

Standard

Rolling Stock - Tram - Communication Systems

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1 PURPOSE

The purpose of this document is to specify the minimum requirements for the function, performance and maintenance of communication systems on existing Yarra Trams rolling stock fleet.

2 SCOPE

The requirements described in this standard apply to the maintenance and modifications to existing trams. This standard does not specify requirements for design or procurement of communication systems for new tram types.

This standard defines the minimum requirements to support the safe maintenance for communication systems on existing Yarra Trams rolling stock fleet.

This standard considers the differing age profiles, tram and communications system designs and modification levels of trams and communications systems in use on the existing Yarra Trams rolling stock fleet.

This standard recognises that any previous designs or modifications to a tram system will have been designed to those standards in force at the time of the tram design and manufacture. Some of the existing trams will have been designed to standards no longer in force and possibly no longer available. Accordingly, this standard only documents the 'as designed' or current modification level functions, performance characteristics and maintenance requirements for each existing tram type.

The requirements in this standard are derived from the following sources:

- OEM manuals supplied at the time of manufacture
- Previous upgrades/ modifications undertaken since the time of manufacture
- The original specifications for the trams
- Standards available at the time of design
- Local Subject Matter Expert knowledge

Unless otherwise stated, application of this standard is not retrospective to existing trams that are not being modified.

Any future modifications or enhancements to trams, for example for obsolescence, safety or to improve performance, shall, so far as is reasonably practicable, seek to comply with currently accepted standards.

The design and review process shall comply with requirements of the Yarra Trams 'Manage Design Procedure' (CE-021-PR-0006).

3 COMPLIANCE

This standard shall be fully complied to when undertaking maintenance or modifications on the existing tram fleets. Deviation from this standard is only permitted when a Waiver has been sought and approved by the Engineering Design Authority at Yarra Trams.

The Yarra Trams Engineering Change Management Procedure (CE-021-PR-0020) shall be followed in all circumstances where change is proposed to the communication systems on Yarra Trams' existing fleet. For the avoidance of doubt this shall include, but not be limited to:

- An engineering risk assessment in accordance with the Enterprise Risk Assessment and Assurance Framework (c016wi11).
- An assessment to determine the appropriate Safety Integrity Level (SIL) for any modification that has electrical/electronic/programmable electronic safety-related systems. The SIL assessment shall comply with International Electrotechnical Commission's (IEC) standard IEC 61508.
- Complying with the requirements of EN 50155 for any modification that has electronic equipment.
- A list of all applicable laws and standards to be complied with for that modification for review and agreement by Yarra Trams Engineering Design Authority.

A compliance schedule shall be completed and returned for any engineering change activities on communication systems on Yarra Trams' existing fleet. Assessment of compliance shall be provided for each requirement, defined by one of three permissible responses:

- Compliant;
- Partially Compliant;
- Non-Compliant.

Absolute requirements in this standard are defined within square brackets and a tolerance level as a percentage or range e.g. [AM 4000mm $\pm$ 10%. or 3960mm to 4040mm].

Compliance terminology defined in this standard shall be adhered to with the following definitions:

- 'Shall' statements are mandatory in the context of compliance with requirements stipulated in this standard.
- 'Should' statements are considerations in the context of compliance with requirements stipulated in this standard.
- 'Information' statements provide additional content for clarification purposes only and are not requirements in the context of compliance with this standard.
- 'So far as is reasonably practicable' statements must at a minimum result in the provision of an engineering risk assessment in accordance with the Yarra Trams Safety Management System and So Far As Is Reasonably (SFAIRP) Guidance Notes (Rail Safety Regulator).

Note: All standards referred to within this document are correct at the time of writing. It is the responsibility of the user to always ensure the most current version of any standard is referred to when applying any given standard.

4 REQUIREMENTS

4.1 Maintenance of Existing Trams

- 4.1.1.1 Maintenance plans and maintenance instructions shall ensure that routine maintenance (including tram service preparation checks) are applied at a frequency adequate to ensure that the communication systems and equipment are in a compliant condition for safe operation of the trams. Any communication systems or equipment that are not functioning correctly shall be repaired or replaced in accordance maintenance plans or instructions.
- 4.1.1.2 Tram management systems should, where possible, be used to complete as much of the tram service preparation checks so far as is reasonably practicable.

4.2 Modifications to Existing Trams

Any modifications to trams shall consider the following requirements.

4.2.1 General

- 4.2.1.1 Communication systems shall be designed on the principle of open architecture and use industry standards for interfaces and communication protocols between elements.
- 4.2.1.2 Communication systems should comply with the Network Technical Standards for OCMS (PTV-NTS-005 Operational Control and Management Systems).
- 4.2.1.3 Unless agreed with Yarra Trams Engineering Design Authority through exemption, any modification shall be compliant with Disability Standards for Accessible Public Transport 2002 (DSAPT).

4.2.2 Automatic Tram Location System (AVM/AVMS)

- 4.2.2.1 The AVM/AVMS is a Melbourne Metropolitan Tram Network (MMTN) wide communications and data system to assist with the management of the network, providing communications and data transfer between the operations team and all trams.
- 4.2.2.2 The AVM/AVMS shall be capable of interfacing to the TCMS, and other on vehicle systems such as VPIS, APC, EAPS using defined interface specifications.
- 4.2.2.3 The AVM/AVMS requires two power supplies; a permanent power 24V DC negative earth supply of 16 Amp capacity and an ignition switched 24V 8 Amp supply. Both supplies shall be protected by circuit breakers.
- 4.2.2.4 The AVM requires two low profile transit antennas protected by suitable insulated radomes. One antenna is for UHF Mobile band 500-520 MHz, the other is for receive only (sign post beacons) on 38.575 MHz. EN50155 compliant antennas are preferred.
- 4.2.2.5 The AVMS requires two low profile antennas protected by suitable insulated radomes. One antenna is for UHF Mobile band 500-520 MHz, the other is a multi service MiMo GPS/Cellular/Wi-Fi antenna serving all Australian defined cellular and Wi-Fi bands as defined by the current AVMS hardware interface specification. EN50155 compliant antennas are preferred.

4.2.3 Brake Light Control System (BLCS)

- 4.2.3.1 The BLCS shall interface to the TCMS, where fitted.
- 4.2.3.2 The BLCS shall automatically recognise the active cab and the direction of travel.
- 4.2.3.3 Any BLCS modifications shall conform to Australian Design Rules for motor vehicles.

4.2.4 Closed Circuit Television System

- 4.2.4.1 The CCTV system should interface to the TCMS so far as is reasonably practicable.
- 4.2.4.2 All cameras shall be contained in housings suitable for the environment in which the set operates, as defined in AS 60529 Degrees of protection provided by enclosures (IP Code). This includes dust and driving rain whilst travelling at speed and cleaning in wash facilities.
- 4.2.4.3 Full specifications for image quality, frame rate, positioning and storing of data shall be sought from AS 4806: Closed-Circuit Television (CCTV)—Management and Operation.
- 4.2.4.4 CCTV shall comply with the Australia and New Zealand police recommendations for CCTV.
- 4.2.4.5 Further requirements for the CCTV System shall comply with Yarra Trams Standard, Rolling Stock - Tram - Auxiliary Systems (CE-021-ST-0026).

4.2.5 Door Control and Monitoring System (DCMS)

- 4.2.5.1 The DCMS shall interface to the TCMS So far as is reasonably practicable.
- 4.2.5.2 Further specification for door control, monitoring and emergency systems see Yarra Trams Standard, Rolling Stock - Tram - Access and Egress (CE-021-ST-0028) for requirements.

4.2.6 Drivers Communication Systems (DCS)

- 4.2.6.1 Driver communication systems shall, where fitted, enable the driver to communicate with the Fleet Operation Center, between cabs, passengers and other road users.
- 4.2.6.2 If fitted, the right-hand side of the driver's cab shall incorporate an openable portion that when fully opened provides a clear opening of at least 300 mm by 300 mm for passing of information to/from the driver from outside of the vehicle
- 4.2.6.3 Each cab shall be fitted with a driver's gong and or horn with the tonality, volume, angle of sound specific for the Yarra Trams Network.
- 4.2.6.4 Each cab shall be fitted with a driver's horn with the tonality, volume, angle of sound specific for the Yarra Trams Network.
- 4.2.6.5 Modifications to electrical and mechanical gongs shall ensure recorded decibel levels at 1m and 16m are no worse than manufacturers requirements.

4.2.7 Fire and Smoke Detection System

- 4.2.7.1 See Yarra Trams Standard, Rolling Stock - Tram - Fire Safety Systems (CE-021-ST-0024) for requirements.

4.2.8 Disabled Passenger Communications System (DPC)

- 4.2.8.1 Passenger call buttons shall provide a signal to the driver and all passengers on the tram.
- 4.2.8.2 The location of DPCs shall be agreed with Yarra Trams Engineering Design Authority.

4.2.9 Next Stop Button (NSB)

- 4.2.9.1 Next Stop Buttons shall provide a signal to the driver and all passengers on the tram.
- 4.2.9.2 The audio signal shall be a tone of a short duration and the tone shall only be used for the Next Stop Button.
- 4.2.9.3 Next Stop Buttons shall be located throughout the saloon and within reach of any person within the Australian Anthropometry. Reference should be made to Australian Anthropometry as defined within the anthropometry dataset PeopleSize.

4.2.10 On Tram Monitoring Recorder (OTMR)

- 4.2.10.1 The OTMR may be referred to as the event or trip recorder and, when fitted, interface to the TCMS.
- 4.2.10.2 The OTMR shall be the primary device to record the operation of the tram.
- 4.2.10.3 The OTMR shall have the capacity to store all data for a period defined by the Engineering Authority.
- 4.2.10.4 Data taken from the OTMR shall be admissible as evidence in a Court of Law in Victoria.

4.2.11 Radio Systems

- 4.2.11.1 Radio Systems shall be in adherence with bandwidth as licensed and authorised by Australian Communications and Media Authority (ACMA) and administered by VicTrack.

4.2.12 Passenger Counting System

- 4.2.12.1 The passenger counting system should be capable of recording passenger count data to monitor passenger boarding and alighting by route, direction of travel, location and time.
- 4.2.12.2 Data should be held for at least 7 days of operation of the tram in service after which the earlier data may be overwritten.

4.2.13 Passenger Emergency Communications (PEC)

- 4.2.13.1 The PEC system shall enable the passenger to initiate a call to the driver.

- 4.2.13.2 The activation of the system shall open a two-way audio channel between the passenger and the driver, and the communication should be recorded.
- 4.2.13.3 Unless agreed with Yarra Trams Engineering Design Authority through exemption, any modifications shall be compliant with Disability Standards for Accessible Public Transport 2002 (DSAPT).

4.2.14 Passenger Information System (PIS)

- 4.2.14.1 The PIS shall interface with the AVM, where fitted.
- 4.2.14.2 Any PIS audio announcements shall be clearly audible and shall be compliant with Disability Standards for Accessible Public Transport 2002 (DSAPT).
- 4.2.14.3 The illumination level of all displays shall be legible in all ambient light conditions.
- 4.2.14.4 Displays shall be compliant with the latest versions of VicRoads Standards TCS 034 Variable Message Signs for Arterial Roads.

4.2.15 Tram Control and Management System (TCMS)

- 4.2.15.1 The TCMS shall provide monitoring, control, indication, communication, data storage and data retrieval functionality for the effective and efficient operation and maintenance of the modified tram.
- 4.2.15.2 The TCMS shall interface to the on-tram systems to maintain specified performance levels.
- 4.2.15.3 The TCMS shall integrate with the Automatic Tram Location System (AVM).
- 4.2.15.4 All safety functions controlled by software should have SIL level as is defined by EN50126, EN50128 and EN50129.
- 4.2.15.5 All tram control inputs shall be recorded. These inputs are to be date and time stamped.
- 4.2.15.6 All faults shall be reported back to the driver with applicable operating conditions.

4.2.16 WLAN

- 4.2.16.1 The WLAN shall enable the transfer of data from the tram. Any modifications shall ensure a secure means for access control using the WLAN.

4.3 Other Systems

- 4.3.1.1 See Yarra Trams Standard, Rolling Stock - Tram - Vigilance Systems (CE-021-ST-0030) for requirements.

5 RELATED LEGISLATION & DOCUMENTS

Document Number	Name
CE-021-PR-0006	EMS04 Manage Design Procedure
CE-021-PR-0020	EMS06 Engineering Change Management Procedure
CE-021-PR-0004	EMS05 Deviation from Standards Procedure
c016wi11	Enterprise Risk Assessment and Assurance Framework
IEC 61508	Functional Safety
EN 50155	Railway Applications - Rolling Stock - Electronic Equipment
EN50126	The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
EN50128	Software for railway control and protection systems
EN50129	Safety related electronic systems for signalling
N/A	National Code of Practice for CCTV Systems for the Mass Passenger Transport Sector for Counter-Terrorism (the Code)
AS 4806	Closed-Circuit Television (CCTV) - Management and Operation
AS 60529	Degrees of protection provided by enclosures
PTV-NTS-005	Operational Control and Management Systems
TCS 034	Variable Message Signs for Arterial Roads
CE-021-ST-0030	Rolling Stock – Tram – Vigilance Systems
CE-021-ST-0028	Rolling Stock – Tram - Access and Egress
CE-021-ST-0026	Rolling Stock - Tram - Auxiliary Systems
CE-021-ST-0024	Rolling Stock - Tram - Fire Safety Systems
PTV-NTS-005	Operational Control and Management Systems

6 DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	12/03/2020	Original approved issue.
1.01	15/12/2021	Periodic review. Fixing pr task.
1.02	31/05/2023	Review date extension as per Carla Purcell
1.03	8/11/2023	Periodic review no Change
2.0	9/09/2025	Periodic review. Reassigned author.

Version History	Date	Detail
3.0	24/09/2025	4.2.2 AVM/AVMS section updated, ignition power and antenna types. Section 4.2.17 Windscreen wipers deleted. SCP endorsed 2024

7 GLOSSARY

Term	Definition
AVM	Automatic Tram Location System
AVMS	Automatic Vehicle Monitoring Sustainment (updated AVM system)
BLCS	Brake Light Control System BLCS
DCMS	Door Control and Monitoring System
DCS	Drivers Communication System
DPC	Disabled Passenger Communications System
DSAPT	Disability Standards for Accessible Public Transport 2002
Engineering Design Authority	The person or position designated by the Franchisee with the authority to approve engineering design changes, modifications and the TMPs under a system which complies with AS/NZS ISO 9001 Quality Management Systems or similar standard and AS4292 Railway Safety Management as applicable to rolling stock providers.
IEC	International Electrotechnical Commission
NSB	Next Stop Button
OCMS	Operational Control and Management Systems
OEM	Original Equipment Manufacturers
OTMR	On Tram Monitoring System
PEC	Passenger Emergency Communications
PIS	Passenger Information System
SIL	Safety Integrity Level
TCMS	Tram Control Monitoring System
Waiver	Waiver process as per EMS05 Deviation from Standards Procedure.
WLAN	Wireless Local Area Network