

Standard

EMS05 Generic ICT Communication Pathways Standard

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1 PURPOSE

The purpose of this standard is to specify the requirements for ICT communication pathways in Yarra Trams. A standard approach will facilitate the interoperability of infrastructure subject to ICT communication.

2 SCOPE

This standard is based on the requirements documented in Yarra Tram Information and Communications Technology (ICT) infrastructure. The requirements described in this standard apply to ICT infrastructure supporting public transport sites including, but not limited to operational communications systems installation at offices, stabling yards, maintenance facilities and sidings, tram stops and depots.

2.1 Terms

The term ICT encompasses the following typical operational communications systems including, but not limited to:

- a) Closed Circuit Television (CCTV)
- b) Passenger Information Displays (PIDS)
- c) Public Address (PA) and intercom systems
- d) Customer Help Points (CHP)
- e) All voice and data services, including operator Intranets and public telephones
- f) Security Systems
- g) Access Control Systems
- h) Radio systems
- i) Tram control systems
- j) Tram stabling displays
- k) SCADA systems
- l) Trackside Measuring systems

2.2 Scope of Works

The scope of works for the conduit system shall include the detailed design (shop drawings), supply and installation of a communications pit and pipe conduit infrastructure to suit the requirements of all ICT communication systems to be installed on site. Specific items of scope are:

- a) Completion of a detailed design shop drawing based upon the supplied conduit plan, providing specifics such as types, sizes, depths and routes of all items for the pit and pipe install. The drawing shall be submitted to Yarra Trams for review and approval. The installation shall be based on this drawing once approved by Yarra Trams.
- b) Development of a conduit installation as-built drawing is showing the actual conduit system installation including depth and alignment to site building or kerb lines, pit sizes and locations, assigned pit identification numbers and all relevant details to allow users to locate, access and run cables through the life of the site.



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- c) Supply and installation of conduits, pits and accessories to provide a complete ready to use pit and pipe system.

2.3 Detailed Design

The detailed design shall be coordinated with other civil works on the site through collaboration and consultation with the respective designers, to ensure that the position of conduits and pits avoids clashes with other buried services which may include wastewater, stormwater, water supply, gas supply, electrical distribution, carrier services, electricity supply, traction supply, signalling and compressed air.

2.3.1 Coordination

The detailed design shall be coordinated with architects and building services designers to ensure building entry conduits emerge at agreed locations against walls or cable pathway access points, and that the building connection pits are situated in locations which do not clash with building access or function.

The detailed design shall be coordinated with electrical and structural engineers specifying poles and structures supporting ICT assets to ensure that spur conduits from pits to such poles or structures enter the base via a sweeping bend encased in the concrete footing.

2.4 Design Authority

The Design Authority (DA) on all CCTV and operational ICT projects shall be directly involved in all scope change decisions and technical information exchanges throughout the project lifecycle. The DA role (position, organisation, role description) shall be specified in the Project Management Plan and the Design Management Plan for the project.

2.5 Liaison

Liaison with the DA regarding delivery of the pit and pipe installation shall be instigated by the Contractor regarding:

- a) review of shop drawings;
- b) installation inspections; and
- c) as-built documentation review.

3 COMPLIANCE

This standard must fully comply with Information Security Standard. Deviation from this standard is only permitted when a deviation or waiver has been formally requested and approved by the Engineering Design Authority at Yarra Trams.

The Yarra Trams Management of Change (MoC) process must be followed in all circumstances where change is proposed to this standard.

Where a standard is updated, the function(s) which the standard(s) applies to shall discuss and acknowledge via way of toolbox talk sign or equivalent recordable method.



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4 REQUIREMENTS

4.1 General

The pit and pipe system shall comprise the following elements in all areas serviced by underground pathways:

Pits and conduits are classified into the following categories.

- a) Backbone pits or conduits – Pathway of main communications bearers. E.g. between main field, comms rooms or buildings.
- b) Distribution Pits or conduits – Pathway of intermediate communications bearers. E.g. between the main pathway and sub cabinets or unique areas. E.g. platforms.
- c) Spur / Edge pits or conduits – Pathway between distribution pits/cabinets and edge or field devices or housings:
 - i. For trunk route trenches, supply and installation of rigid 1xP50 (internal diameter white communications conduits, including polypropylene drawcords in all conduits,
 - ii. For directionally drilled bores, supply and installation of rigid P100 (internal diameter) polypropylene conduit, including polypropylene drawcords in all conduits.
- d) Pole base pits or conduits – Pathway used to pass communications bearers onto structures or poles. These pits are used to enable communications isolation when structure replacement/maintenance is performed.
- e) Pits shall be installed throughout facility whenever conduit paths change directions, transverse or penetrate the surface.
- f) Supply and installation of minimum dual rigid P50 (internal diameter) white communications conduits in all spur trenches, including polypropylene drawcords in all conduits, and

4.1.1 Infrastructure

The infrastructure shall generally comply with the relevant clauses of referenced documents, with particular attention to the following:

- a) All sections of AS3084 relating to inter-building and campus pathway conduit systems

4.2 Backbone Pit and Pipe Infrastructure

4.2.1 Pit and Pipe

A pit and pipe (conduit) system shall be provided over all underground cable routes through the site to support specified communications requirements. This infrastructure shall support the services outlined in section 2.2.

4.2.2 Conduit

The minimum backbone conduit provision for the full length of the conduit runs shall be:

- a) Tram Platforms: 2 × P80 white conduits (3.8mm wall thickness), and



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- b) Depot Car Parks: 2 × P80 white conduits (3.8mm wall thickness).

4.2.3 Stabling yards and maintenance facilities

Stabling yards and maintenance facilities the minimum backbone conduit provision for the full length of the conduit runs and into all buildings shall be 2× P100 (6mm wall thickness) rigid white conduits.

4.2.4 Minimum spur conduit provision

Within the Tram precincts the minimum spur conduit provision for the full length of the conduit runs shall be:

- a) Platforms: 2× P80 rigid white conduits (3.8 mm wall thickness) between the main field Comms cabinet and each platform pit.
- b) Platforms: 1×P80 rigid white conduit (3.8mm wall thickness) between tram stop communications cabinet and Centre of Track Communications pathway (Fibre incoming path). Where no main communications cabinet exists, individual conduits must be run to each and every platform pit or cabinet.
- c) Platforms: 2×P80 rigid white conduit (3.8mm wall thickness) between interconnecting platform communications pits.
- d) Platforms: 2×P32 rigid white conduit (2.85mm wall thickness) from each and every shelter to associated platform communications pit. The configuration may be 1 per shelter end or 2 at a single shelter end, dependent upon the shelter design and site specifics.
- e) Car parks and stabling yards: 2×P100 rigid white conduit (6mm wall thickness) between major field communications cabinets and backbone or distribution pits.
- f) Car parks and stabling yards: 2×P80 rigid white conduit (3.8mm wall thickness) between backbone pits and distribution pits.
- g) Car parks and stabling yards: 2×P50 (2.95mm wall thickness) rigid white conduits between distribution pits and pole base pits.
- h) Car parks and stabling yards: 2×P50 (2.95mm wall thickness) rigid white conduits from nearest pit to all locations housing Field LAN Edge Switches. (e.g. Poles, Walls).

4.2.5 Conduit bends

All conduit bends from horizontal to vertical shall be a minimum radius of 6×[conduit diameter], i.e. long sweep.

4.2.6 Haul pits

Haul pits shall be provided at nominally 100 m maximum spacings in strategic locations such as the junction of several backbones, major direction changes and to optimise spur conduit connections to poles and post mounted items.

4.2.7 Underground conduit Pits

- a) Pits for all underground conduit routes shall meet the following requirements:
- b) All pits shall comply with AS3996



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- c) Pits terminating track crossings and any pits containing fibre splices shall be size 99 polycrrete with extension risers.
- d) Pits used for backbone communication conduits/cabling shall be size 66 polycrrete with extension risers.
- e) Pits used for Tram Platforms shall be size 66 polycrrete with extension risers.
- f) Pits used at pole bases in trafficable areas or on hard finished surfaces shall be size 45 polycrrete with extension risers.
- g) Pits used at pole bases in non-trafficable garden reserves may be substituted for size 43 polyethene with concrete lid.
- h) Pits in non-trafficable areas shall be provided with a recessed, galvanised locking lid capable of being locked with a padlock keyed to Yarra Tram's requirements. E.g. Building entry pits, site entry pits.
- i) Pits in foot only trafficable areas shall be provided with Class A concrete lids and finished to match the surrounding surfaces.
- j) Pits in trafficable areas (including maintenance vehicles) shall be provided with Class D lids and load-bearing concrete surrounds and finished to match the paved surface.
- k) In rectangular plastic pits, all conduits must enter through the ends of the pit and not the sides.
- l) Unused pit entries shall be sealed to prevent ingress of soil, water and vermin.
- m) All pits shall be drained to either:
 - i. a drainage trench of minimum 2m length and 0.2m diameter filled with 20mm coarse aggregate grade gravel and sloping down and away from the pit base; or
 - ii. a lower level gravel bed of 20mm coarse aggregate grade gravel, having a minimum depth of 50cm below the entire base of the pit.
- n) Where pits are being placed in rock or heavy clay conditions the Design Authority is to be consulted regarding drainage requirements.
- o) All backbone and building entrance conduits shall be fitted with a rounded bush or bell mouth at the pit entry to achieve a flush, rounded and firmly secured finish to the pit wall, to prevent any bedding sand from washing into the pit over time.
- p) Pits shall be spaced apart at the following maximum intervals on long runs without major spurs:
 - i) In solid fill platforms: 50 m
 - ii) In car parks and pedestrian areas away from platforms: 100 m
 - iii) Around stabling yards: 100 m
 - iv) Where communications conduits pass tram poles, pole base pits shall be installed at each and every pole base.
- q) Pits and spur conduits shall be positioned to minimise cable run lengths to edge devices. By design, the need to run a cable through a spur along a trench route in one direction and then double back along a trunk conduit in the opposite direction shall be avoided where possible and minimised if unavoidable.
- r) A Pole base pit shall be fitted no further than 1,000mm from the base of any pole or structure where communications cabling or conduits continue onto the pole or structure.
- s) Conduits or cabling must never directly run up onto poles without a pole based pit.



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4.2.8 Underground conduits Depth

Underground conduits shall be provided with the following depths of cover to the top of the highest conduit:

- a) Under platform paving 450 mm below finished paving level. Refer to S009 for conduits within a slab or directly under concrete.
- b) The 450mm cover around the site but away from the track corridor should only be in the non-trafficable areas. If exposed to traffic, the depth should be 650mm.
- c) Track crossings: 650 mm below the top of the rail.

4.2.9 Requirements Conflict

Where the requirements of 6.2.8 conflicts with the requirements of other buried services which may have significant depth and route constraints (such as drainage), a custom civil design shall be developed in consultation with the other services to meet the track support and deflection requirements underpinning the 650 mm below top of rail criterion by running the affected conduits with reduced depth of cover by encasing the conduits and other pipes in a suitable strength of LSCM ("low strength cementitious mix").

4.2.10 Cable distribution under suspended slabs

Cable distribution under suspended slabs shall meet the following requirements:

- a) The area under the suspended slab shall be physically secured from unauthorised access at a minimum 900mm to permit ready access by authorised installers and maintainers after pipes and conduits are fitted. (If this criterion is not met, a suspended conduit infrastructure with surface level access pits shall be provided in lieu of suspended tray, refer to clause 6.2.11).
- b) A suspended cable ladder tray system shall be provided with the tray bottom at least 300 mm below the finished slab to distribute cables along the platform and to support cable spurs connecting to communications equipment.
- c) Cable tray shall be a minimum of 450 mm W×50 mm H galvanised steel ladder tray, Burndy LT3-450 or approved equivalent.
- d) A galvanised steel segregation barrier 50 mm high shall be provided within 100 mm of one side of the tray for its full length, and the 100 mm wide segregated zone reserved for 100V line Public Address speaker cables.
- e) Tees and vertical bends and/or spur conduits shall be provided to support and segregate cables teeing off the tray to surface penetration conduits leading to station terminal equipment or entering the equipment room.

4.2.11 Pits in suspended slab floors

Pits in suspended slab floors with under-slab suspended conduit distribution infrastructure shall meet the following requirements

- a) Pits shall be provided with recessed locking lids and locking bars and have paving inserted to match the surrounding finish.



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- b) The pit size shall be consistent with the number of conduits being terminated onto each face. Rectangular pits with all conduits terminating at the pit ends shall be at least 300 W × 600 L. Pits having spur conduits entering at the sides shall be at least 500 × 500 square.
- c) The pit depth shall be consistent with the thickness of the slab, and suspension depth of conduits under the slab, allowing the conduits to enter the slab without bending up in the vertical plane.
- d) Pits shall have a drain hole at the base left open (to drain to the ground below) or be fitted with a drain pipe connected to a stormwater drain.
- e) The type of inspection pit for each application is to be approved by Yarra Trams.
- f) Spur conduits to surface equipment shall enter pits in the horizontal plane and bend up to the vertical plane below or within the respective suspended slab penetration.

4.2.12 Pits lids

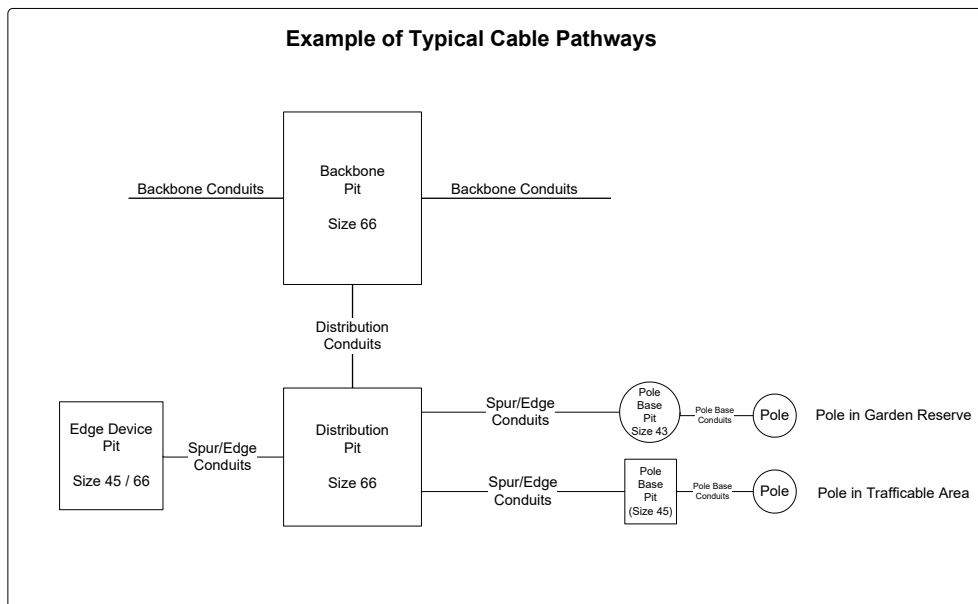
All Pits lids shall be labelled or embossed permanently with the word “Communications” or “Comms”. Pit Lids with labels referring to Power or electrical shall not be used.

4.2.13 Post Installation

Upon installation conduits shall be cleaned and tested using a mandrel of at least 90% of the conduit inner diameter and length three times the inner diameter.

4.2.14 Polypropylene drawcord

All conduits shall be fitted with a polypropylene drawcord. A new cord shall be hauled with each cable pull to facilitate further future overhauling.





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4.3 Implementation, Commissioning and Documentation

4.3.1 Overview

- Project implementation intend is to ensure all activities are only commenced once applicable documentation and drawings have been presented for and have been approved by the Design Authority as per section 2.7.
- The Contractor shall ensure all contract deliverables required pre-implementation are delivered and approved by the Design Authority prior to implementation works commencing.
- As-Built drawings will be completed by the Contractor based upon the installed system by process of editing the approved 'for construction' drawings.
- The Design Authority reserves the right to reject work of an unacceptable standard and will commit to performing reviews of delivered documentation within ten (10) working days of receipt under normal circumstances. The Contractor will rectify such work at their cost and re-submit. Rejection of a reviewed item will not constitute grounds for project delays or variations.
- Acceptance of these works shall be based upon provision and Design Authority approval of all Contract Data Requirement List (CDRL) items and site inspection to be conducted by Yarra Trams and the Contractor.

4.3.2 Records

- A pit schedule shall be provided by the Contractor comprising a spreadsheet format table listing every pit ID together with its easting and northing measured via differential GPS with a minimum accuracy of ± 100 mm.
- A conduit schedule shall be provided by the Contractor comprising a spreadsheet format table listing every conduit ID, its start and end depth and length (to an accuracy of better than ± 1 m).
- Records shall be supplied by the Contractor electronically in both native editable and PDF formats.

4.3.3 Drawings

- All drawings, including the use of symbol sets, shall generally comply with VRIOGS 007.2 Infrastructure Drawing Standard and relevant Australian Standards including all those referenced in AS 3085.1, AS 1102 and AS 4383 (all parts). Where the requirements of AS 3085.1 are shown as informative, they shall be treated as normative (mandatory) for the purposes of the respective conduit works.
- Drawings shall include the following elements:
 - a) key dimensions and a scale rule for physical layouts;
 - b) changes made during construction and the commissioning period;
 - c) size, capacity and terminations of pathway elements in accordance with AS 3085.1, AS 1102 and AS 4383 conventions.



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- All 'As In Service' drawings shall be booked in and out of DMS in accordance with DMS processes and procedures.
- As part of the authorisation process, all drawings must be submitted to the Yarra Trams both as 3 hard copies, and as electronic files on CD-ROM media in the following formats:
 - d) portable document format (.pdf) electronic files; and
 - e) CAD files in editable *.dwg (Autocad) format.

4.3.4 DATA REQUIREMENTS LIST

CONTRACT DATA REQUIREMENTS LIST:

- The following table lists those items of data/documentation deliverables to be delivered as part of

CDRL Item	Delivery Schedule
Conduit installation shop drawing	Prior to installation
Conduit system as built drawing	At Acceptance
Conduit/Pit records	At Acceptance

this project in accordance with the identified delivery schedule.

- All drawings shall be DMS compliant in accordance with **VRIOGS 007.2** and shall be authorised by the ARO prior to registration in DMS.

5 RELATED LEGISLATION & DOCUMENTS

Name	Document number
Closed circuit television (CCTV) Part 2: Application guidelines	AS 4806.2
Management of Change(MoC)	
Wiring rules	AS 3000
Information technology -- Generic cabling for customer premises -- Part 1: General requirements (ISO/IEC 11801-1:2017)	AS 3080
Telecommunications installations - Telecommunications pathways and spaces for commercial buildings	AS 3084
Telecommunications installations - Administration of communications cabling systems - Basic requirements	AS 3085.1
Installation of underground utility services and pipelines within railway boundaries	AS 4799
Preparation of documents used in electro technology	AS 4838.1 - 4
Installation requirements for customer cabling (Wiring Rules)	AS/ACIF S 009



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Graphical symbols for electro technical documentation	AS 1102
Preparation of documents used in electro technology Location and installation documents	AS 4383
Communications Cable Installation Specification Note: Applies primarily for site connection conduits for VicTrack services and within the track	VicTrack TS-SP-013 V2.3
Specification for Signalling Supply, Construction and Installation Note: Applies primarily to location boxes and pit and pipe construction within the track (including around stabling yards) and for connections of infrastructure to equipment rooms.	VRIOGS 12.2
CCTV Development Standard (Draft 1.9)	VRIOGS 013.2
Infrastructure Drawing Standards	VRIOGS 007.2

DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	12/04/2018	Original approved issue.
1.01	09/11/2018	Template update
1.02	19/09/2023	Periodic review. No change.
1.03	13/05/2025	Periodic review. No change.
1.04	26/03/2026	Changed logo to YJM

APPENDIX A – GLOSSARY

[Note that words defined in this document must be consistent with the glossary in Yarra Trams and list in alphabetical order.]

Word	Definition
ACMA	Australian Communications and Media Authority (formerly Austel, then Australian Communications Authority)
AFFL	Above finished floor level
CAD	Computer Aided Drafting
CCTV	Closed circuit television
CDRL	Contract Data Requirements List
CER	Communications Equipment Room
DA	Design Authority
DMS	DOT Drawing Management System



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Word	Definition
DOT	Department of Transport (Victoria)
ELV	Extra Low Voltage
KD	Keolis Downer
PDF	(Adobe) Portable Document Format
SAA	Standards Association Australia