES-SIQA-TMP-4203
	CSW	Core Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4206	M4M5-SICE-PRW-MES-SIQA-TMP-4207
	DFW_logical	Firewall	M4M5-SICE-PRW-MES-SIQA-TMP-4208	M4M5-SICE-PRW-MES-SIQA-TMP-4209
	DSW_logical	Distribution Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4210	M4M5-SICE-PRW-MES-SIQA-TMP-4211
	ESW_logical	Edge Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4212	M4M5-SICE-PRW-MES-SIQA-TMP-4213
	NMS Server	NMS Server	M4M5-SICE-PRW-MES-SIQA-TMP-4258	M4M5-SICE-PRW-MES-SIQA-TMP-4259
	SAS	Server Access Switch	M4M5-SICE-PRW-MES-SIQA-TMP-4240	M4M5-####-PRW-MES-GE01-PRC-2012
OM21, OM26, IT24	CMS	Changeable Message Sign	M4M5-SICE-PRW-MES-SIQA-TMP-4204	M4M5-SICE-PRW-MES-SIQA-TMP-4205
	SGI	ISLUS Group (including ISLUSs)	M4M5-SICE-PRW-MES-SIQA-TMP-4216	M4M5-SICE-PRW-MES-SIQA-TMP-4217
	TMS	Tunnel Message Sign	M4M5-SICE-PRW-MES-SIQA-TMP-4250	M4M5-SICE-PRW-MES-SIQA-TMP-4251
	VMS	Variable Message Sign	M4M5-SICE-PRW-MES-SIQA-TMP-4252	M4M5-SICE-PRW-MES-SIQA-TMP-4253
	DAS Controller	DAS Controller (all types)	M4M5-SICE-PRW-MES-SIQA-TMP-4242	M4M5-SICE-PRW-MES-SIQA-TMP-4243
OM22, OM26, IT25	MBL	Maintenance Bay Loop	M4M5-SICE-PRW-MES-SIQA-TMP-4248	M4M5-SICE-PRW-MES-SIQA-TMP-4249
	VDS	Vehicle Detection Site (including TLPs)	M4M5-SICE-PRW-MES-SIQA-TMP-4246	M4M5-SICE-PRW-MES-SIQA-TMP-4247
	IVD	Traffic Loop Controller	M4M5-SICE-PRW-MES-SIQA-TMP-4218	M4M5-SICE-PRW-MES-SIQA-TMP-4219
OM23, IT20, IT21	Cameras	PTZ, TVI, TVT, TVS	M4M5-SICE-PRW-MES-SIQA-TMP-4230	M4M5-SICE-PRW-MES-SIQA-TMP-4231
	AVIDS	TVI, TVT	M4M5-SICE-PRW-MES-SIQA-TMP-4232	M4M5-SICE-PRW-MES-SIQA-TMP-4233
OM25, CM04	Modbus Gateway	Telephone PABX	M4M5-SICE-PRW-MES-SIQA-TMP-4256	M4M5-SICE-PRW-MES-SIQA-TMP-4257
	Telephones	Telephones (MET, FET, IOCS)	M4M5-SICE-PRW-MES-SIQA-TMP-4214	M4M5-SICE-PRW-MES-SIQA-TMP-4215
OM25 - RRB&PA	Audio Server	RRB Server	M4M5-SICE-PRW-MES-SIQA-TMP-4260	M4M5-SICE-PRW-MES-SIQA-TMP-4261
	AUE	Audio Player (old AUP)	M4M5-SICE-PRW-MES-SIQA-TMP-4262	M4M5-SICE-PRW-MES-SIQA-TMP-4263
	AUZ	Audio Zone	M4M5-SICE-PRW-MES-SIQA-TMP-4264	M4M5-SICE-PRW-MES-SIQA-TMP-4265
	OMC	Audio Console (Old AUC)	M4M5-SICE-PRW-MES-SIQA-TMP-4268	M4M5-SICE-PRW-MES-SIQA-TMP-4269
		Audio Receiver (old AUR)	M4M5-SICE-PRW-MES-SIQA-TMP-4236	M4M5-SICE-PRW-MES-SIQA-TMP-4237
	OMN	OMNEO Module	M4M5-SICE-PRW-MES-SIQA-TMP-4224	M4M5-SICE-PRW-MES-SIQA-TMP-4225
	Fire System Interface	Network Controller	M4M5-SICE-PRW-MES-SIQA-TMP-4222	M4M5-SICE-PRW-MES-SIQA-TMP-4223
	PAA	Public Address Amplifier	M4M5-SICE-PRW-MES-SIQA-TMP-4226	M4M5-SICE-PRW-MES-SIQA-TMP-4227
	PAC	Public Address Cabinet	M4M5-SICE-PRW-MES-SIQA-TMP-4228	M4M5-SICE-PRW-MES-SIQA-TMP-4229
	Public Address Server	PA Server	M4M5-SICE-PRW-MES-SIQA-TMP-4254	M4M5-SICE-PRW-MES-SIQA-TMP-4255
	QSS	Qsys Server	M4M5-SICE-PRW-MES-SIQA-TMP-4234	M4M5-SICE-PRW-MES-SIQA-TMP-4235
OM83	MFT	Multi Function Phone	M4M5-SICE-PRW-MES-SIQA-TMP-4220	M4M5-SICE-PRW-MES-SIQA-TMP-4221
	SIT	SIP Interface	M4M5-SICE-PRW-MES-SIQA-TMP-4270	M4M5-SICE-PRW-MES-SIQA-TMP-4271

L5 Non-OMCS Test Cycle	DPK	Test Plan (ITP) Doc #	Test Cases (ITR) Doc #
HV System	ES01	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-ES01-PRC-3008
Fire System	FS02	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-FS02-PRC-3008
MPR - Mobile Phone System	CM01	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-CM01-PRC-3008
Public Address System	CM03	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-CM03-PRC-3008
Water Treatment Plant	ME06	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-ME06-PRC-3008
Pumped Drainage System	ME06	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-ME06-PRC-3008
Radio Rebroadcast System	CM02	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-CM02-PRC-3008
Tolling System	TO01	Refer Kapsch Plan	Refer Kapsch test procdure
Smokey Vehicle	IT04	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-ES01-IT04-3008
O&M Radio Operation	CM02	M4M5-####-PRW-MES-GE01-ITP-3008	M4M5-####-PRW-MES-ES01-CM02-3008

L5 Test Cycle	Test Procedure document name	DPK	Test Plan ID ITP	Test Procedure ID PRC	Test Cases ID ITR
SAT - OMCS			M4M5-####-PRW-MES-GE01-ITP-1008	1008	1008
MNCS SAT	MNCS SAT Test Procedure	OM05	-	M4M5-####-PRW-MES-OM05-PRC-1008	M4M5-####-PRW-MES-OM05-ITR-1008
AVIDS SAT	AVIDS SAT Test Procedure	IT21,OM23	-	M4M5-####-PRW-MES-IT21-PRC-1008	M4M5-####-PRW-MES-IT21-ITR-1008
OMCS Hardware SAT	OMCS Hardware SAT Test Procedure	OM01	-	M4M5-####-PRW-MES-OM01-PRC-1008	M4M5-####-PRW-MES-OM01-ITR-1008
TMCS Tunnel Closure Systems SAT	TMCS Tunnel Closure Systems SAT Test Procedure	IT22,IT23,OM24,OM26	-	M4M5-####-PRW-MES-GE01-PRC-1011	M4M5-####-PRW-MES-GE01-ITR-1011
TMCS Vehicle Monitoring and Control Systems SAT	TMCS Vehicle Monitoring and Control Systems SAT Test Procedure	IT25,OM22,OM26	-	M4M5-####-PRW-MES-OM22-PRC-1008	M4M5-####-PRW-MES-OM22-ITR-1008
TMCS Video Surveillance Systems SAT	TMCS Video Surveillance Systems SAT Test Procedure	IT20,OM23,OM10	-	M4M5-####-PRW-MES-OM23-PRC-1008	M4M5-####-PRW-MES-OM23-ITR-1008
TMCS Voice Communications (RRB/PA) SAT	TMCS Voice Communications (RRB/PA) SAT Test Procedure	OM25	-	M4M5-####-PRW-MES-OM25-PRC-1008	M4M5-####-PRW-MES-OM25-ITR-1008
TMCS Voice Communications (Telephones) SAT	TMCS Voice Communications (Telephones) SAT Test Procedure	CM04,OM25	-	M4M5-####-PRW-MES-OM25-PRC-1008	M4M5-####-PRW-MES-OM25-ITR-1008
TMCS Driver Advisory Systems SAT	TMCS Driver Advisory Systems SAT Test Procedure	IT24,OM21,OM26	-	M4M5-####-PRW-MES-OM21-PRC-1008	M4M5-####-PRW-MES-OM21-ITR-1008
OMCS Training & Development Systems SAT	OMCS Training & Development Systems Test Procedure	OM18	-	M4M5-####-PRW-MES-OM18-PRC-1008	M4M5-####-PRW-MES-OM18-ITR-1008
OMCS SIDERA Core Functionality SAT	OMCS SIDERA Core Functionality SAT Test Procedure	OM17, OM10	-	M4M5-####-PRW-MES-OM17-PRC-1008	M4M5-####-PRW-MES-OM17-ITR-1008
OMCS C2C E2E SAT	OMCS C2C E2E SAT Test Procedure	OM13,OM26, OM10, OM21	-	M4M5-####-PRW-MES-OM13-PRC-1008	M4M5-####-PRW-MES-OM13-ITR-1008
IBM Maximo Interface SAT (OMCS)	IBM Maximo Interface SAT (OMCS) Test Procedure	OM86	-	M4M5-####-PRW-MES-OM86-PRC-1008	M4M5-####-PRW-MES-OM86-ITR-1008
PMCS Architecture SAT	PMCS Architecture SAT Test Procedure	OM02	-	M4M5-####-PRW-MES-OM02-PRC-1008	M4M5-####-PRW-MES-OM02-ITR-1008
OMCS PMCS Electrical SAT	OMCS PMCS Electrical SAT Test Procedure	OM33	-	M4M5-####-PRW-MES-OM33-PRC-1008	M4M5-####-PRW-MES-OM33-ITR-1008
OMCS PMCS Fire SAT	OMCS PMCS Fire SAT Test Procedure	OM31	-	M4M5-####-PRW-MES-OM31-PRC-1008	M4M5-####-PRW-MES-OM31-ITR-1008
OMCS PMCS Hydraulics SAT	OMCS PMCS Hydraulics SAT Test Procedure	OM32	-	M4M5-####-PRW-MES-OM32-PRC-1008	M4M5-####-PRW-MES-OM32-ITR-1008
OMCS PMCS Lighting SAT	OMCS PMCS Lighting SAT Test Procedure	OM34	-	M4M5-####-PRW-MES-OM34-PRC-1008	M4M5-####-PRW-MES-OM34-ITR-1008
OMCS PMCS MVAC SAT	OMCS PMCS MVAC SAT Test Procedure	OM35	-	M4M5-####-PRW-MES-OM35-PRC-1008	M4M5-####-PRW-MES-OM35-ITR-1008
OMCS PMCS Ventilation SAT	OMCS PMCS Ventilation SAT Test Procedure	OM30	-	M4M5-####-PRW-MES-OM30-PRC-1008	M4M5-####-PRW-MES-OM30-ITR-1008
ISAT - IOMCS			M4M5-####-PRW-MES-GE01-ITP-2008	2008	2008
IOMCS Network ISAT	IOMCS Network ISAT Test Procedure	OM85,OM96,OM97	-	M4M5-####-PRW-MES-OM97-PRC-2008	M4M5-####-PRW-MES-OM97-ITR-2008
IOMCS Servers ISAT + IOMCS Control Room	IOMCS Servers ISAT + IOMCS Control Room Test Procedure	OM91,OM92	-	M4M5-####-PRW-MES-OM91-PRC-2008	M4M5-####-PRW-MES-OM91-ITR-2008
IOMCS DVMS Architecture ISAT	IOMCS DVMS Architecture ISAT Test Procedure	OM81	-	M4M5-####-PRW-MES-OM81-PRC-2008	M4M5-####-PRW-MES-OM81-ITR-2008
IOMCS AVIDS Interface ISAT	IOMCS AVIDS Interface ISAT Test Procedure	OM82	-	M4M5-####-PRW-MES-OM82-PRC-2008	M4M5-####-PRW-MES-OM82-ITR-2008
IOMCS Video Wall Architecture ISAT	IOMCS Video Wall Architecture ISAT Test Procedure	OM84	-	M4M5-####-PRW-MES-OM84-PRC-2008	M4M5-####-PRW-MES-OM84-ITR-2008
IOMCS Voice Communications Integration - Software Component ISAT	IOMCS Voice Communications Integration - Software Component ISAT Test Procedure		-	M4M5-####-PRW-MES-OM87-PRC-2008	M4M5-####-PRW-MES-OM87-ITR-2008
IOMCS Training and Development Systems ISAT	IOMCS Training and Development Systems ISAT Test Procedure	OM64	-	M4M5-####-PRW-MES-OM64-PRC-2008	M4M5-####-PRW-MES-OM64-ITR-2008
IOMCS SIDERA Core Functionality ISAT	IOMCS SIDERA Core Functionality ISAT Test Procedure	Fire System Interface	-	M4M5-####-PRW-MES-OM63-PRC-2008	M4M5-####-PRW-MES-OM63-ITR-2008
IOMCS SIDERA Core IMS ISAT	IOMCS SIDERA Core IMS ISAT Test Procedure	OM63	-	M4M5-####-PRW-MES-OM63-PRC-2008	M4M5-####-PRW-MES-OM63-ITR-2008
IOMCS C2C E2E ISAT	IOMCS C2C E2E ISAT Test Procedure	OM71, OM72	-	M4M5-####-PRW-MES-OM71-PRC-2008	M4M5-####-PRW-MES-OM71-ITR-2008
IBM Maximo Interface ISAT (IOMCS)	IBM Maximo Interface ISAT (just IOMCS) Test Procedure	OM86	-	M4M5-####-PRW-MES-OM86-PRC-2008	M4M5-####-PRW-MES-OM86-ITR-2008
IOMCS Configuration Management ISAT	IOMCS Configuration Management ISAT Test Procedure	OM50	-	M4M5-####-PRW-MES-OM50-PRC-2008	M4M5-####-PRW-MES-OM50-ITR-2008
IOMCS OMCS Interface ISAT	IOMCS OMCS Interface ISAT Test Procedure	OM66	-	M4M5-####-PRW-MES-OM66-PRC-2008	M4M5-####-PRW-MES-OM66-ITR-2008
IOMCS PMCS Fire ISAT	IOMCS PMCS Fire ISAT Test Procedure	OM31	-	M4M5-####-PRW-MES-OM31-PRC-2008	M4M5-####-PRW-MES-OM31-ITR-2008
IOMCS PMCS Lighting ISAT	IOMCS PMCS Lighting ISAT Test Procedure	OM34	-	M4M5-####-PRW-MES-OM34-PRC-2008	M4M5-####-PRW-MES-OM34-ITR-2008
IOMCS PMCS Ventilation ISAT	IOMCS PMCS Ventilation ISAT Test Procedure	OM30	-	M4M5-####-PRW-MES-OM30-PRC-2008	M4M5-####-PRW-MES-OM30-ITR-2008
IOMCS PMCS MVAC ISAT	IOMCS PMCS MVAC ISAT Test Procedure	OM35	-	M4M5-####-PRW-MES-OM35-PRC-2008	M4M5-####-PRW-MES-OM35-ITR-2008

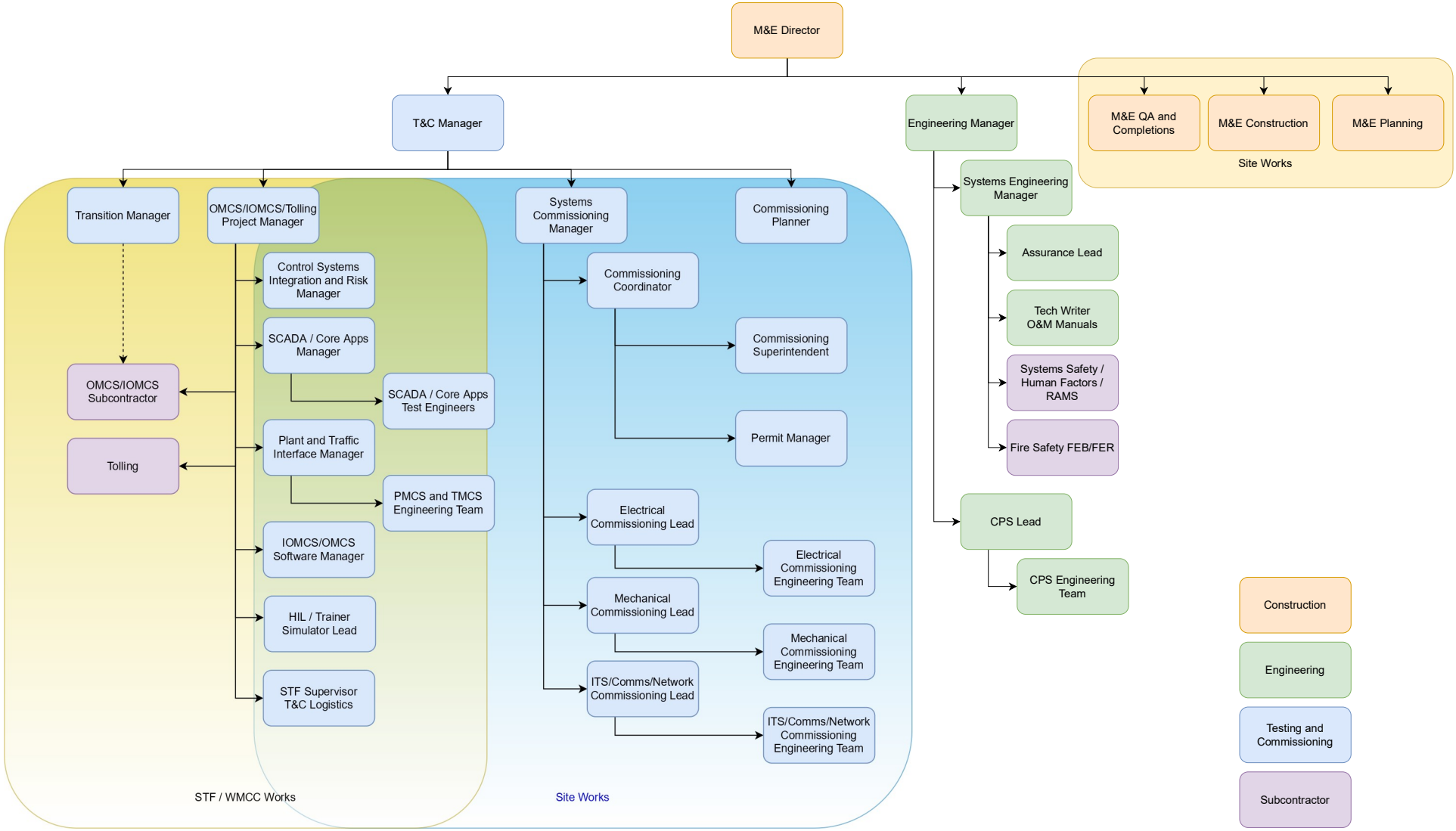
L6 Test Cycle	Test Procedure document name	Test Procedure Title	Test Plan ID ITP	Test Procedure ID PRC	Test Cases ID ITR
SIT - OMCS			M4M5-####-PRW-MES-GE01-ITP-1009	1009	1009
IMS SIT	OMCS IMS SIT	OMCS IMS SIT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-1011	M4M5-####-PRW-MES-GE01-ITR-1011
OMCS Failover Scenarios SIT	OMCS Failover Scenarios SIT	OMCS Failover Scenarios SIT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-1012	M4M5-####-PRW-MES-GE01-ITR-1012
ISIT - IOMCS			M4M5-####-PRW-MES-GE01-ITP-2009	2009	2009
IMS ISIT	IOMCS IMS ISIT	IOMCS IMS ISIT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-2011	M4M5-####-PRW-MES-GE01-ITR-2011
IOMCS Failover Scenarios ISIT	IOMCS Failover Scenarios ISIT	IOMCS Failover Scenarios ISIT Test Procedure	-	M4M5-####-PRW-MES-GE01-PRC-2012	M4M5-####-PRW-MES-GE01-ITR-2012

Appendix C

Organisation Structure

Appendix C Organisation Structure

M&E Testing and Commissioning Organisation Chart



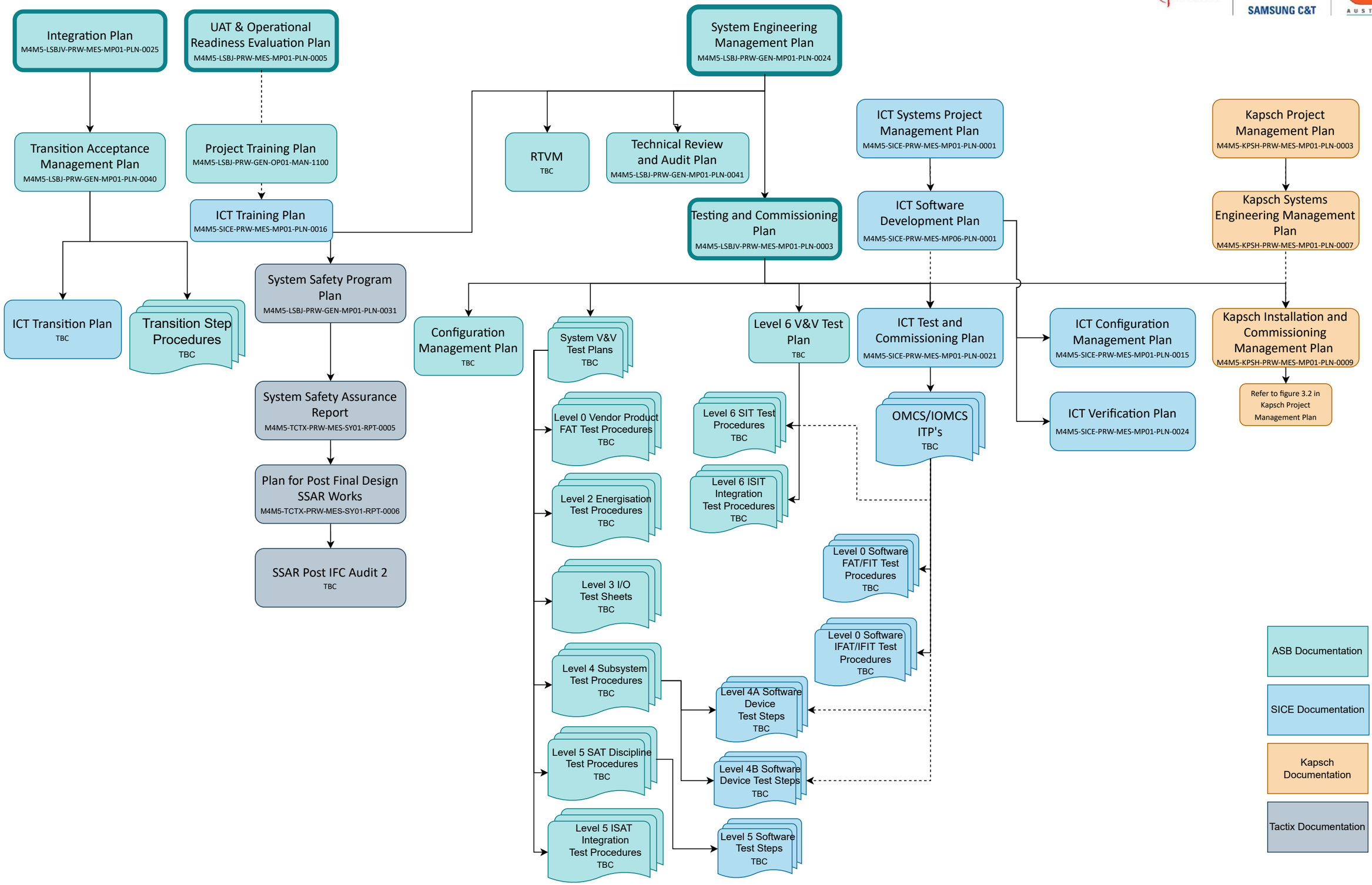
Appendix D

Document Hierarchy

Appendix D Document Hierarchy

WestConnex M4-M5 Link Tunnels

acciona | SAMSUNG C&T | BOUYGUES CONSTRUCTION AUSTRALIA



Revision: 01

Appendix E

RVC Comments

Appendix E RVC Comments

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

PLAN NUMBER
M4M5-LSBJ-PRW-MES-MP01-PLN-0003

PROJECT PLAN TITLE
Testing & Commissioning Management Plan

Design Report: M4M5-LSBJ-PRW-MES-MP01-PLN-0003
Drawings: None

SUBMISSION	REVISION	TIME ISSUED	DATE ISSUED
NDIFR	00	3:54 PM	Thursday, 17 October 2019
NDIFR	01	10:35 PM	Wednesday, 10 February 2021
NDIFR	02	1:56 PM	Wednesday, 15 September 2021

<======= TO BE COMPLETED BY IC

COMPLIANCE STATUS LEGEND
O Observation / Comment
D From information currently provided not able to determine whether design / proposal is compliant
N Non-Compliant (must provide reference to a Project Deed / SWTC requirement)

TO BE COMPLETED BY IC======>

RESPONSE STATUS
O Open
C Closed
CA Closed against this package but subject to action in another package
CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
L Certification Limitation

IC Use Only	DRR TEAMBINDER REF:	M4M5-WCX3-PRW-MES-MP01-RVC-1003	
DRR REV	DRR STATUS	DATE	BY
00	RMS / IC / M4-M5 Link Group Comments	15-Nov-19	M4-M5 Link Group
01	ASBJV responses to Rev 00 Initial Comments (10/02/2021) TINSW Rev 00 comment closeouts and review M4-M5 Link Group Rev 00 comment closeouts and review / Rev 01 review Arcadis (IC) Rev 00 comment closeouts and review / Rev 01 review	16-Mar-21	M4-M5 Link Group
02	ASBJV responses to Comments (15/09/2021) TINSW / IC / M4-M5 Link Group - comment closeouts and review	12-Oct-21	M4-M5 Link Group

No.	Stage	PACKAGE	Doc Rev	Reviewer Name	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment Closeout	Date Comment Closed	IC Use Only Incorporation Status / Date
1	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Subhash Devabathini	22-Oct-2019	Control Systems	M4-M5 Link Group	Appendix A - Testing and Commissioning Program	Figure 5 is completely illegible.please upate to make it readable	Appendix C1, Section 17 (a)	N	Project Program provides specific details of what activities will occur when and is a live document. Appendix A Program information has been removed and report updated to reflect reference to Project Program.		C	Comment Closed	04-Mar-2021	
2	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Subhash Devabathini	22-Oct-2019	Control Systems	M4-M5 Link Group	Section 3	Its not clear in which level will the change to OMCS 1 and OMCS 2 will be made even through its indicated that integration of OMCS 1 and 2 are planned to happen during ISIT.	Appendix C1, Section 17 (b)	N	Changes to systems aren't within the reference provided, depending on system, changes, access, and testing this will vary. Additional information has been added in Section 3.8 SAT. High level requirements are within this plan and specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 and associated test documents that will be provided prior to testing. 02/08/2021 DW: Any changes required to be made to the OMCS on Stage 1 or Stage 2 will be tested during Stage 0 FAT and made as part of Level 5 SAT and ISAT, managed by the Transition Working Group under the COES process as defined in the Deed. This will be further detailed in the ICT T&C Plan, the Transition Acceptance Management Plan and the lower level subsystem commissioning plans. Additonal text has been added to Table 1, Section 3.3 and 3.8 to cover these steps.		C	The comment is not fully addressed in either here or ICT Test and commissioning plan. SD 12/10/21 : Comment closed here and review the transition plan	12-Oct-2021	
3	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Subhash Devabathini	22-Oct-2019	Control Systems	M4-M5 Link Group	General Comments	This plan has no processes for the Rollback and hand back procedures. There is no information in this plan as to how will testing and commissioning will be coordinated with Operations of the stage 1 and stage 2 as these will be operational mototways at the time of Stage 3 commissioning	Appendix C1, Section 17 (b) (i)	N	As a plan it is intended to not go into the specific steps of testing or related procedures, these types of items will be produced as needed in future. Interfaces with live motorways i.e. Stage 1 and Stage 2 will be developed later in the project prior to the relevant stages of testing. Stage 3B is outside of the scope of Stage 3A project. There is the CICG, and specific SWTC interface requirements for relevant systems that will be adhered to. 02/08/2021 DW: This process will be defined in the TAMP, managed by the Transiton Working Group using the COES proposal process. Refer to the TAMP and the lower level subsystem commissioning plans for Level 5 testing for further information.		C	The comment is not fully addressed in either here or ICT Test and commissioning plan. SD 12/10/21 : Comment closed here and review the transition plan	12-Oct-2021	
4	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Peter Wheen	13-Nov-2019	Technical	M4-M5 Link Group	General Comments	There is no commentary or consideration of the Stage 3B Commissioning overlap and implications.	Appendix C1, Section 17 (b)(ii)	N	Stage 3B is outside of the scope of Stage 3A project. There is the CICG, and specific SWTC interface requirements for relevant systems that will be adhered to.		C	25/02/2021 KV: Comment is closed.	25-Feb-2021	
5	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 1.3	Thie section implies that Table 1 includes references in this document as to where the specific SWTC reference identified is addressed. There does not appear to be any references to clauses in this document in the Table as intended?	SWTC, App C.1, Section 17	D	Previous Table 1 has been removed. Section 1.3 Scope has been updated/simplified. In addition to this App A PRD has been incorporated into this submission of document to provide traceability. 02/08/2021 DW: The "Compliance Statement" column in Appendix A refers to specific sections in the T&C Plan. - A line by line review of TS911 Section 9 has been performed against the SWTC Appendix B12 Section 12 and it is confirmed that every clause in TS911 Section 9 is contained in Appendix B.12 Section 12. Therefore compliance to Appendix B.12 Section 12 of the SWTC will meet the requirements of TS911 Section 9. - A review of TS912 Section 7 (TMCS) and TS913 Section 6 (PMCS) both refer back to TS901 Clause 5 (OMCS documentation requirements covered by the SWTC) and TS911 Clause 9. - TS914 refers to TS931 for testing and commissioning except for minor equipment FAT requirements which have been addressed in the individual design packages. TS931 is basic testing of electrical boards covered in the lower level electrical FAT documents and not required to be nominated in this T&C plan. - TS915 speciies OTDR tests which are a basic requirement of MNCS network installation and testing and are not required to be nomintated in this T&C plan rather they will be covered in lower-level sub-system commissioning documentation - TS916 refers back to TS901. - Reference to TS917 Testing requirements have been included in Section 3.5 Level 5, Section 3.9 Level 6 and Section 3.10 UAT for the C2C interface. - TS918 Lighting System testing requirements will be covered in the sub-system testing plan for lighting. - The R series specifications eg R163, R164, R165 and TS-SI specifications have been traced to the individual design packages for any testing requirements which are generally specific factory and routine euipment tests.		C	26/2/21: GP: There is still no reference to clauses in the Appendix A PDR, only the overall document title is referenced. In addition, the PRD does not include the detailed requirement in TS911 Section 9, and other TS documents. 29/9/21: GP: Closed on the basis of the Compliance Statement column and designers response.	29-Sep-2021	
6	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 1.3	The Testing and Commissioning Plan should also make reference to, and ensure compliance with, the detailed and extensive tesing and commissioning requirements as listed in TS911, Section 9, and all subsections therein.	TS911, Section 9	D	For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 *This document represents the ICT TEST & COMMISSIONING PLAN for WestConnex M4-M5 Link and has been developed in accordance with the requirements from the SWTC App. B12, B31, TS911, TS912 and TS917, therefore conforming to the IEEE standard for software test documentation (AS 4006).* 02/08/2021 DW: A line by line review of TS911 Section 9 has been performed against SWTC Appendix B12 Section 12 and it is confirmed that every clause in TS911 Section 9 is contained in Appendix B.12 Section 12. It is therefore expected that demonstration of compliance to Section 12 of Appendix B.12 of the SWTC is sufficient to meet the deed requirements regarding Testing and Commissioning of the OMCS. This compliance register has been provided in the Appendix A PDR. A document hierachy has been provided in Appendix D of Rev 02 of the Plan. Level 5 testing will be further and properly detailed in the lower level sub-system test plans referenced in the document hierachy.		C	26/2/21: GP: The Appendix A PRD does not include the TS911 Section 9 clauses. In addition, the relationship between this T&S Plan and the SICE Plan is not defined - i.e. document heriarchy. Please provide a clear document herarchy. Please note that all OMCS/IOMCS T&C cannot be left to the SICE document, especially given that Level 5 onwards are integrated tests beyond IOMCS/OMCS only. 29/9/21: GP: Closed on the basis of the response.	29-Sep-2021	
7	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.1	Table 2 includes a TBC at non COTS hardware devices. Why is this TBC, should be YES as per SWTC, App B.12, Section 12.3 which requires FAT on all devices and subsystems, and 12.2 (g) re formal witnessing on FAT, SAT, SIT, UAT.	SWTC, App B.12, Section 12.3 and 12.2 (g).	D	Table 2 is now Table 1. Table 2 – Testing and Commissioning phases and levels - has been updated TBC have all been removed.		C	26/2/21: GP: Closed, refer to new comments on new Table 1 in Rev 1.	26-Feb-2021	
8	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.1	Table 2 FAT: Hardware COTS is identified as non witnessed. Where a COTS configurable, the configuration itself is the design, and needs to be validated at FAT. All FATs should be identified as witnessed. Many of the items listed in row 4 of Table 2 will not have a FAT, those being static devices with no configuration (e.g cable tray/ladder, anchors, light fixtures, etc.). I am not sure why these are listed. All such items will have usual QA testing as part of the goods outwards process, but not a FAT.	SWTC, App B.12, Section 12.3	D	Table 2 is now Table 1. Table 2 – Testing and Commissioning phases and levels - has been updated TBC have all been removed. Reason for previous submission with Hardware COTS and not being witnessed is in line with comment where it is more QA not formal FAT.		C	26/2/21: GP: Closed, refer to new comments on new Table 1 in Rev 1.	26-Feb-2021	
9	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.1	Table 2: Level 1, 2 and 3: While these are non witnessed, the IC shall have access to all records, artefacts and dashboards associated with these works. The IC may also elect to spot sample such testing by way of witness to obtain confidence in the processes being adopted. This should be noted.	SWTC, App B.12, Section 12.2 (f).	D	Table 2 is now Table 1. Levels 1,2,3, and 4 will be activities carried out on site, and normal client/RMS/IC access is allowed. Records, etc. will all be available. Specific details and systems to be used will be developed and documented in due time. Note added to 3.1 (post table) in line with requested		C	26/2/21: GP: Closed.	26-Feb-2021	
10	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.1	Table 2: Level 5 module testing. This line incorrectly states that no formal witness testing. This is assumed in error. SAT includes both device SAT and subsystem SAT, as per SWTC, Appb.12, Section 12.5. W/Inessed Device SATs can be undertaken as part of a 'special version' Level 4 (on some projects identified as Level 4B), or as part of Level 5 in addition to the subsystem Level 5 SATs.	SWTC, App B.12, Section 12.5.	N	Table 2 is now Table 1. Following Note has been included "The IC shall have access to all records, artefacts and dashboards associated with the non-witnessed and witnessed works. Upon request, spot checks of non-witnessed testing can be performed. SAT is documented with Yes for Formal Testing witness by client in line with SWTC.		C	26/2/21: GP: Closed, witnessed Level 4B is now included in the table as a Device Level SAT.	26-Feb-2021	
11	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.1	Table 2: ORE: The definition of ORE as stated here is incorrect. As per SWTC Section 2.6.3, the purpose of ORE is to "ensure all of the Motorway physical assets, people and documented processed function seamlessly and correctly to facilitate safe traffic operations...." It is not an asset test. In addition, the row on UAT identifies UAT as the final stage of testing. ORE is the final state of testing. As noted in SWTC, Section 2.6.3 (b) the ORE commences after ALL systems and equipment testing and commissioning activites, including training, are fully completed.	SWTC, Main Body, Section 2.6.3 (a) and (b)	N	ORE has been amended and new section added to report 4.2 - ORE		C	26/2/21: GP: Closed.	26-Feb-2021	
12	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.2	This section makes reference to entry and exit criteria. SWTC, App B.12, Section 12 makes clear specific entry and exit criteria that needs to be adopted, e.g. all installation works to be complete prior to SATs (S12.5 (a)); all SATs to be completed prior to SITs (S12.6 (a)(i)); UAT cannot commence until all SITs have been completed (S12.7 (a) (i); and ORE requires completion of all testing and commissioning activities, and all training (SWTC Main Body, S2.6.3 (b)). These should be identified in this plan.	SWTC, App B.12, Section 12.5 (a); 12.6 (a)(i); 12.7 (a)(i); and SWTC Main Body S2.6.3 (b).	D	Document has been updated to include relevant sections referenced ion comment have been incorporated. Specific entry and exit criteria, details for each stage/system will be provided with the relevant testing documentation.		C	1/3/21: GP: Closed. Specific requirements from the SWTC have been included in the text.	01-Mar-2021	

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

PLAN NUMBER
M4M5-LSBJ-PRW-MES-MP01-PLN-0003

PROJECT PLAN TITLE
Testing & Commissioning Management Plan

Design Report: M4M5-LSBJ-PRW-MES-MP01-PLN-0003
Drawings: None

SUBMISSION	REVISION	TIME ISSUED	DATE ISSUED
NDIFR	00	3:54 PM	Thursday, 17 October 2019
NDIFR	01	10:35 PM	Wednesday, 10 February 2021
NDIFR	02	1:56 PM	Wednesday, 15 September 2021

<======= TO BE COMPLETED BY IC

COMPLIANCE STATUS LEGEND
O Observation / Comment
D From information currently provided not able to determine whether design / proposal is compliant
N Non-Compliant (must provide reference to a Project Deed / SWTC requirement)

TO BE COMPLETED BY IC======>

RESPONSE STATUS
O Open
C Closed
CA Closed against this package but subject to action in another package
CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
L Certification Limitation

IC Use Only	DRR TEAMBINDER REF:	M4M5-WCXJ-PRW-MES-MP01-RVC-1003
DRR REV	DRR STATUS	DATE
00	RMS / IC / M4-M5 Link Group Comments	15-Nov-19
01	ASBJV responses to Rev 00 Initial Comments (10/02/2021) TINSW Rev 00 comment closeouts and review M4-M5 Link Group Rev 00 comment closeouts and review / Rev 01 review Arcadis (IC) Rev 00 comment closeouts and review / Rev 01 review	16-Mar-21
02	ASBJV responses to Comments (15/09/2021) TINSW / IC / M4-M5 Link Group - comment closeouts and review	12-Oct-21

DRR REV	DATE	BY
00	15-Nov-19	M4-M5 Link Group
01	16-Mar-21	M4-M5 Link Group
02	12-Oct-21	M4-M5 Link Group

No.	Stage	PACKAGE	Doc Rev	Reviewer Name	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment Closeout	Date Comment Closed	IC Use Only Incorporation Status / Date
13	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.2	Reference should also be made to the OMCS ICT Subplan for details in relatio to sofware development and testing process adopted as at that stage of construction.	SWTC, App C.1, Section 17 (c)	D	SICE ICT Test & Commissioning Plan is referenced as Item 14 in Section 1.5 - Standards, Procedures and References. Section 1.2 makes references to Specific sub plans for C2C and Tolling - Further details have been added to these. 03/08/2021 DW: Rrefer to the Document Hierarchy provided in Appendix D where the relationship between this Plan and the relevant sub-plans has been outlined, including the relationship between SICE and ASB produced documents. Note that references to additional sub plans have been added to Section 1.3 to cover off all testing that is not covered by the SICE or Kapsch documentation.		C	1/3/21: GP: OPEN: The relationship between this T&S Plan and the SICE Plan is not defined - i.e. document heriarchy. Please provide a clear document heriarchy. Please note that all OMCS/IOMCS T&C cannot be left to the SICE document, especially given that Level 5 onwards are integrated tests beyond IOMCS/OMCS only. Refer also to new comment re other potential subplans. 29/9/21: GP: Closed on the basis of the response and the new Appendix D included in Rev 02.	29-Sep-2021	
14	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.8	This section should also include other specific requirements in SWTC App B.12 not currently identified, such as system performance at max load, all operating modes including normal, emergency operations, total or partial power failures, redundancy failovers, interuption of power supply and comms, operation on UPS, etc.	SWTC, App B.12, Section 12.5 (c) (iv) and (vi)	D	This plan is intended to be process related. Specific Test case scenarios and required should be documented in relevant system testing information e.g. UPS testing 12.5. c) (vi) - the UPS systems, where installed, must be commissioned under actual operating conditions for the full duration of the required stand-by period; is a clearly testable requirement that the electrical system needs to be tested under. e.g. 12.7. c) (viii) automatic control and management of water discharge from drainage sumps and the water treatment plant; is a testable requirement that the Mechanical system needs to test.		C	1/3/21: GP: Closed: Section 3.8 has since been updated to include those aspects in the original comment, extracted from the SWTC, App B12, Section 12.5 (c).	01-Mar-2021	
15	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.9	This section states that ORE will be performed as part of Level 6. ORE is not part of Level 6, as per SWTC, Main Body, Section 2.6.3, ORE is performed after all systems equipment testing and commissioning activites are completed, as well as all training. It is the stage just prior to opening.	SWTC, Main Body, Section 2.6.3	N	ORE has been amended and new section added to report 4.2 - ORE		C	1/3/21: GP: Closed: Separate section now provided, as stand alone testing as required. Refer to new comments on Rev 01 re level of detal beyond repeating of SWTC clauses.	01-Mar-2021	
16	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 3.9	This section also appears to group UAT into Level 6. UAT is completely distinct stage of testing and commissioning that cannot commence until Level 6 SIT is completed (as per SWTC, App B.12, Section 12.7 (a) (i)), and with the control room fully operational (S12.7 (a) (ii)). A separate section should be provided to explain how it is to be conducted, and the role of operator versus D&C. etc.	SWTC, App B.12, Section 12.7 (a) (i) (ii)	N	SWTC requires further clarity on the inter relationships between Phases and Levels, the intention was to provide this. Given that level 7 is Post Opening Tuning UAT is obviously prior to this, and post SIT, therefore decision was to include it in Level 6. Document has been amend to reflect there is no level against UAT.		C	1/3/21: GP: Closed: Separate section now provided, as stand alone testing as required. Refer to new comments on Rev 01 re level of detal beyond repeating of SWTC clauses.	01-Mar-2021	
17	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 5 & 6	What specific documentation management systems are to be used for the differing testing and commissioning stages? What access arrangements to be provided for IC and other stakeholders?	SWTC, Main Body, Section 6.20.1 (i)	D	The process has been documented as part of this Testing and Commissioning Plan. Details of specific systems will continue to be developed, and details provided in the future. Access (physical and software) for records, inspections, etc. will be in line with SWTC. Relevant systems training will occur as required.		C	1/3/21: GP: Closed - refer to new specific comments on Rev 01 on updates in relation to documentation.	01-Mar-2021	
18	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 6	Is a test and defects management system such as JIRA also to be used as per other WCX Stages for nominated test and commissioning stages?	SWTC, Main Body, Section 6.20.1 (i)	D	JIRA will be utilised for testing. Completions Connect will be used for installation and energisation. Additional information has been added to this document.		C	1/3/21: GP: Closed - refer to new specific comments on Rev 01 on updates in relation to documentation.	01-Mar-2021	
19	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 7.2	What are the pre-requisites for handover from construction to commissioning? What is the level of completeness required for handover (i.e What is an acceptable punch list item and one that isnt, etc.). Who is responsible for addressing the outstanding punchlist items after handover to commissioning, etc.? Please provide some more detail on these aspects that have traditionally caused issue and impacted on the efficiency of testing and commissioning on other similar projects.	SWTC, App B.12, Section 12.2	D	Cant find any requirements in SWTC reference B12 Section 12.2 on handover from construction to commissioning or civil to M&E. Section 8.1 8.1Discipline Construction Handovers - states 'In regard to the M&E handovers this will be detailed in the Tunnel Handover Procedure and will use Completions Certificates to clearly document completed works. ' Further details will be developed in due time. 03/08/2021 DW: Refer to Section 3.4 and 7.2, which detail the requirements expected of the construction team prior to handover to commissioning. Discussion of audits of the installation ITP's and ITR's is included. Outstanding defects or punch items will be referred to the Testing and Commissioning Manager for resolution with the Construction Project Manager.		C	1/3/21: GP: Open: The response is not accepted. This is not a comment re compliance, but rather seeking details of the proposed process which should also serve to address mitigations for issues and concerns as noted in previous WCX phases re clarity on open defect management from construction once handed to commissioning. Refer also to new comment on Rev 01 re level of detail beyond repeating SWRTC clauses. 29/9/21: GP: Closed on the basis of the response, and additional detail included in Section 6.3.1 in Rev 02 (although not referenced in the response).	29-Sep-2021	
20	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 7.2	There is no mention of the stakeholder notification periods etc. as required re notice for formal witnessing 21 days prior as per SWTC, App B.12, Section 12.2 (g); and the provision of test documentation at the time for review by stakeholders.	SWTC, App B.12, Section 12.2 (g)	D	Has been added to section 3.2 Testing and Commissioning Overview.		C	1/3/21: GP: Closed based on updates in Rev 01.	01-Mar-2021	
21	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 7.8	There is no detail provided as to the non conformance criteria or defects severity classifications to be applied, etc., or statement as to the impact of defects on retesting, regression, etc.	SWTC, App B.12, Section 12.5 (f); TS911, Section 9.3.4 (c) (d)	D	Punchlist/Defect section has been added to provide details. In relation to TS911 For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 03/08/2021 DW: Section 6.3 has been updated with the punch item and defect management regime defined for each stage of testing.		C	1/3/21: GP: Open: This plan should be the head plan within the hierarchy of T&C Plans (note earlier comments on lack of heirarchy definition), and in so doing, it was anticipated that this plan would define the defect management regime for testing phases beyond that of FAT when the test lead will be ASBJV (and not SICE). SAT and beyond are integrated tests (software and plant), and it is anticipated that the associated defect management process would continue in those non SICE lead phases. Other related topics include carry over of plant defects into SAT testing, etc., all of which is an ASBJV level management issue. 29/9/21: GP: Closed: noted references to the SICE plan for defect classifications, etc. Besst in this plan, but accepted.	29-Sep-2021	
22	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	Section 7	There is no information on regular or routine testing and commissioning meetings, joint TRR meetings, and other test coordination related meetings proposed.	SWTC, App B.12, Section 12.2	D	Additional Information has been added to Section 3.2 Testing and Commissioning Overview 03/08/2021 DW: Further information on regular planning meetings and TRR sessions has been provided in section 3.2.		C	1/3/21: GP: Open: There is no mention of T&C steering group, stakeholder meetings or workshops in this updated Section 3.2 of Rev 01. There is no clarity of stakeholder involvement in the TRR and other forums as mentioned. 29/9/21: GP: ok - there is no specific list of artefacts for TRR or Test Doc, but generally accepted given where we are now and have pre-agreed.	29-Sep-2021	
23	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	There is no information on hold and witness point requirements as per the hold and witness point requirements in TS911	TS911 Annexure C and various other sections.	D	In relation to TS911 For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 03/08/2021 DW: Witness and Hold points are discussed in section 6.2 of both Rev 00 and Rev 01. Further information has been added to this section to clarify the process.		C	1/3/21: GP: Open: This plan should be the head plan within the hierarchy of T&C Plans (note earlier comments on lack of heirarchy definition), and in so doing, it was anticipated that this plan would define the hold/witness point implications of TS911. Witness points apply to testing beyond that of SICE lead testing stages, i.e. applies to SAT, SIT, etc.. 5/10/21: GP: Closed on the basis of the updates in SEction 6.2	05-Oct-2021	
24	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	There is no detail on the proposed defects management process and workflow for addressing and closing out defects that are identified as limitations on entry into witness testing, as well as all defects raised in witness testing. Is the intent for Jira or similar to be used, with built in workflows with IC gates, etc.? Not currently addressed in this plan.	SWTC, App B.12, Section 12.5 (f); TS911, Section 9.3.4 (c) (d)	D	6.2 Punchlist/Defects details have been added. Clarifications on which systems will Additional details around the use of JIRA have been added. 11/08/2021 DW: Section 6.3.2 has been included to provide more informaiton on the defect management process. The type of specific workflows highlighted in the comment from 1/3/21 will not be included in this T&C Plan but has been agreed and is documented in a sub-plan or document to the satisfaction of the IC and other stakeholders.		C	1/3/21: GP: Open: While Jira and workflow is mentioned in brief, there are no specfics of say the defects management workflow in Jira with all associated states & gates, including that of IC dedicated closure, etc. This plan should be the head plan within the hierarchy of T&C Plans (note earlier comments on lack of heirarchy definition), and in so doing, it was anticipated that this plan would define these processes as oppoxed to a SICE subplan. The Defect section is realtively limited in detail. If this is to be documented in another ASBJV subplan, please identify. 29/9/21: GP: Closed: Limited update in Section 6.3.2. noted, with details of defect management process in the SICE subplan. to be reviewed as part of the subplan review.	29-Sep-2021	
25	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	What form will test results be provided in, what sign offs are required, etc. noting the requirements for such in TS911 Section 9.5.4. Not currently addressed in this plan.	SWTC, App B.12, Section 12.5 (e); TS911, Section 9.3.4	D	Further details have been added to the document to address this comment, including further information e.g. 6.5 JIRA and the plug in Zephyr that is being used. In relation to TS911 For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 12/08/2021 DW: Test results for software testing will be delievered progressively and issued via Teambinder. Hardware FAT results are contained in Completions Connect as are Level 2-4 testing ITRs. Relevent sections of the Plan have been updated to include the transmittal of the completed test reports via Teambinder.		C	1/3/21: GP: Open: The detail around delivery is limited. At what stage will 'formal' test reports be issued for the differing stages? Confirm means of issuance also (i.e. Teambinder?), etc. On both prior WCX stages the formalisation of this has been lacking, and left until a last minute activity prior to Opening Completion, with conjecture around format and means of issuance. 5/10/21: GP: Closed based on updates in Section 6.2 identifying TEambinder of the medium for Test Reports.	05-Oct-2021	
26	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	Please include a detailed compliance matrix as an Appendix to address to all testing and commissioning requirements in the suite of SWTC cdy, etc.) and TS documents (TS911 primarily), with a specific compliance position for each requirement, and trace to this document (or other documents) as applicable. Please confirm.	testing and commissioning requirements in SWTC, App C.1, App B.12, Main Body, TS911, etc.	D	Document format amended and PRD/Compliance Matrix included in Appendices. In relation to TS911 For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 12/08/2021 DW: Refer to the response to Item 5 and item 8 above and the document hierachy in Appendix D.		C	1/3/21: GP: Open: This plan should be the head plan within the hierarchy of T&C Plans (note earlier comments on lack of heirarchy definition), and in so doing, it was anticipated that this plan would define all requirements for T&C including those of TS911 and other RMS TS as applicable. The IOMCS/OMCS testing extends beyond the SICE testing alone (i.e. SAT, SIT, etc.). As noted in an earlier comment, there are no specific document clause references provided in the Appendix PRD in Rev 01. 29/9/21: GP: Closed on the basis of the updated report as identified and the new Appendix D.	26-Sep-2021	
27	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	It is assumed that future revisions will include additional appendicies so as to provide more details on testing and commissioning workflows, test and commissioning documentation structure, and other aspects when specfics are determined? Please confirm?	SWTC, App C.1, Section 17 (e)	D	Additional information has been added to main document. Details of work flows are within relevant systems such as JIRA, example information is provided. Access to JIRA will be organised.		C	1/3/21: GP: Closed - refer to new specific comments on Rev 01 in relation to more details on workflows and processes.	01-Mar-2021	
28	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Geoff Pitcher	07-Nov-2019	ITS/OMCS/Systems	IC	General	The IOMCS is a unique aspect of this project, and therefore will require a significant verification and validation effort to demonstrate functionality and performance, and to enable acceptance. However there is only brief mention of the IOMCS testing and commissioning activities, or how the existance of an IOMCS will impact on the testing of OMCS.	SWTC, App B.12, Section 12.2	D	For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021		C	1/3/21: GP: Closed - refer to new specific comments on Rev 01 in relation to more details on level of detail, and other potential T&C staging subplans.	01-Mar-2021	
29	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	Please provide the requirements of SWTC Appendix C.01 17bii) and 17b iii) as separate sub-plans within the Testing and Commissioning Plan	SWTC Appendix C.01 17 c)	N	References provided are for (ii) SWTC Appendix B.12 'Operations Management and Control Systems', including but not limited to: (iii) Section 12 'Installation, Testing and Commissioning Requirements'; Information is incorporated within this document and the ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 which is a subplan to the project Testing and Commissioning Plan.		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

PLAN NUMBER
M4M5-LSBJ-PRW-MES-MP01-PLN-0003

PROJECT PLAN TITLE
Testing & Commissioning Management Plan

Design Report: M4M5-LSBJ-PRW-MES-MP01-PLN-0003
Drawings: None

SUBMISSION	REVISION	TIME ISSUED	DATE ISSUED
NDIFR	00	3:54 PM	Thursday, 17 October 2019
NDIFR	01	10:35 PM	Wednesday, 10 February 2021
NDIFR	02	1:56 PM	Wednesday, 15 September 2021

<======= TO BE COMPLETED BY IC

COMPLIANCE STATUS LEGEND
O Observation / Comment
D From information currently provided not able to determine whether design / proposal is compliant
N Non-Compliant (must provide reference to a Project Deed / SWTC requirement)

TO BE COMPLETED BY IC======>

RESPONSE STATUS
O Open
C Closed
CA Closed against this package but subject to action in another package
CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
L Certification Limitation

DRR TEAMBINDER REF: M4M5-WCXJ-PRW-MES-MP01-RVC-1003

IC Use Only DRR REV	DRR STATUS	DATE	BY
00	RMS / IC / M4-M5 Link Group Comments	15-Nov-19	M4-M5 Link Group
01	ASBJV responses to Rev 00 Initial Comments (10/02/2021) TfNSW Rev 00 comment closeouts and review M4-M5 Link Group Rev 00 comment closeouts and review / Rev 01 review Arcadis (IC) Rev 00 comment closeouts and review / Rev 01 review	16-Mar-21	M4-M5 Link Group
02	ASBJV responses to Comments (15/09/2021) TfNSW / IC / M4-M5 Link Group - comment closeouts and review	12-Oct-21	M4-M5 Link Group

No.	Stage	PACKAGE	Doc Rev	Reviewer Name	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment Closeout	Date Comment Closed	IC Use Only Incorporation Status / Date
30	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 1.3	Section 1.3 Notes that Table 1 includes where each requirement is addressed in the report. Please update the table to include this information		O	This table has been removed and PRD added as an appendices.		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	
31	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 1.3	Requirements of SWTC 2.6.1, 2.6.2 and 2.6.3; SWTC Appendix B.12 Section 11.1.6 and 11.1.7; SWTC B.31 Section 8.1 and 10.2.1.5 should be added to the table as per SWTC Appendix C.01 17 b)	SWTC Appendix C.01 17 b)	D	SWTC 2.6.1, 2.6.2 and 2.6.3; - have all been added into the report in relevant sections and references to sections included in the PRD, please review. Appendix B.12 Section 11.1.6 and 11.1.7 - These Requirements are captured as part of SICE scope and are covered in the ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 SWTC B.31 Section 8.1 and 10.2.1.5 are C2C testing and related to separate document as per detailed in plan.		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	
32	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 1.2	Please indicate the framework for when the Testing and Commissioning Plan will be reviewed, developed and updated. Will this be reviewed periodically and at what frequency will this occur	SWTC Appendix C.01 17 e	D	*Testing and Commissioning Plan will be reviewed, developed and updated as required by ASBJV.* Has been added to Section 1.3 Scope		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
33	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 4	Section notes "Related detail of the testing and commissioning of the OMCS and IOMCS systems can be found in the Integration Plan, shown in below." Please clarify as nothing is indicated below. Is a reference missing?		O	Section amended. For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
34	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Appendix B	Appendix B text in boxes are unclear. Please update for clarity		O	Appendices have been amended. Believe reference to App B was actually App A. This has now been removed and for all details of program please refer to project program		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
35	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	Please confirm that commissioning procedures will include operational tests in all modes including normal operation, emergency operation and total and partial power failures. Currently only mentioned under Level 0 FAT	SWTC Main Body 6.20.1 e)	N	Specific details of what tests and test modes e.g. normal operation, emergency operation total and partial power failure. will occur at which Test Phase / System will be define in the relevant test procedures. This has been added to doc - refer to Section 3.2 Testing an Commissioning Overview.		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	
36	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	Please confirm that there will be consideration to interruption of electricity supply and communication facilities and the consequent effect on electrical and electronic equipment. Please indicate how this is planned to be considered	SWTC Main Body 6.20.1 f)	N	This isn't really a Testing and Commissioning Plan requirement as it is not a process. Reference to this has been added. Specific test cases to address this will be documented with relevant Electrical test cases		C	TfNSW - 24/02/21 - Closed. Not relevant to contract	24-Feb-2021	
37	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General Section 3.10	Please confirm that UPS system will be commissioned under actual operating conditions for the full duration of the standby period and how this will be conducted. No indication currently	SWTC Main Body 6.20.1 g)	N	This isn't really a Testing and Commissioning Plan requirement as it is not a process. Reference to this has been added. Specific test cases to address this will be documented with relevant Electrical test cases		C	TfNSW - 24/02/21 - Closed. UPS will be picked up in Lighting Tests	24-Feb-2021	
38	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 3.8	Section 3.8 indicates that Deluge system operation to verify production of spray density at a number of hydraulically disadvantaged locations. Please confirm that this will be conducted at the most hydraulically disadvantaged deluge zone in conjunction with other adjacent zones that are designed to operate simultaneously	SWTC Appendix B.03 11.2 i)	D	Specific details of tests, locations, etc. will all detailed in future system test documents, not the overarching Testing and Commissioning Plan.		C	TfNSW - 24/02/21 - Closed. Ensure these are captured in relevant documents	24-Feb-2021	
39	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	The plan does not appear to address the transition requirements in Section 2.6.1. Please explicitly include in the plan	SWTC Appendix C.01 17 b) SWTC Main Body 2.6.1, 2.6.2 and 2.6.3	N	Transition section has been added.		C	TfNSW - 24/02/21 - Closed	24-Feb-2021	
40	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	The plan does not appear to address the transition requirements in Section 2.6.1, 2.6.2 and 2.6.3. Please explicitly include in the plan	SWTC Main Body 2.6.1	N	Transition section has been added.		C	TfNSW - 24/02/21 - Closed	24-Feb-2021	
41	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 3.9	ORE is listed as occurring at Level 6. Please address the requirements to conduct this in three stages as indicated in SWTC section 2.6.2	SWTC Appendix C.01 17 b) SWTC Main Body 2.6.1, 2.6.2 and 2.6.3	N	ORE has been amended and new section added to report 4.2 - ORE		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	
42	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 8	Please include the role of the Quality Manager in the responsibilities	SWTC Appendix B.12 12.2 j	D	SWTC Appendix B.12 12.2 j requirement has been added, refer to section 9.1 12/08/2021 DW: The role of the Quality Manager is defined in the QA Plan. The responsibility of B.12 12.2.j sits with the M&E T&C Manager, the M&E Systems Commissioning Manager and the OMCS/IOMCS Project Manager.		C	There is no Section 9.1..- TfNSW Closed, this is adressed in Section 3	28-Sep-2021	
43	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 3.9	Please include the number of pre-requisites that need to be satisfied prior to the commencement of the final SIT and UAT as per SWTC Appendix B.12 12.6 a) and 12.7 a) or indicate how these pre-requisites will be monitored and confirmed prior to testing.	SWTC Appendix B.12 12.6 & 12.7	D	Additional information has been added for prerequisite and ORE to the document.		C	TfNSW - 23/02/21 - Closed	23-Feb-2021	
44	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	Please indicate compliance against AS 4006 for the test plan.	AS 4006	D	The Project is not Tracing to Australian Standards		C	TfNSW - 17/02/21 - Closed. Note that it is a requirement in B.12 clause 11.1.6 and 11.1.7 that test plans and test specifications are to comply to AS 4006. IC to consider this requirement in their review of the test plans etc.	17-Feb-2021	
45	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 3.10	Noted that Tolling is indicated in section 1.2 to be covered under a specific sub-plan. Suggest remove Tolling in Section 3.10 and instead include full testing in sub-plan		O	Left as is, as example of level 7 information, details in other plan.		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
46	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 1.2	Section 1.2 indicates that Incident detection systems are included in scope of testing and commissioning. Incident detection is only mentioned at Level 6 and Level 7. Please confirm how requirements of SWTC Appendix B.31 Section 8.1 are addressed in this plan	SWTC Appendix C.01 17 b SWTC Appendix B.31 8.1	D	B31 Sect 8.1 is Traffic Incident Detection Requirements - specific details of how what tests will occur to demonstrate requirements is outside the scope of the Testing and Commissioning Plan which is a Process document. The information believe you are after will have some further in the ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021 and then subsequent testing procedures.		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
47	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	Section 1.2	Please advise where the requirements of SWTC Appendix B.31 Section 10.2.1.4 are addressed in this plan? Is this intended to be covered in the separate sub-plan for C2C?	SWTC Appendix C.01 17 b SWTC Appendix B.31 10.2.1.4	D	C2C details will be provided in relevant sub plan		C	TfNSW - 17/02/21 - Closed. C2C plans to be provided as they become available.	17-Feb-2021	
48	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Joel Gruber	13-Nov-2019	RMS Delivery	RMS	General	Please review Testing and Commissioning Plan following ConOps activities to confirm applicability or requirements against the requirements derived from the ConOps activities.	SWTC Appendix B.14 3.3	D	ASBJV believe that the ConOps activities necessary to inform the design process were largely competed prior to the formulation of the SWTC, but has now been supplemented by the WCX Traffic Strategy (compiled by ASBJV with input from stakeholders) and together form the necessary inputs for the design process. It is understood that WCX are in the process of updating the ConOps documentation to complete the process to RMS satisfaction. Any changes to SWTC/Requirements following this ConOps process between WCX and RMS will follow project Change processes.		C	TfNSW - 17/02/21 - Suggest that this is OBE and can be closed.	17-Feb-2021	
49	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	Table 2	List of Formal Witnessed Testings does not comply to SWTC requirement.	SWTC Appendix B.31, 13.2 f,i	D	Some amendments made to document, please be more specific if there is still an issue.		C	TfNSW - 17/02/21 - Closed noting that Level 4 (Device Testing) is considered part of SAT so all aspects of the SAT should be made accessible and witnessed by IC or RMS as per B.12 clause 2.2.d) should either the IC or RMS request. The intent and practicality of the proposed Level 4B is understood but should not be misconstrued as either IC or RMS waiving the right to oberve any aspect of formal testing if requested.	17-Feb-2021	
50	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	General	Test plan does not address the requirements for preliminary test before formal witnessed testings are organised.	SWTC Appendix B.31, 13.2 f	D	Section 3.2 - Testing and Commissioning Process Compliance information is in JIRA. Testing & Commissioning Plan - M4M5-LSBJ-PRW-MES-MP01-PLN-0003 Section 1.4 Details "Formal test" Definition.		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
51	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	General	Current test procedure does not cover all the required test phases for IOMCS. Some stages such as isolated SAT and integrated SAT are not covered.	SWTC Appendix B.31, 13.2 h	D	Refer to Section 3.1 - believe this is all covered in table.		C	TfNSW - 17/02/21 - Closed. This is now covered in IOMCS SAT (ISAT) description in Table 1 / Level 5.	17-Feb-2021	
52	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	General	Using OMCS simulators for integrated site acceptance testing stage is not being addressed in the report	SWTC Appendix B.31, 13.4.2	D	For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	
53	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	1.2	"There will be specific sub plans for the following topics: C2C, Tolling" Please clarify where these plans are being provided.		O	Doc numbers have been added for the Tolling. C2C – this will be detailed once finalisation of C2C with TfNSW has occurred.		C	TfNSW - 17/02/21 - Closed. C2C and Tolling plans to be provided as they become available.	17-Feb-2021	
54	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	General	Testing of Tolling system is only being noted at L7 testing. Please clarify how tolling FAT, SAT will be implemented.		O	Level 7 is Tuning activities that occur post opening, and typical examples of these were provided including Tolling. As per Section 1.2 - Purpose and previous comments "There will be specific sub plans for the following topics: C2C, Tolling"		C	TfNSW - 17/02/21 - Closed. Tolling plans to be provided as they become available.	17-Feb-2021	
55	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	General	Testing plan does not address the requirements for regression testing of existing OMCS systems	SWTC Appendix B.31, 13.2.2.2	D	For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021		C	TfNSW - 17/02/21 - Closed. Addressed in SICE ICT Test & Commission Plan.	17-Feb-2021	
56	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Babak Khanjani	14-Nov-2019	Systems	RMS	5.1	Please clarify how the test specifications will be provided as part of test documents	SWTC Appendix B.31, 13.2.4	D	For Specific details on I/OMCS Testing please refer to ICT TEST & COMMISSIONING PLAN M4M5-SICE-PRW-MES-MP01-PLN-0021		C	TfNSW - 17/02/21 - Closed. Addressed in SICE ICT Test & Commission Plan.	17-Feb-2021	
57	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	00	Adison Ang	14-Nov-2019	Systems	RMS	General	Please include RMS and IC inspection requirements as per the SWTC with notice 21 days in advance of tests.	SWTC Appendix B.12 12.2d	D	The following has been added to report 'As per the SWTC Notice for the formal witness testing (FAT, SAT, SIT and UAT) must be given 21 days in advance of the scheduled date of the tests. The Project Company must supply all copies of the proposed test documentation at least 21 days before the proposed date for the tests.'		C	TfNSW - 17/02/21 - Closed.	17-Feb-2021	

DESIGN REVIEW RECORD (DRR)

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PLAN NUMBER
M4M5-LSBJ-PRW-MES-MP01-PLN-0003

PROJECT PLAN TITLE
Testing & Commissioning Management Plan

Design Report: M4M5-LSBJ-PRW-MES-MP01-PLN-0003
Drawings: None

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RESPONSE STATUS
O Open
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FOR IC USE ONLY
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IC Use Only	DRR TEAMBINDER REF:	M4M5-WCX3-PRW-MES-MP01-RVC-1003
DRR REV	DRR STATUS	DATE	BY
00	RMS / IC / M4-M5 Link Group Comments	15-Nov-19	M4-M5 Link Group
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02	ASBJV responses to Comments (15/09/2021) TINSW / IC / M4-M5 Link Group - comment closeouts and review	12-Oct-21	M4-M5 Link Group

No.	Stage	PACKAGE	Doc Rev	Reviewer Name	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment Closeout	Date Comment Closed	IC Use Only Incorporation Status / Date
58	Update 1	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Geoff Walker	23-Feb-21	Systems	M4-M5 Link Group	Section 3.9	The description of Level 6 SIT does not cover the IOMCS tests through to plant and traffic field devices of the existing operational OMCSs of the adjacent WCX stages - i.e. M4 and M8. The previous section 3.8.3 only covers the 'monitoring' of plant and traffic devices of the operational OMCSs. Please add some details of the Level 6 through testing to the plant and traffic devices in the M4 and M8 OMCSs.	SWTC Appendix B.31, section 13.2	O	12/08/2021 DW: Further details have been added to section 3.8 to cover this topic. Further details will be developed through the Transition Working Group, the ICT Test and Commission Plan and the lower-level sub-system commissioning documents.		C	GW Comment Closed	12/10/2021	
59	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.3.1 Vendor FAT	Regarding the following: "The results of the hardware FATs will be recorded in iTWOcx as part of the project QA processes. Defects will be noted on the FAT test documentation and registered in iTWOcx." Please confirm that both FAT results and FAT related defects will be recorded in Completions Connect (and not iTWOcx as stated above).	N/A	O	12/08/2021 DW: Confirmed. These results are recorded in Completions Connect. This has been updated in Section 3.3.1		C	Matt Turner 18/08/2021 - Comment closed based on the Contractor's response.	18/08/2021	
60	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.4 Level 1: Installation Testing	Regarding the following: "When handover is complete, the M&E Test and Commissioning Manager will issue a Commissioning Notice to the project stakeholders the area is now under the control of commissioning with any remaining installation works requiring a Permit to Work that will be issued and controlled by commissioning." Please advise how the project stakeholders will be notified that an area has been handed over to commissioning.	N/A	O	12/08/2021 DW: The M&E Systems Commissioning Manager will issue the notice via Outlook. It is noted that the IC and AT are involved in the two week and final handover walkdowns from M&E construction to T&C.		C	Matt Turner 18/08/2021 - Comment closed based on the Contractor's response.	18/08/2021	
61	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.5 Level 2: Energisation Testing	Regarding the following: "Level 2 will perform initial energisation and LV electrical testing utilising temporary or permanent power to the LV distribution boards located in the Electrical Equipment Rooms." From recent discussions held as part of the fortnightly commissioning meeting , it is the AT's understanding that the Contractor does not intend to undertake testing and commissioning activities utilising temporary power. Please confirm that this is correct.	N/A	O	12/08/2021 DW: Level 2 testing will commence in some areas using temporary power from the tunnel power supply.		C	Matt Turner 18/08/2021 - Comment closed based on the Contractor's response.	18/08/2021	
62	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.7 Level 4: Device Testing	Regarding the following: "Level 4 tests will generally be unwitnessed (unless requested by the IC)" Please include the AT along with the IC, noting that the AT is interested in witnessing a certain % of LHD mapping, outside of the Level 4B type test.	N/A	O	12/08/2021 DW: This has been revised from "IC" to "client parties" 03/09/2021 DW: Confirmed		C	Matt Turner 18/08/2021 - Contractor's response noted regarding Level 4 testing. Could the Contractor please confirm that the IC and the AT ("client parties") are able to witness any level of testing (upon sending a request to the Contractor in advance of the test) for particular areas of concern (e.g. vibration levels of axial fans and diesel engine driven deluge pumps during start-up as part of Level 2/3 testing). Matt Turner 11/10/2021 - Noted. Comment closed.	10/11/2021	
63	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.8 Site Acceptance Testing	The AT notes that no minimum % of Level 4 testing completed is stated in order to commence Level 5 SAT testing for a particular sub system. As per the lessons learned presentation delivered to the contractor, it is the AT expectation that a minumum level (of say 90%) would berequired to enable Level 5 SAT testing to commence. Please address.	N/A	O	12/08/2021 DW: Level 2/3/4 testing will be based on the sub-system breakdown included in Section 3.2. This will be further detailed in the lower-level sub-system commissioning documents referenced in Appendix D. 03/09/2021 DW: This will be agreed with he client parties through the regular stakeholder meetings and documented in the Level 5 test plans. The SAT TRRs will demonstrate that the agreed entry criteria is met.		C	Matt Turner 18/08/2021 - Contractor's response noted, however the original comment regarding minimum % of succesful Level 4 testing required in order to procedd to Level 5 (i.e. minimum acceptance criteria) has not been specified. Matt Turner 11/10/2021 - Noted. Comment closed.	10/11/2021	
64	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 7 .6 Commissioning Notices	The AT notes the following: "7 .6 Commissioning Notices 7.6.1 Energisation Bulletin Prior to any energisations a simple bulletin in layman's terms will be issued and read out in the prestart for the day explaining what is being energised and where it is. This process must be completed in tandem with the Notice of Energisation being issued and placed on relevant notice boards 7 .6.2 Notice of Energisation A Notice of Energisation (NoE) is necessary to enhance the PTW system when energy sources are introduced to the project for commissioning and operational purposes. This occurs when the project moves from a deenergised construction site to a potentially energised commissioning area. Prior to issuing a NoE, and ICC is required. The general rule for this process is 'those who introduce the hazard must control the hazard', therefore the Commissioning/Energisation teams are responsible." Please advise how this information will be communicated.	N/A	O	12/08/2021 DW: This is issued to the project personnel via Outlook and read out in pre-starts as appropriate. 03/09/2021 DW: AT and IT is bieng included in the Bulletin Distribution via Outlook.		C	Matt Turner 18/08/2021 - Contractor's response noted. To date, the AT has not received either "Energisation Bulletins" or "Notice of Energisations" via Outlook. Could this please be arranged - the AT has previously requested this via email. Matt Turner 11/10/2021 - Noted. Comment closed.	10/11/2021	
65	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Appendix B Test Document Matrix	The AT notes that Appendix B Test Document Matrix is in draft. Please update.	N/A	O	12/08/2021 DW: Appendix B has been updated. 03/09/2021 DW: DRAFT has been removed on the Rev 02 submission 31/05/2022 DW: The list of L2 and L3 ITRs has been included in Appendix B		O	Matt Turner 18/08/2021 - Contractor's response noted. The final page of Appendix B (page59/65) still contains the "draft" stamp. Please correct. Matt Turner 11/10/2021 - It is noted that references to Level 2 and Level 3 commissioning ITRs have not been provided in Appendix B. Please provide this information.		
66	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	Section 3.7 Level 4: Device Testing	Please confirm that wherever possible, Level 4 testing will involve analog inputs received at the OMCS via direct connection to the field device (as opposed to 4-20mA signal injection). An example of the above would be to confirm that the correct tunnel lighting level is selected by the PMCS for the entrance portal lighting by way of luminance levels measured via the connected photometers.	N/A	O	12/08/2021 DW: This is confirmed.		C	Matt Turner 18/08/2021 - Comment closed based on the Contractor's response.	18/08/2021	
67	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	Matt Turner	18-Feb-2021	M&E	M4-M5 Link Group	General Comment	Noting a 28 day proving period was implemented for the M8 Water Treatment Plant (WTP), whereby the WTP was required to operate (major) defect free and without breaching effluent limits, please demonstrate how the same level of assurance will be achieved on the M4-M5 Link Project with the WTP running in automatic mode and connected to the low point sump drainage system.	N/A	O	12/08/2021 DW: This level of detail will be provided in the lower-level subsystem commissioning documentation. It is expected that the WTP will be commissioned well in advance of the date of opening completion including trailing of maintenance personnel in the use of the plant. 03/09/2021 DW: Noted		O	Matt Turner 18/08/2021 - Contractor's response noted. Comment remains open until the comment has been addressed via the lower-level subsystem commissioning documentation (specifically the number of days planned for defect free proving period).		
68	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	SD	03-Mar-2021	Systems	M4-M5 Link Group	Section 3	Its not clear what the criteria is for the entry and exit gates for each of the levels described here is.		D	12/08/2021 DW: The entry and exit criteria for Level 0 testing will be described in the ICT Test and Commission Plan. Further details on the entry and exit criteria to Level 4B, 5 and 6 testing will be agreed with the stakeholders through the regular workshops and meetings and provided in the lower-level sub-system commissioning documentation.		C	SD 12/10/2021: Comment Closed	12/10/2021	
69	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	02	SD	03-Mar-2021	Systems	M4-M5 Link Group	Section 6.3	The desciption of punchlist items as A,B and C.. This is simple description of item related to only the OMCS These defect categories do not consider integration and How defects associated with integration of systems are treated at the IOMCS Level. The IOMCS will need a a dedicated Catergory of the punclist items.		D	12/08/21 DW: Further details have been provided in Section 6.1 and 6.3 of this plan.		C	SD 12/10/2021: Comment Closed	12/10/2021	
70	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 2.1	Neither this Section nor elsewhere does this document attempt to address the relative roles and responsibilities of ASBJV and SICE in the differing test stages - i.e. ASBJV Overall Test Lead, FAT/IFAT - SICE Execution Lead, SAT/SIT/etc - ASBJV Execution Lead supported by SICE and others, etc. This also influences the hierarchy of T&C Plans as identified in IC comments above.		O	12/08/2021 DW: Uupdate to Section 2.1 has been provided to address these stage lead definitions. This is further supported by the document hierachy provided in Appendix D		C	5/10/21: GP: Closed on the basis of the updates in Section 2.1, and other sections.	5/10/2021	
71	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.2, Last para	Re the reference to review and commenting on testing documentation re 21 days issuance,10 working days for responses, etc., the details should also clarify the means (Teambinder), and who the party is that will collate comments, etc.	SWTC, App B.12, Section 12.2 (g)	D	12/08/2021 DW: Section 3.2 has been updated to address this comment.		C	5/10/21: GP: Closed on the basis of the updates in Section 3.2, and other sections.	5/10/2021	
72	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.7 & 3.4	This section mentions the Witnessed Level 4B type tests in the second last sentence (i.e. Device level SATs), however implications for defects (i.e. Jira and not Completions Connect) are not addressed.	SWTC, App B.12, Section 12.5	D	14/08/2021 DW: Section 3.7 has been updated to include management of punch items in Completions Connect and software defects in KNOSSOS. 31/05/2022 DW: The following has been included in section 3.7 "Level 4B testing will be performed in JIRA and software defects managed using the same process as Level 0 software testing."		O	5/10/21: GP: As identified in a recent T&C Meeting, the procedure for open defects in Level 4B is not yet agreed. All system defects evidenced in a witness test for SAT (which includes 4B, as 4B is by definition a Device SAT) are to be included in Jira and managed as part of the defects to be closed by the IC. Section 3.7 currently identifies Level 4B defects in Completions Connect and knossos only.		
73	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.8	This section does not clearly identify the intent for both M&E SATs (non OMCS related) and entire Subsystem SATs, which are end to end (M&E and OMCS combined). Similarly, more detail is required in terms of any differing strategies for defects capture and management in the differing SAT tests, etc.	SWTC, App B.12, Section 12.5	D	14/08/2021 DW: Section 3.8 has been revised to address this comment including the addition of non-OMCS related SATs.		C	5/10/21: GP: Closed: details now provided in terms of non OMCS SAT Testing as per the original comment.	5/10/2021	

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

PLAN NUMBER
M4M5-LSBJ-PRW-MES-MP01-PLN-0003

PROJECT PLAN TITLE
Testing & Commissioning Management Plan

Design Report: M4M5-LSBJ-PRW-MES-MP01-PLN-0003
Drawings: None

SUBMISSION	REVISION	TIME ISSUED	DATE ISSUED
NDIFR	00	3:54 PM	Thursday, 17 October 2019
NDIFR	01	10:35 PM	Wednesday, 10 February 2021
NDIFR	02	1:56 PM	Wednesday, 15 September 2021

<======= TO BE COMPLETED BY IC

COMPLIANCE STATUS LEGEND
- O Observation / Comment
- D From information currently provided not able to determine whether design / proposal is compliant
- N Non-Compliant (must provide reference to a Project Deed / SWTC requirement)

TO BE COMPLETED BY IC======>

RESPONSE STATUS
- O Open
- C Closed
- CA Closed against this package but subject to action in another package
- CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
- L Certification Limitation

IC Use Only	DRR TEAMBINDER REF:	M4M5-WCXJ-PRW-MES-MP01-RVC-1003	
DRR REV	DRR STATUS	DATE	BY
00	RMS / IC / M4-M5 Link Group Comments	15-Nov-19	M4-M5 Link Group
01	ASBJV responses to Rev 00 Initial Comments (10/02/2021) TfNSW Rev 00 comment closeouts and review M4-M5 Link Group Rev 00 comment closeouts and review / Rev 01 review Arcadis (IC) Rev 00 comment closeouts and review / Rev 01 review	16-Mar-21	M4-M5 Link Group
02	ASBJV responses to Comments (15/09/2021) TfNSW / IC / M4-M5 Link Group - comment closeouts and review	12-Oct-21	M4-M5 Link Group

No.	Stage	PACKAGE	Doc Rev	Reviewer Name	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment Closeout	Date Comment Closed	IC Use Only Incorporation Status / Date
74	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	General	It was anticipated that this document would address the remote testing provisions across the differing test stages. There is only one mention of remote testing and its in Section 3.3.2 (FAT/FIT). The IC also notes that the context of the reference is in terms of 'stakeholders that cant attend' as opposed to identifying it as a beneficial (effective and efficient) means of undertaking testing. It was anticipated that this document would document the proposed configuration and systems to be used for remote testing, particularly in terms of the OMCS related tests.		O	14/08/2021 DW: Section 3.3.2 has been updated and the reference to remote witness testing has been added to Section 3.8 SAT and 3.9 SIT. The remote witnessing process has for FAT has been documented and agreed in the ongoing working groups. Similarly the process for SAT will be agreed and documented if different to that used for FAT.		C	5/10/21: GP: Closed on the basis of the updates.	5/10/2021	
75	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.8.2	This document does not provide reference to the need for Simulator specifications and certification, whether that be M4E/M8 simulators or others.	SWTC, App B.12, Section 12	D	16/08/2021 DW: Section 3.8.2 has been updated to include this reference.		C	5/10/21: GP: Closed: Inclusions in Section 8.2 noted. No reference to certification of the simulators, but mention of being 'proven'?	5/10/2021	
76	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.8.3	It was anticipated that this section would also make reference to the need for some level of 'control' function testing in ISAT, and therefore the need for M4E and M8 tunnel closures to enable sufficient testing to ensure confidence.	SWTC, App B.12, Section 12.5	D	16/08/2021 DW: ISAT Targeted has been added which aligns with the SICE ICT T&C Plan for Level 5 test stages.		C	5/10/21: GP: Closed on the basis of the update in Section 3.8.2. In addition, it is anticpated that a subplan will be provided for the SAT/ISAT stage that will provide more specific details.	5/10/2021	
77	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.9	Dot point 1, please include the word "all" in front of "installation and SATS have been completed successfully" for clarity, as it is documented in the SWTC. Thereby ensuring the intent of each and every aspect of installation and SATs fully completed.	SWTC, App B.12, Section 12.6 (a) (i)	D	16/08/2021 DW: This update has been made to the Plan.		C	26/8/21: GP: Closed on the basis of the updates.	5/10/2021	
78	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 3.8, 3.9, 3.10 and other sections	A number of the sections in this report are copies of clauses from the SWTC. While it is important to identify compliance, there are sections for which specific process details were anticipated beyond that of the compliance statements alone. The IC suggests that consideration should be given to the provision of more specific and detailed Test Management Plans for differing test phases to be delivered at a later stage in the project, i.e. FAT, IFAT, SAT, SIT, UAT, etc. given the level of detail provided in this plan to date, and developing strategies for differing phases. This T&C Plan can then identify this intent and reference future plans.	SWTC, App B.12, Section 12	D	16/08/2021 DW: Reference has been made to lower-level test documents and stage specifc test plans which will be developed and agreed in consultation with the stakeholders through the working groups and issued prior to the relevant stage of testing or test cycle. Appendix D has been included which dhows the document hierachy. 31/05/2022 DW: Further detail has been added to Section 3.8 and 3.9 detailing the requirements for the L5 and L6 test Procedures. Each test procedure is essentially a test plan for that system.		O	5/10/21: GP: Open: Please include the option of a SAT/ISAT Test Subplan in addiiton to the Level 6 plan already identified.		
79	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Section 4.2	This section should include the statement on pre-requisites/emtry criteria for ORE given its significance. i.e. SWTC, Main Body, Section 2.6.3 (b) All systems and equipment testing and commissioning activities, plus all training activities, must be satisfactorily completed prior to the commencement of the ORE.	SWTC, Main Body, Section 2.6.3 (b)	D	16/08/2021 DW: This wording was included in the Rev 01 version already. The section has been revised. Details will be provided in the ORE Plan.		C	5/10/21: GP: Closed on the basis of the updates. No real change, but accepted.	5/10/2021	
80	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	Appendix C and General	There is no discussion in this Plan on testing resource requirements and hence justification of the Org chart proposed in terms of sufficiency both in terms of quantity of management leads and general resources. More so than any other tunnel constructed in Australia, the nature of this project will require a far greater volume and complexity of testing (i.e. planning, documentation development, execution and defect recitification). How has ASBJV assessed their currently proposed resourcing at all levels to be sufficient to achieve the required effort?	SWTC, App B.12, Section 12	D	16/08/2021 DW: Section 2.1.1 has been added to the report to discuss this resourcing.		C	5/10/21: GP: Closed on the basis of the updates.	5/10/2021	
81	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	01	G Pitcher	26-Feb-2021	ITS/OMCS/Systems	IC	General	In updating this plan, please refer to the IC comments on the SICE ICT Plan, all of which were developed in the absence of this updated Rev 01 plan. It was anticipated that a number of the issues raised against the SICE plan should have been addressed in ASBJV Plan.		O	16/08/2021 DW: Noted. Ths plan has been reviewed and updated in conjunction with the SICE ICT T&C Plan.		C	5/10/21: GP: Closed on the basis of the updates.	5/10/2021	
82	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	02	B.Humble	28-Sep-2021	Systems	RMS	General	TfNSW has no further comment	SWTC Appendix B.12	O			C	N/A	28-Sep-2021	
83	NDIFR	M4M5-LSBJ-PRW-MES-MP01-PLN-0003	02	J Jong	12-Oct-21	General	M4-M5 Link Group		No comments to rev 02.		O			C	N/A	12/10/2021	

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Attachment 2: TMC Consultation

Transport for NSW

WestConnex E13 Protocol

TMC Consultation

Transport for NSW | November 2022

Ministers Condition of Approval E13

A Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol must be prepared in consultation with the TMC. The Protocol must be reviewed and endorsed by a suitably qualified and experienced independent ventilation specialist. The Protocol must demonstrate that the ventilation and traffic management systems would operate together to ensure conditions of this approval are met.

Confirmation of TMC Consultation

Please accept this letter as confirmation the Transport Management Centre were consulted by the WestConnex (WCX) project team when finalising the WCX Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol draft document.

The Transport Management Centre (TMC) provided feedback regarding the protocol's related Incident Response Procedures (PR-13,19 and 24) being ambiguous when the trigger of <20km/h average speed is confirmed throughout the tunnel. The WCX Operations team have committed to providing further clarity within WCX Incident Response Procedures including key triggers, operator and system actions and sequence of closures prior to opening WCX stage 3A (estimated for January 2023).

Ray Bakhos

Ray Bakhos

Senior Manager, Operational Readiness

Transport Management Centre

Transport for NSW

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Attachment 3: Review and Endorsement by Xavier Guigas

100492.01-RN0101
15 November 2022

Acciona / Samsung / Bouygues
Joint Venture

WESTCONNEX M4-M5 LINK TUNNEL

REVIEW OF THE TUNNEL VENTILATION, TRAFFIC INCIDENT RESPONSE AND TRAFFIC MANAGEMENT SYSTEMS INTEGRATION PROTOCOL

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WESTCONNEX M4-M5 LINK TUNNEL

REVIEW OF THE TUNNEL VENTILATION, TRAFFIC INCIDENT RESPONSE AND TRAFFIC MANAGEMENT SYSTEMS INTEGRATION PROTOCOL

VERSION	-	a	b
DOCUMENT	100492.01-RN0101	100492.01-RN0101	
DATE	08 November 2022	15 November 2022	
AUTHOR	Xavier Guigas	Xavier Guigas	
APPROVAL	Xavier Guigas	Xavier Guigas	
COLLABORATION	-		
DISTRIBUTION	ASBJV	ASBJV	

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APPENDIXES

1. Preliminaries

1.1 Introduction / Purpose of this Document

BG Consulting Engineers Ltd. (BG) has been engaged by Acciona / Samsung / Bouygues Joint Venture (ASBJV) to conduct the review of the Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) for the WestConnex M4-M5 Link Tunnels in Sydney, New South Wales, Australia.

This review is stipulated in the condition E13 of the MCoA.

1.2 Limitations

The following limitations apply:

- The review concerns the WCX M4-M5 Link Tunnel Integration Protocol. The integration of the adjacent tunnels (M4E, NM5, Rozelle, …) is out of the scope of this review.
- The correct and exhaustive implementation of the design outcomes, procedures and Test and Commissioning Plan is out of the scope of this review.
- BG gives its expert opinion on the Protocol. ASBJV keep the full responsibility of the design and of the implementation of the Protocol.

1.3 Overview of the Project

WestConnex is an 33-kilometre predominately underground motorway scheme partially completed and partially still currently under construction in Sydney. The Figure 1 below, localizes this infrastructure together with the M4-M5 Link.

The WestConnex M4-M5 Link – Main Tunnel Works project is being designed and constructed by the Acciona Samsung Bouygues Joint Venture (ASBJV). The project involves the design and construction of a new motorway between the M4 East Motorway (M4E) at Haberfield and New M5 Motorway (NM5) at St Peters, including entry and exit ramps to Wattle Street Interchange and St Peters Interchange.

The M4-M5 Link – Main Tunnel Works connects into the existing M4 East Motorway and New M5 Motorway at underground connections, forming one continuous system of tunnels.

The tunnel ventilation system is of longitudinal type with air exchanges at the boundaries between the stages (M4E / M4M5 / NM5) and capture of the polluted air before exit portals in order to avoid the emission of polluted air at these locations.

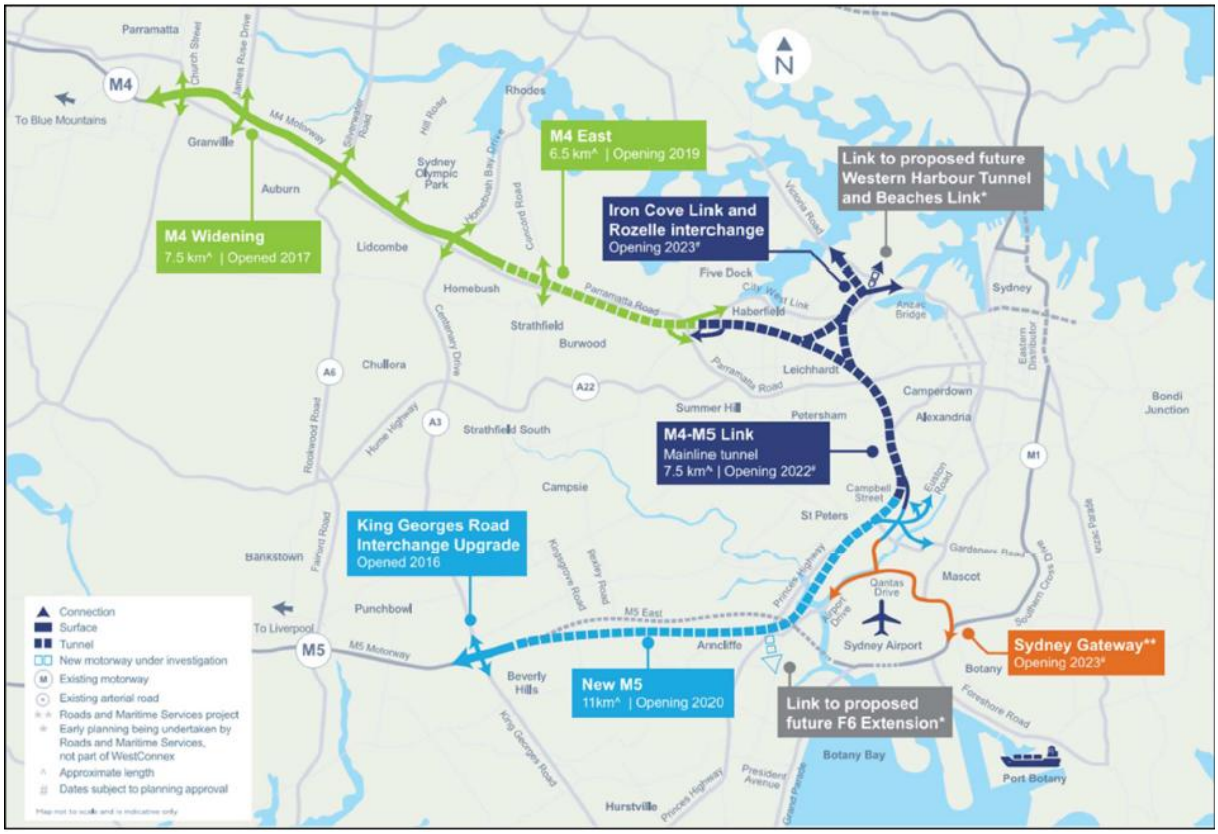

Figure 1: Map of the WestConnex Motorway.

1.4 Abbreviations

A list of applicable abbreviations is presented in the Table 1.

Abbreviation	Definition
ASBJV	Acciona / Samsung / Bouygues Joint Venture
ATLOS	Averaged Traffic Level of Service
BG	BG Consulting Engineers Ltd.
ERP	Emergency Response Plan
EIS	Environmental Impact Statement
FAT / SAT / SIT	Factory / Site Acceptance Test / Site Integration Tests
IMS	Incident Management System
IRP	Incident Response Plan
MCoA	Minister's Conditions of Approval
M4-M5 or Link	M4-M5 Link Tunnel connecting the M4 East tunnel and the New M5
M4E	M4 East tunnel
NM5	New M5 Tunnel
PMCS	Plant Monitoring and Control System
OMCS / IOMCS	Operation Management and Control System / Integrated OMCS

Abbreviation	Definition
SWTC	Scope of Work and Technical Criteria
TfNSW	Tunnel for New South Wales
TMC	Transport Management Center for New South Wales
TMCS	Traffic Management and Control System
TVS	Tunnel Ventilation System
VCS / IVCS	Ventilation Control System / Integrated VCS
WCX	WestConnex M4-M5 Link Project

Table 1: Applicable abbreviations.

2. Condition E13

This review aims at fulfilling the condition E13 stipulated in the WestConnex M4-M5 Link Instrument of Approval_201118 [R1.1]. The condition E13 is expressed as follow:

PART E - KEY ISSUE CONDITIONS

Section AIR QUALITY

Sub-Section Air Quality Design Optimisation

E13 *A Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) must be prepared in consultation with the TMC. The Protocol must be reviewed and endorsed by a suitably qualified and experienced independent ventilation specialist. The Protocol must demonstrate that the ventilation and traffic management systems would operate together to ensure conditions of this approval are met.*

3. Reference Documents

The reference documents provided by ASBJV are listed in the Table 2.

Reference	Document
PROJECT CONTRACTUAL REQUIREMENTS	
[R1.1]	WestConnex M4-M5 Link Instrument of Approval_201118.
[R1.2]	SWTC requirements concerning the Integration Protocol.
INTEGRATION PROTOCOL / TESTING AND COMMISSIONING PLAN	
[R2.1]	TUNNEL VENTILATION, INCIDENT RESPONSE AND TRAFFIC MANAGEMENT SYSTEM INTEGRATION PROTOCOL M4M5-LSBJ-PRW-GEN-OP01-PLN-0006 00 dated 11/11/2022
[R2.2]	TESTING AND COMMISSIONING MANAGEMENT PLAN M4M5-LSBJV-PRW-MES-MP01-PLN-0003 03
TVS	
[R3.1]	TUNNEL VENTILATION ANALYSIS REPORT M4M5-JAJV-TUN-MES-ME01-RPT-0005.H.IFC-R
[R3.2]	TUNNEL VENTILATION PLANT DESIGN REPORT M4M5-LSBJ-PRW-MES-ME02-RPT-0005.G.FD

Reference	Document
[R3.3]	TUNNEL VENTILATION CONTROLS DESIGN REPORT M4M5-LSBJ-PRW-MES-ME03-RPT-0005.F.FD
[R3.4]	AMBIENT AIR MONITORING DESIGN REPORT M4M5-LSBJ-PRW-MES-ME04-RPT-0005.D.FD
EMERGENCY RESPONSE PLAN	
[R4.1]	EMERGENCY RESPONSE PLAN M4M5-LSBJ-PRW-GEN-OP01-PLN-0005.01.NDIFI
TMCS	
[R5.1]	TMCS FUNCTIONALITY - DRIVERS ADVISORY SYSTEMS M4M5-SICE-PRW-MES-OM21-RPT-0005.E.IFC-R
[R5.2]	TMCS FUNCTIONALITY - VEHICLE MONITORING AND CONTROL SYSTEMS M4M5-SICE-PRW-MES-OM22-RPT-0005.E.IFC-R
[R5.3]	TMCS FUNCTIONALITY - VIDEO SURVEILLANCE SYSTEMS M4M5-SICE-PRW-MES-OM23-RPT-0005.D.IFC-R
[R5.4]	TMCS FUNCTIONALITY - TUNNEL CLOSURE SYSTEMS M4M5-SICE-PRW-MES-OM24-RPT-0005.C.FD
[R5.5]	TMCS FUNCTIONALITY - VOICE COMMUNICATIONS M4M5-SICE-PRW-MES-OM25-RPT-0005.D.IFC-R
[R5.6]	TMCS FUNCTIONALITY – MISCELLANEOUS MONITORING & CONTROL M4M5-SICE-PRW-MES-OM26-RPT-0005.E.IFC-R
PMCS	
[R6.1]	PMCS FUNCTIONALITY - VENTILATION M4M5-SICE-PRW-MES-OM30-RPT-0005.D.FD
OMCS / IOMCS	
[R7.1]	OMCS HARDWARE M4M5-SICE-PRW-MES-OM01-RPT-0005.F.FD
[R7.2]	OMCS SOFTWARE ARCHITECTURE M4M5-SICE-PRW-MES-OM10-RPT-0005.D.FD
[R7.3]	IOMCS ARCHITECTURE M4M5-SICE-PRW-MES-OM60-RPT-0005.D.FD
[R7.4]	IOMCS HARDWARE M4M5-SICE-PRW-MES-OM90-RPT-0005.A.DCD

Table 2: Reference Documents.

4. Review Process

4.1 Timeline

The timeline of the review was:

- The review started the 10th of October 2022.
- A draft version of the review report (this report) was transmitted to ASBJV the 8th of November 2022.
- ASBJV comments on the draft review report was transmitted to BG the 9th of November 2022.
- An updated version of the Protocol was transmitted to BG the 11th of November 2022.

- The final version of the review report was transmitted to ASBJV the 15th of November 2022.
- Weekly progress meetings (BG/ASBJV) were held during the review (see main Q&A in appendix).

4.2 Activities and Actions

The activities and actions conducted during this review were:

- Collect and examine in detail the Protocol [R2.1].
- Collect and take notice of the documents related to the Protocol:
  - Document supporting the designs of the TVS, TMCS, PMCS, OMCS, iOMCS;
  - Testing and commissioning management plan;
  - Emergency Response Plan.
- Review of the Protocol in terms of:
  - Evidence of internal (ASBJV) reviews and stakeholder's consultation.
  - Soundness and completeness of the demonstration of the integration between TVS and TMCS / IRP (IMS).

The review is based on the documents provided by ASBJV. No site visit was included.

4.3 Hypothesis

This review focusses on the Protocol [R2.1]. The other documents (concerning TVS / TMCS / PMCS / OMCS / iOMCS / ERP / EIS) are provided by ASBJV for the BG understanding of the systems and their interactions, they are not reviewed in detail. It is assumed that the TVS design, sizing and implementation allow the in-tunnel air quality objectives to be met. Similarly, it is assumed that the TMCS / PMCS / OMCS / iOMCS design and implementation allow the required information / orders exchanges with the TVS.

The status and progress of the testing and commissioning activities is not part of the review. It is assumed that ASBJV applies the methodology described in the T&C management plan [R2.2] and that the tests are (or will be) successfully conducted.

5. Outcomes of the Review

5.1 Contents of the Protocol

The Protocol [R2.1] contains:

- Introduction with purpose and executive summary.
- MCoA [R1.1] requirements for the Protocol.
- Summary of the air quality limits and goals required by the MCoA [R1.1] in terms of:
  - Ventilation outlet air quality limits (MCoA E2)
  - In-tunnel air quality limits (MCoA E3 to E5)
  - Ambient air quality goals (MCoA E6)
  - Ventilation outlets tip heights (MCoA E12)
- Consultation Process.
- Compliance to Ambient Concentrations.
- Summary descriptions of the:
  - Tunnel Ventilation System (TVS)

- Traffic Management Control System (TMCS)
- TVS Interactions with other systems (TMCS, IMS)
- Integrated design approach between TVS (PMCS) and TMCS
- Possible actions (in relation with incidents)
- Incident Response Plan (IRP)
- Integration of the connected WestConnex stages
- Commissioning procedures.

- Conclusion

The Testing and Commissioning Management Plan Management Plan [R2.2] is placed in appendix to the Protocol. It describes in a detailed manner:

- The applicability of the document (purpose, scope, …).
- The roles and responsibilities of ASBJV (including suppliers), the Independent Certifier, WCX and TfNSW.
- The testing and commissioning processes through the various phases and test stages:
  - FAT / IFAT – Factory Acceptance Tests.
  - FIT / IFIT – Factory Integration Tests.
  - Installation / energisation / IO testing.
  - Device testing.
  - SAT / ISAT – Site Acceptance Tests.
  - SIT / ISIT – System Integration Tests.
  - UAT – User Acceptance Tests.
  - System tuning.

5.2 Concerning the Consultation with TMC

Extract of E13:

A Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) must be prepared in consultation with the TMC.

Opinion / comments of the Reviewer:

1) The Protocol [R2.1] includes a chapter (4) dedicated to the consultation process. This chapter indicates that:
   - The documents underlying the Protocol (see list in Table 2) have been the subject of consultations with the stakeholders.
   - Transport for NSW and Transport Management Centre were consulted on the development of the Protocol.

   Therefore, it appears that the consultation process asked by E13 has been conducted.

5.3 Concerning the Demonstration of Integration

Extract of E13:

The Protocol must demonstrate that the ventilation and traffic management systems would operate together to ensure conditions of this approval are met.

Opinion / comments of the Reviewer:

2) The Protocol provides a clear and synthetic description of the TVS, TMCS and IRP.

3) It is understood that the TMCS and TVS (PMCS ventilation functionality) must work in an integrated manner. Data from TMCS could trigger TVS actions/functionalities and vice versa. The Protocol explains this principle and summarizes these interactions which are:
   - TVS actions triggered by TMCS:

     Change of the base ventilation level as a function of a change in the Average Traffic Level of Service (ATLOS). ATLOS is calculated, from traffic monitoring devices, by SIDERA (traffic management software) for each ventilation zone in the tunnel.
   - TMCS actions triggered by TVS:

     The TMCS does not trigger any TVS actions.

4) The Protocol indicates the test procedure (SAT level) associated with TVS / TMCS interactions and indicates that the ATLOS and minimum base ventilation level table will be reviewed and modified through Level 7 testing post opening (fine tuning).

5) We also note that the base ventilation level (or change of level) is not only triggered by the TMCS but is set as the maximum of both time of the day table and ATLOS. Offset of the ventilation level and activation of air exchanges between stages are also commanded from the feedback of the in-tunnel and outlet air quality sensors (tables 9 and 10 of chapter 6).

6) The Protocol explains the interaction between TVS and IMS. The TVS, through its pollution sensors or state of the equipment, will trigger incidents in the IMS. These incidents are listed in the protocol:
   - Incident type Air Quality – sub-type In-tunnel Air Quality is triggered if CO, NO2 or Visibility MCoA limit is exceeded.
   - Incident type Air Quality – sub-type Outlet Air Quality is triggered if Solid Particles, NOx, NO2, CO, VOC or outlet velocity MCoA limit is exceeded.
   - Incident type Air Quality – sub-type Segment Degraded is triggered if more than the allowable number of fans are not available for automatic control.

   The possible actions available to the tunnel operators to deal with incidents are described in chapter 10 of the Protocol.

7) The Protocol indicates the test procedure associated with the above list of IMS incidents triggered by the TVS.

8) The results of the tests of integration between TVS / TMCS / IMS were not available at the date of this review. The Protocol describes however the principle of the commissioning procedure with reference to the testing and commissioning management plan [R2.2]. The method and tools (JIRA with plugin Zephir) used for the monitoring of the status / progress / results of the tests is also outlined.

6. Conclusion

This document reviewed the Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol (Protocol) as required in the condition E13 of the MCoA.

- The Protocol has been prepared by ASBJV and submitted to the BG's review.

- Other documents, such as the Testing & Commissioning Management Plan, documents sustaining the design of the systems (TVS, TMCS, PMCS, OMCS), ERP and EIS have been transmitted to BG to contextualize the review. These documents were not reviewed in detail by BG.

In the BG's opinion the Protocol fulfils the condition MCoA E13:

- The Protocol has been prepared in consultation with the TMC and the other stakeholders.
- The application of the methodology described in the Protocol (and in the T&C management plan) would allow the TVS / TMCS / IRP (IMS) to operate together to ensure MCoA conditions of approval concerning air quality are met.

The final demonstration of the integration between TVS / TMCS / IRP (IMS) will necessitate the following:

- Application of the methodology indicated in the Protocol and T&C management Plan and successful completion of all the tests, including integration tests.
- Adequate formation of the tunnel operator.
- Fine tuning of the interaction TVS / TMCS after opening to the traffic.

APPENDIX 01 - QUESTIONS AND ANSWERS	
Project:	WestConnex M4-M5 Link Tunnel - Review of the tunnel ventilation, traffic incident response and traffic management systems integration protocol
Author of document:	BG Consulting Engineers Ltd.

No.	Reviewer Name	Date of question	Origin	Document Reference	Doc. Revision	Doc. Date	Section	Question	ASBJV response
1	Xavier Guigas	25.10.2022	BG	WestConnex M4-M5 Link Instrument of Approval_201118	-	Nov. 2020	E	The review of the integration protocol (according t0 E13 of the MCoA) must concentrate on the air quality management (in-tunnel air quality and outlet air quality). Please confirm this understanding.	This is ASBJV's understanding.
2	Xavier Guigas	25.10.2022	BG	Testing & Commissioning Management Plan M4M5-LSBJ-PRW-MES-MP01-PLN-0003	3	30.05.2022	3.9	Our understanding of the testing and commissioning plan is that the integration between TVS and TMCS will be tested during the SIT, all the other previous test phases are prerequisites for the SIT. Is that correct ?	This is correct.
3	Xavier Guigas	25.10.2022		- M4M5-LSBJ-PRW-MES-ME04-RPT-0005.D.FD AMBIENT AIR MONITORING REPORT - M4M5-SICE-PRW-MES-OM30-RPT-0005.D.FD PMCS FUNCTIONALITY - VENTILATION - M4M5-SICE-PRW-MES-OM22-RPT-0005.E.IFC-R TMCS FUNCTIONALITY - VEHICLE MONITORING			- 3.18 - 3.2.23 - 3.2.7	The documents in reference have sections dedicated to "System Integration". These sections are however very short and do not explain the interation between the different systems (TMCS / TVS). Are those interactions described in other specific documents ?	Refer to OM30-RPT, Section 3.2.14 - Ventilation Normal Mode (ALG_NORMAL_VENT) for TMCS/TVS interaction.
4	Xavier Guigas	25.10.2022	BG	Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol M4M5-LSBJ-PRW-GEN-OP01-PLN-0006	A	02.09.2022	6, 7, 8	It is understood that the TMCS and TVS (PMCS ventilation functionnality) should work in an integrated manner. Data from TMCS should trigger TVS actions/functionnalities and vice versa. Could you please provide BG with: - an exhaustive list of the TVS actions triggered by the TMCS. - an exhaustive list of TMCS actions triggered by the TVS. - for each action (or group of actions) the related test procedure in relation with the air quality management. - summary of the status / progress / results of these tests.	1. An exhaustive list of the TVS actions triggered by the TMCS. - Traffic level - level 1 to 4 - Refer to tables A.36a to A.37b. 2. An exhaustive list of TMCS actions triggered by the TVS. - OM17 and OM63 identifies the incidents raised by vent system and available TMCS responses for each of those incident types. 3. For each action (or group of actions) the related test procedure in relation with the air quality management. - ASBJV to provide test procedures 4. Summary of the status / progress / results of these tests. - ASBJV still to advise regarding status
5	Xavier Guigas	25.10.2022	BG	Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol M4M5-LSBJ-PRW-GEN-OP01-PLN-0006	A	02.09.2022	9	Our understanding is that the IRP (Incident Response Plan) contains specific procedures that are proposed to the tunnel operator in relation with specific events (incidents). Some of these procedures can trigger, in an automated way, actions of the TVS. Is that understanding correct ?	Depending on the incident or incident subtype the incident management window may be available to the operator to implement a response, e.g. implement traffic plans, close lanes etc. Incident management window also has incident response plan tab and ventilation management tab available which would allow the operator to change vent modes etc. Tunnel vent related incidents are as follows: INCIDENT: Air Quality incident in tunnel INCIDENT SUBTYPES: 1. In-Tunnel Air Quality calculated by algorithm 2. In-Tunnel Air Quality 3. Ventilation Outlet 4. Portal Emissions 5. Reduced Visibility / Smoke 6. Inadequate Air velocity 7. Toxic fumes in tunnel INCIDENT: Ventilation System Maintenance Tasks INCIDENT SUBTYPES: 1. Equipment test program / Time program Configurable plan 2. Ventilation Facility Equipment / CPVF equipment testing 3. Flushing of the Stage 3 stubs / Flashing of the stubs
6	Xavier Guigas	25.10.2022	BG	Tunnel Ventilation, Incident Response and Traffic Management System Integration Protocol M4M5-LSBJ-PRW-GEN-OP01-PLN-0006	A	02.09.2022	9	Similarily to question 3, in relation to question 4 and concerning the IRP, could you provide BG with: - an exhaustive list of the TVS actions from IRP triggered through the TMCS. - for each action (or group of actions) the related test procedure in relation with the air quality management. - summary of the status / progress / results of these tests.	- See vent management tab, OM63 - ASBJV to provide test procedures where applicable. - ASBJV still to advise regarding status
7	Xavier Guigas	25.10.2022	BG	-	-	-	-	The integration between TVS and TMCS will be tested pior to the tunnel opening to traffic. What will be the methodology used to simulate the interactions between these two systems without traffic data and pollution data ?	- ASBJV to provide test procedures