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# Generic ICT communications pathways specification

Telecommunications

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Nothing in this document diminishes the responsibility of designers and constructors for applying the requirements of any applicable law or standard.

## Reviews and Amendments

This document should be reviewed every one (1) year by the Group Manager Engineering or amended as appropriate if the nature of operations changes significantly.

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## 1. Conventions

1. Words or phrases that appear capitalised out of context are defined within the Definitions section of this VRIOG Standard.
2. The word “**Shall**” is to be understood as mandatory.
3. The word “**Should**” is to be understood as non-mandatory i.e. advisory or recommended.
4. Uncontrolled Standards may not be referenced within the VRIOG Standards. These include former PTC Standards, Franchisee Standards, Franchisee Subcontractor Standards and Infrastructure Lessee Standards.
5. Controlled Standards, including Australian Standards and other VRIOG Standards, may be referenced but only if:
  - a) The referenced item cannot be adequately explained with an amount of text that could not reasonably be inserted into the body of the Standard.
  - b) The reader is not referenced to another Controlled Standard necessary for the item to be adequately explained i.e. one document link only.
  - c) The referenced document is a Figure or table and could not reasonably be included in the appendices of the Standard.
6. The format employed in the VRIOG Standards is compatible with Australian Standards, and will be used from this point on.
7. The VRIOG Standards contain engineering information necessary to operate a safe Railway. VRIOG Standards will not contain any information that can be construed as a work instruction, procedure, process or protocol. This information forms the basis of each individual entity’s Safety Accreditation Certification, and, as such, is outside the scope of VRIOG Standards.

## 2. Definitions

Terminology used and/or applied in this Standard is defined as follows:

Terminology	Definition
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
DOT	Department of Transport (Victoria)
ELV	Extra Low Voltage
PDF	(Adobe) Portable Document Format
SAA	Standards Association Australia
VRIOG	<p>Victorian Rail Industry Operators' Group (VRIOG) comprises the following members:</p> <ul style="list-style-type: none"> <li>Australian Rail Track Corporation (ARTC)</li> <li>Metro Trains Melbourne</li> <li>VicTrack</li> <li>V/Line</li> <li>Yarra Trams</li> <li>Public Transport Division of the Department of Transport</li> </ul>

Table 1 Acronyms

### 3. Scope and general

#### 3.1. Scope

- 3.1.1 This document constitutes the specification for the communications conduits, pits and pipes, to be installed as part of site Information and Communications Technology (ICT) infrastructure supporting public transport sites including, but not limited to operational communications systems installation at railway stations, stabling yards, maintenance facilities and sidings, tram stops and depots, and tramways, in Victoria.
- 3.1.2 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), including hearing augmentation loops
  - d. Clocks
  - e. Customer Help Points (CHP)
  - f. All voice and data services, including operator Intranets and public telephones
  - g. Security Systems
  - h. Access Control Systems
  - i. Lifts interfacing to ICT systems
  - j. Train Number Transmitter (TNT)
  - k. Position of Trains System (POTS)
- 3.1.3 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 communications 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 DOT and the relevant ARO for review and approval. The installation shall be based on this drawing once approved by DOT and the relevant ARO.
  - b. Development of a conduit installation as-built drawing clearly 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.
  - c. Supply and installation of conduits, pits and accessories to provide a complete ready to use pit and pipe system.
- 3.1.4 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 waste water, storm water, water supply, gas supply, electrical distribution, carrier services, electricity supply, traction supply, signalling and compressed air.

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- 3.1.5 The detailed design shall be coordinated with architects and building services designers to ensure building entry conduits emerge at agreed locations against walls or at cable pathway access points, and that the building connection pits are situated in locations which do not clash with building access or function.
- 3.1.6 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.
- 3.1.7 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.
- 3.1.8 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.

### 3.2. Applications

- 3.2.1 Main backbone cable pathways and signalling pathways requirements are addressed in VRIOG 12.2.1 and VicTrack's TS-SP-013.
- 3.2.2 The conduit installation shall follow the pathways identified in the supplied conduit plan and adhere to the requirements of this document and standards referenced therein.
- 3.2.3 The conduit installation is designed to service communications Extra Low Voltage (ELV) systems and shall be treated as such. Orange conduit shall not be used.
- 3.2.4 Where not explicitly covered in the specification, project specific design documentation and detailed infrastructure and equipment requirements are provided in the CCTV Development Standard (most recent version).
- 3.2.5 The ICT design will incorporate an equipment room to house ICT communications equipment as specified in VRIOGS 013.1: Communications Equipment Room Brief. Conduit entries into that room shall comply with the requirements of that specification.



## 4. System Requirements

### 4.1. General

- 4.1.1 The pit and pipe system shall comprise the following elements in all areas serviced by underground pathways:
- a. Trenching and / or directional drilling works to ensure conduits and pits are installed at required depths as follows:
    - I. For trunk route trenches, supply and installation of rigid 1xP50 (internal diameter white communications conduits, including polypropylene draw cords in all conduits,
    - II. For directionally drilled bores, supply and installation of rigid P100 (internal diameter) polypropylene conduit, including polypropylene draw cords in all conduits.
  - b. Supply and installation of minimum dual rigid P50 (internal diameter) white communications conduits in all spur trenches, including polypropylene draw cords in all conduits, and
  - c. Supply and installation of all required pits, with depth and width selected to achieve mandatory depths of cover and drainage slope (without the requirement to bend conduits up in the vertical plane to enter the pit).
- 4.1.2 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
  - b. VRIOGS 12.2-2007: Clauses 7.14 to 7.19
  - c. VicTrack TS-SP-013: clauses 1.2 through 1.4 and clause 4.

### 4.2. BACKBONE PIT AND PIPE INFRASTRUCTURE

- 4.2.1 A single 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 3.1.2.
- 4.2.2 Within the station precinct the minimum backbone conduit provision for the full length of the conduit runs shall be:
- a. Platforms: 2 x P100 white conduits (6mm wall thickness), and
  - b. Car Parks: 1 x P100 white conduit (6mm wall thickness).
- 4.2.3 Within stabling yards the minimum backbone conduit provision for the full length of the conduit runs and into all building shall be 2x P100 (6mm wall thickness) rigid white conduits.
- 4.2.4 Within the station precinct the minimum spur conduit provision for the full length of the conduit runs shall be:

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- a. Platforms: 1× P50 rigid white conduits (3.6 mm wall thickness) to all poles and locations carrying ICT infrastructure.
- b. Platforms: 2× P50 rigid white conduits (3.6 mm wall thickness) to all poles and locations carrying ICT infrastructure.
- c. Platforms and car parks: 4× P50 (3.6 mm wall thickness) or 1× P100 (6mm wall thickness) rigid white conduits from nearest pits to all CCTV Field LAN Switch locations.
- d. Stabling yards: 4× P50 (3.6 mm wall thickness) or 1× P100 (6mm wall thickness) rigid white conduits from the two nearest pits either side of each CCTV Field LAN Switch location.
- e. Car Parks and stabling yards: 1× P50 white conduits (3.6 mm wall thickness) to camera pole locations.

4.2.5 The conduit entries should conform with the requirements as defined in VRIOGS 013.1 Communications Equipment Room Brief.

4.2.6 All conduit bends from horizontal to vertical shall be a minimum radius of 6× [conduit diameter].

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

4.2.8 Pits for all underground conduit routes (including under solid fill platforms) shall meet the following requirements:

- a. Haul pits terminating track crossings and any pits containing fibre splices shall be size 99 polycrete with extension risers.
- b. Other haul pits shall be a minimum of size 66 polycrete and fitted with extension risers if necessary to reach the conduits, and fitted with lockable lids.
- c. Pits in paved areas shall be provided with a recessed, galvanised locking lid capable of being locked with a padlock keyed to the relevant ARO requirements, and have paving inserted to match the surrounding finish.
- d. Pits in trafficable areas (including maintenance vehicles) shall be provided with Class D “gatic” locking lids and load bearing concrete surrounds, and finished to match the paved surface.
- e. In rectangular plastic pits, all conduits must enter through the ends of the pit and not the sides.
- f. 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.
- g. Where pits are being placed in rock or heavy clay conditions the Design Authority is to be consulted regarding drainage requirements.
- h. 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.
- i. Pits shall be spaced apart at the following maximum intervals on long runs without major spurs:

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- i. In solid fill platforms: 20 m
  - ii. In car parks and pedestrian areas away from platforms: 100 m
  - iii. Around stabling yards: 200 m
- j. Pits and spur conduits shall be positioned to minimize cable run lengths to terminal 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 minimized if unavoidable.
- k. 'Spur conduits of up to 25m in length may be run directly to a pole, post, canopy or site building without the requirement for an associated terminating pit. For spurs over 25m in length, or where the spur undergoes direction changes prior to entering the terminating structure, the spur shall run to a Polycrete 45 pit located no more than 1.5m from the entry point of the structure. The pit shall be fitted with a recessed, galvanised, lockable lid able to be locked with a padlock keyed according to the relevant ARO requirements.

4.2.9 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: 1200 mm below top of rail.
- d. within Stabling Sidings within 3 metres parallel to the track : 1200 mm below top of rail

4.2.10 Where the requirements of 4.2.9 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 1200 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").

4.2.11 Cable distribution under suspended slab platforms shall meet the following requirements:

- a. The area under the suspended slab platform 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 platform level access pits shall be provided in lieu of suspended tray, refer to clause 4.2.12).
- 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 platform equipment.
- c. Cable tray shall be a minimum of 450 mm W x 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.

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- e. Cable tray shall run parallel with the back edge of the platform at a location clear of platform structural members and a minimum of 600 mm clear of other service pipes and ducts.
- f. Tees and vertical bends and/or spur conduits shall be provided to support and segregate cables teeing off the tray to platform penetration conduits leading to station terminal equipment or entering the equipment room.

4.2.12 Pits in suspended slab platforms 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.
- 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 x 600 L. Pits having spur conduits entering at the sides shall be at least 500 x 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 storm water drain.
- e. The type of inspection pit for each application is to be approved by the relevant ARO.
- f. Spur conduits to platform equipment shall enter pits in the horizontal plane and bend up to the vertical plane below or within the respective suspended slab penetration.

4.2.13 Labelling of pits and conduits will conform to VRIOGS 013.4 Naming Conventions (currently being drafted) agreed between DOT, the AROs and VicTrack.

4.2.14 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.

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

## 5. IMPLEMENTATION, COMMISSIONING AND DOCUMENTATION

### 5.1. OVERVIEW

- 5.1.1 The intent of project implementation 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 3.1.7.
- 5.1.2 The Contractor shall ensure all contract deliverables required pre- implementation are delivered and approved by the Design Authority prior to implementation works commencing.
- 5.1.3 As-built drawings will be completed by the Contractor based upon the installed system by a process of editing the approved 'for construction' drawings.
- 5.1.4 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.
- 5.1.5 Acceptance of these works shall be based upon provision and Design Authority approval of all CDRL items and a site inspection to be conducted by the Contractor, witnessed by DOT and the relevant ARO.

### 5.2. RECORDS

- 5.2.1 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 to accuracy better than  $\pm 100$  mm.
- 5.2.2 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  $\pm 1$ m).
- 5.2.3 Records shall be supplied by the Contractor electronically in both native editable and PDF formats.

### 5.3. DRAWINGS

- 5.3.1 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.
- 5.3.2 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;

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- c. size, capacity and terminations of pathway elements in accordance with AS 3085.1, AS 1102 and AS 4383 conventions.

5.3.3 All 'As in Service' drawings shall be booked in and out of DMS in accordance with DMS processes and procedures.

5.3.4 As part of the authorisation process, all drawings must be submitted to the ARO both as three hard copies, and as electronic files on CD-ROM media in the following formats:

- a. portable document format (.pdf) electronic files; and
- b. CAD files in editable \*.dwg (Autocad) format.

### 5.4. CONTRACT DATA REQUIREMENTS LIST

5.4.1 The following table lists those items of data/documentation deliverables to be delivered as part of this project in accordance with the identified delivery schedule.

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

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

## 6. REFERENCES

In particular, and without limiting the generality of the foregoing, the following standards shall be read in conjunction with this specification and shall be taken as forming part of the requirements of this specification. Should conflict arise between the requirements of a nominated standard and this specification, the latter shall prevail.

The installation and as-built documentation shall adhere to the following Australian Standards:

Document No	Title
AS 4806.2	CCTV Part 2: Application guidelines
AS 3000	SAA Wiring rules
AS 3080	Telecommunications installations - Generic cabling for commercial premises (ISO/IEC 11801:2002, MOD)
AS 3084	Telecommunications installations - Telecommunications pathways and spaces for commercial buildings
AS 3085.1	Telecommunications installations - Administration of communications cabling systems - Basic requirements
AS 4799	Installation of underground utility services and pipelines within railway boundaries
AS 4838.1 - 4	Preparation of documents used in electro technology
AS/ACIF S 009	Installation requirements for customer cabling (Wiring Rules)

In respect of compliance with AS 3084, particular compliance attention shall be given to routing conduits into the ends of rectangular pits, achieving drainage gradient and establishment of pole and building entries.

The installation and as-built documentation shall adhere to the following Victorian Rail Industry and VicTrack Standards for the applicable aspects:

Document No	Title
VicTrack TS-SP-013 V2.3	Communications Cable Installation Specification
VRIOGS 12.2	Specification for Signalling Supply, Construction and Installation
VRIOGS 007.2	Infrastructure Drawing Standards

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- a. Note that VicTrack TS-SP-013 V2.5a applies primarily for site connection conduits for VicTrack services and within the track.
- b. Note that VRIOGS 012.2.1 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.

The following DOT documents are referenced and form part of this specification to the extent specified herein:

Document No	Title
VRIOGS 013.2	CCTV Development Standard (Draft 1.9)