Roads

Master Specification

RD-ITS-D2 ITS Design for TrafficNet Infrastructure Buildings

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Contents

RD-ITS-D2 ITS Design for TrafficNet Infrastructure Buildings

1 General

1.1 The purpose of this standard is to define an acceptable operational environment for the system components that make up the control systems for TrafficNet.

1.2 This standard will apply to any location in which TrafficNet has a presence save for roadside cabinets which are covered under RD-ITS-S3 "ITS Enclosures".

1.3 Any alterations or exceptions to this standard will require the approval of the Manager, Traffic Operations.

1.4 This Part shall be read in conjunction with the following:

  a) RD-ITS-D1 "Design for Intelligent Transport System (ITS)".

  b) RD-ITS-C3 "Telecommunications Cabling".

1.5 The following documents are referenced in this Part:

a)	AS/NZS3000	Electrical Installations (Australian/New Zealand Wiring Rules).
b)	AS/NZS3080	Information Technology – Generic cabling for customer premises (ISO/IEC 11801:2011, MOD).
c)	AS/NZS3085	Telecommunications Installations – Administration of communications cabling systems – Basic requirements.
d)	AS/CA S009	Installation requirements for customer cabling (Wiring Rules).

2 Definitions

Term	Definition
Access Switch	A Layer 2 network switch that connect between workstations and other network devices and the Distribution Network.
Core Switch	A Layer 2 switch that connects the network backbone to the distribution switches.
Distribution Network	A combination of Layer 2 (or Layer 3) switches, routers and firewalls that handle routing, packet filtering and access control between the access switches and the core switches.
Field Network	A network of access switches that connect roadside devices to the distribution network.
Firewall	A network device that controls access between different networks or network segments.
Layer 2 Switch	A network switch that switches packets based on hardware addresses.
Layer 3 Switch	A network switch that also has the capability of routing packets based on their Internet Protocol (IP) destination addresses.
Roadside Network	See Field Network
Router	A network device that routes packets between IP networks based on destination IP address.

3 Infrastructure Buildings and Computer Rooms

General

3.1 Any major construction project that requires connections to TrafficNet via Department-owned or third-party network links shall incorporate a purpose-designed infrastructure building to house the Core Switches, Distribution Network and such access switches as may be required to provide access for personnel working at, or equipment installed in, the building. The building may be designed to serve more than one purpose (e.g. as a maintenance or spares holding facility for field equipment or as a

backup control centre). The purposes for which the building is to be designed shall be specified by the Department. All such buildings shall comply with all applicable building codes and regulations.

3.2   Any TrafficNet infrastructure building, in which servers, routers, switches or other network concentration points are installed, shall incorporate one or more computer rooms.

3.3   All computer rooms are to be designed and constructed so as to offer sufficient work space for the needs of the equipment and functions to be carried out in that space.

3.4   Equipment racks shall be bayed together side-by-side with end panels on each end of the bay. If multiple bays are required, they shall be arranged in parallel rows.

3.5   Rooms shall be designed to allow a clear walkway of at least 1 m width around all sides of each rack bay with all doors open.

3.6   Layouts and designs shall be approved by the Principal's Authorised Representative(s) as being suitable to the role they are to perform. Approval shall constitute a **Hold Point**.

3.7   All infrastructure buildings are to have appropriately sealed surfaces on all walls, floors and ceilings.

3.8   All cable pits associated with cabling entering the building shall be lockable and properly secured.

3.9   All conduit entries to the building shall be sealed against the ingress of moisture, contaminants and vermin, using a method that allows for easy re-entry for maintenance, additions or moves / changes, for example, TDUX or similar.

Environmental Controls

3.10   All infrastructure buildings are to be pressurised in that there is a positive air flow from the room to the outside environment whenever access is obtained in order to keep the influx of dust and other airborne contaminants to a minimum. Wherever possible the building is to be constructed with a dual air-lock arrangement for routine entry and egress. The airlock shall be large enough to accommodate the needs of those attending the site (including allowing for movement of equipment into / out of the site). The airlock shall be a minimum size of 2 m wide by 3 m long. Doors shall open inwards against the flow of positive air pressure.

3.11   All doors and windows (if any) shall be sealed when closed such that airflow is directed only through open doors.

3.12   All computer rooms will be environmentally controlled by redundant systems (N+1) with automatic changeover to ensure load-sharing. Each component of these redundant systems is to be capable of maintaining the room within the operational needs of the equipment without assistance and without suffering undue load or shortening of its life cycle. Where this standard is being used in order to construct a new site, the air-conditioning plant shall accommodate the design load plus 25% for future expansion.

3.13   All environmental control systems shall provide for remote monitoring / reporting. Provision shall be made for connection to the Department's existing SCADA systems. Alarms shall be presented to the Traffic Management Centre operators through STREAMS via the STREAMS SCADA interface. As a minimum, alarms shall be generated for:

    a) over temperature;

    b) under temperature; and

    c) equipment faulted.

3.14   If a vehicle loading bay or undercover parking area is incorporated into the design, these areas are not to be covered by the environmental controls specified in this section. Access from the parking area / loading bay shall be via an air lock as specified above.

Contamination Control Mats

3.15   Contamination Control Mats, also known as "tacky mats" or "sticky mats", with at least 30 tear-off layers, of a minimum size of 900 mm x 1200 mm shall be installed at the entrance to each computer room within the building, such that any person entering or leaving the room must step on the mat to

remove contaminants from the soles of their shoes. The mats shall not be installed in a general walk-way area where they may be walked on unnecessarily.

3.16 It will be the responsibility of each person accessing the computer rooms to check and tear-off layers as required (when they are dirty enough to have lost their effectiveness). The Contractor shall be responsible for replacing exhausted tacky mats prior to handover. At least two spare mats shall be provided for each computer room at handover. These shall be stored on site in a suitable storage facility to allow for easy replacement. The Contractor shall include details of the supplier of the tacky mats in the site documentation to be provided at handover.

Equipment Installation

3.17 All equipment that is installed in these rooms is to be rack mountable except for where the function of such equipment would be compromised by this requirement and the approval of the Principal has been obtained.

4   Security and Amenities

Access Control

4.1 Access to the site, the building and individual areas shall be secured with swipe-card access using a system compatible with the Department's existing security systems on other sites, and approved by Building Management and Property Services (BMAPS). Access to the areas within the building shall be controlled using area privileges, such that computer room access can be controlled independently of overall building access or site access. Each computer room shall be capable of being assigned separate area privileges. The system shall not be connected to TrafficNet; it shall be managed by a separate network connection to a provider to be specified by BMAPS.

4.2 Servers, core switches, distribution switches and firewalls shall be located in a dedicated computer room, separate from access switches and other equipment. The area access privileges for this room shall be able to be controlled separately to other areas.

Detection of Unauthorised Entry

4.3 The security system shall incorporataae an alarm system that detects unauthorised entry by multiple methods including;

a) if specified by the Department, Perimeter beams (around the site perimeter);

b) infrared motion detectors;

c) reed switches on all external doors and windows (if any), including emergency exits; and

d) reed switches on all internal doors that have access control fitted.

4.4 Alarms shall be monitored and transmitted in real-time to the Police Security Services Division monitoring centre. The alarm system shall be connected to the building's essential power distribution board. It shall also include internal backup power and a dedicated backup communications path independent of all other communications links connected to the building.

4.5 The alarm system shall detect and generate an alarm if the system is armed but the site is not properly secured.

Site Monitoring by CCTV

4.6 All infrastructure buildings are to be monitored by Closed Circuit Television (CCTV) 24x7 with 100% coverage of the entry and exit points without the need to pan / tilt any CCTV device in order to achieve this. The cameras monitoring the entry / exit points shall be positioned and configured such that a person entering the area being monitored can be clearly identified in real time or from the recorded footage. Entry points to computer rooms and any other restricted access areas within the building shall be similarly monitored.

4.7   Other areas of the building shall be monitored using Pan Tilt Zoom (PTZ) cameras (e.g. a vehicle loading bay, all rooms within the building (with the exception of toilets / washrooms)) such that the welfare of a person working alone on site can be monitored or checked as required.

4.8   PTZ cameras shall be mounted outside the building in locations that will allow full coverage of all possible building access points plus the grounds outside the building (within the perimeter alarm area).

4.9   The security cameras shall be connected to the Department's CCTV network and shall be recorded on site using Network Video Recorders (NVRs) compatible with the Department's CCTV network. These may be the same NVRs as are provided under the Contract to record other video streams (e.g. roadside CCTV cameras). The cameras shall be able to be viewed in real time from the primary or backup Traffic Management Centres and recorded footage shall be able to be retrieved from either location by Traffic Management Centre operators using the Department's video management software / systems.

Fire Detection and Suppression

4.10   Fire detection, alarm and suppression systems appropriate to the purpose(s) of the building shall be installed. Computer and UPS rooms shall be covered by a "Very Early Warning" aspirating smoke detection system ("VESDA" or equivalent) and a suitable fire suppression system capable of preventing a fire from spreading to other locations in the building. The workstation area and any kitchen facilities or vehicle-related areas shall be specifically excluded from coverage by the very early warning system due to the risk of false alarms. Hard-wired mains-powered smoke detectors shall be installed in other parts of the building as required. Smoke detection and fire suppression systems shall be included in the building's essential power distribution.

Amenities

4.11   Appropriate amenities shall be provided on site as required under the Workplace Health and Safety Act and regulations in force at time of construction, relevant to the purpose of the building.

4.12   At least one work-station including desk (with at least 1 desktop computer, to be supplied by the Department) and a static-safe workbench suitable for assembly / disassembly of computer and other electronics hardware shall be provided within the building, for the purpose of maintaining network and computer equipment installed within the building. Access arrangements shall allow for easy movement of equipment into, within and out of the building using suitable trolleys (not required to be supplied as part of the contract).

4.13   Sufficient power and telecommunications outlets shall be provided at the workstation to allow for at least one desktop computer, one laptop computer, one telephone and for other equipment to be plugged in and tested without the need to unnecessarily swap power and network plugs. As a minimum, 3 double General Purpose power outlets (GPOs) and 4 network points shall be supplied for each workstation. The network points shall be incorporated in the building's structured cabling arrangement such that they can be patched to a designated access switch. One double GPO shall be connected to the building's essential power switchboard.

4.14   Any additional workstation requirements shall be detailed in the project-specific specification.

5   External Networks

5.1   The computer room shall be connected to the Metropolitan Adelaide Broadband Network (MABN) via at least 2 geographically diverse paths.

5.2   Connection to other third party networks may also be required. Where connection to third party networks is required, this shall be detailed in the project-specific specifications.

6   Mains Power

6.1   Mains power to infrastructure sites shall be provided by a high-reliability three-phase power supply from redundant services, unless the electricity supply authority is physically unable to provide redundant feeds.

6.2   GPOs connected to the essential power circuits shall be coloured red. All other GPOs shall be coloured white. GPOs shall be clearly marked to indicate which phase and circuit they are connected to.

6.3   A full-online three-phase Uninterruptible Power Supply (UPS) shall be installed In the building, capable of powering all essential equipment, with sufficient overhead for future upgrades and expansion. The UPS shall be capable of powering all essential equipment for a minimum 4 hours in the event of a complete mains and generator failure.

Generator

6.4   A standby three-phase diesel driven generating set shall be included within the design, sized to meet the load of the CER essential equipment including computer systems and essential air conditioning + 25%.

6.5   The set shall start automatically upon mains failure and feature a fuel tank capable of supplying the set at 100% of its rated capacity for 24 hours.

6.6   The set shall be acoustically enclosed.

6.7   The status of the set shall be remotely monitored via a Modbus interface between its onboard controller and STREAMS MMS.

6.8   The set shall be integrated with the CER's electrical system so as to provide fully automatic operation / auto transfer switching and load transfer upon both the loss and return of supply.

6.9   The set shall be designed to allow safe isolation during the replacement of the faulty system.

6.10   The generator shall be monitored via SCADA. Alarms shall be integrated into STREAMS. The Principal shall specify exactly what parameters and alarms need to be monitored. As a minimum, monitoring shall include:

   a) generator status (standby, running);

   b) fuel level;

   c) output voltage (per phase); and

   d) output current (per phase).

7   Computer Room Equipment

Approved Equipment

7.1   Previous installations of computer room equipment were based on the following manufacturers. The designer shall obtain approval from the Principal, Traffic Management Centre if alternative superior solutions may exist.

   a) Switches: CISCO.

   b) Routers: CISCO.

   c) Servers: DELL.

   d) Firewalls: CISCO.

   e) Power Rails: Raritan or MFB.

   f) Racks: MFB or Rittal.

7.2   Precise models and specifications will be dependent on network design calculations. Details shall be incorporated into the project-specific specification documents.

Configuration and testing

7.3   Configuration of core and distribution TrafficNet network equipment shall be the responsibility of the Principal's Authorised Representative. The equipment shall be supplied to the Principal's Authorised

Representative to be configured and tested. Delivery of the equipment shall constitute a **Hold Point**. Once configured and tested, it will then be delivered to the Contractor for installation.

7.4   Post installation testing shall again be carried out by the Principal's Authorised Representative. The Contractor shall provide a representative to be present during the post-installation testing to rectify any installation-related issues.

8   Standard Rack Architecture

Physical Specifications

8.1   Racks will be based on the MFB S2005 or Rittal DK 5514.110 Network Server cabinets at 45RU 800W and 1200D, with integral vertical cable ducts (MFB P/N 03311-01) down both sides of the cabinet, front and rear. The front mounting rails shall be recessed into the cabinet to provide at least 150 mm clearance between the door and the front of the mounted equipment. Racks shall be fitted with Double Vented doors front and rear.

8.2   Any modifications to these standards will be assessed on a case by case basis and only changed to suit environments that can in no other way be adapted to this standard.

8.3   Each rack shall be fitted with a telescopic shelf, 450 mm deep, rated to at least 45 kg (evenly distributed), installed at a height of 1,000 mm – 1,100 mm above floor level.

8.4   Racks shall be fitted with a switchable internal light mounted in the rear of the rack at the top.

8.5   Equipment shall be installed in racks with consideration to ventilation requirements and heat load. The equipment should ideally be installed in descending order of heat load (i.e. hottest at the top), with due consideration to maintenance access requirements.

8.6   Horizontal cable management facilities shall be provide above and below each piece of equipment where cables are connected (front and / or rear).

8.7   Vertical cable management shall be via the ducts specified in Clause 8.1.

8.8   Appropriate front-to-rear horizontal cable management between the vertical cable management ducts shall be installed in at least two locations on both sides of each rack.

8.9   All cabling within the racks shall be routed via the internal cable management systems. Cable management systems shall not be filled to more than 50% capacity when all cables and equipment are installed.

Environmental Monitoring

8.10 The managed power rails shall provide the ability to monitor at least the following:

a) power usage on a per-port basis;

b) total power usage per power rail;

c) temperature; and

d) humidity.

Power Provision

8.11 Each rack is to be supplied power from at least two separate dedicated circuits, so that tripping of a single circuit breaker cannot interrupt power to multiple racks.

8.12 No circuit is to exceed 80% of its rated capacity in total when at peak load. Consideration should be given to power load balancing across phases.

8.13 Rack power distribution boards will be managed, network-connected devices that provide for remote monitoring and control of connected equipment via a secure web-based interface and SNMP v3.

8.14 All power cables are to be adjusted to fit without needing to be coiled up or cable tied to parts of the rack to accommodate slack.

8.15   Power cables carrying power to the racks will be mounted in cable trays suspended from the ceiling. 2 x individual power circuits shall feed each rack. Connection shall be via captive "screw down" power chords to prevent gravity or accidental dislodging.

8.16   Power and data cables are to be kept sufficiently far apart that they do not interfere with each other either physically or electrically (direct or induced). This separation is to be enforced by the nature of the conduit or cable tray carrying the cables not simply relying on cable ties and the like.

8.17   Separation between copper and optical fibre cables is also to be accommodated for and enforced by the nature of the cable tray.

8.18   Wherever possible, power cables running between equipment and the rack mounted power rails should be cut to appropriate lengths so as to allow for their adequate functioning but without necessitating the sequestering of the excess length inside the rack in some way.

8.19   Each rack will have left and right side mounted vertical power rails at the rear.

8.20   Racks that house devices using a dual power supply should be setup to use both circuits, i.e. one PSU connected to the left power rail and one PSU connected to the right power rail.

8.21   All power leads are to be labelled at both ends in a manner that clearly identifies which device they belong to.

8.22   Devices using a single power supply should be connected to alternating circuits, i.e. one device to the left power rail, the next to the right, etc.

8.23   If power rails with IEC type outlets are supplied, compatible equipment power lead shall also be supplied. Devices with captive power cords that use a standard 3-pin Australia/NZ standard power connector shall have their connector changed to an IEC plug to suit the power rails.

8.24   All modifications to electrical cables shall be performed by a licensed electrician in accordance with AS3000 and the Electricity Act. A Certificate of Compliance shall be provided for all such work.

Network Provision

8.25   All Ethernet patch cables are to comply with the following colour coding scheme:

    a) Green: Generic TrafficNet Ethernet segment.

    b) Purple: iSCSI network connections.

    c) Yellow: Router to Router (or Firewall) connections that do not pass a TrafficNet boundary.

    d) Orange: Serial connections (RS232/RS422/RS485) over Cat 5/6.

    e) Pink: Video applications (including digital video or analog video over CAT5/6 (where applicable).

    f) Black: Crossover cables.

    g) Blue / Grey: Not to be used for TrafficNet.

    h) Red: FIRE ALARM SYSTEMS / EQUIPMENT ONLY.

    i) Other Colours:Only by arrangement with the Principal's authorised TrafficNet representative.

8.26   All Ethernet cables should be made to length whenever possible. Connectors shall be fitted with suitable strain relief to prevent stressing of the terminations within the connectors. All interconnectivity between racks shall be achieved using a structured cabling arrangement based on (minimum) Category 6 cabling designed, installed and tested in accordance with AS/NZS3080 to Class EA (10Gbps Ethernet / 500MHz) and AS/NZS S009.

8.27   The structured cabling system shall provide at least 100% extra capacity above that in use at handover.

8.28   One rack shall be dedicated as a "distribution frame" or "patch bay" rack for Ethernet cabling. All structured cabling entering / exiting the room or interconnecting racks shall terminate in this rack.

8.29   One rack shall be dedicated as a "distribution frame" or "patch bay". All optical fibre structured cabling entering / exiting the room or interconnecting racks shall terminate in this rack.

Cable Routing

8.30   All cabling entering / leaving racks shall do so via overhead cable ladder.

8.31   Cable ladder shall be installed at 450 mm above the cabinets along the axis of the cabinet bay / row.

8.32   Transverse cable ladder (perpendicular to the cabinet row) shall be installed 900 mm above the cabinets.

8.33   Separate cable ladders shall be installed for copper data (Ethernet) cables, fibre optic cables and electrical / power cables.

8.34   Cable ladders shall not be filled to more than 50% capacity on completion of the works.

8.35   Vertical cable ladder extensions with bends of suitable radius shall be installed between longitudinal and transverse ladders and between longitudinal sections and each rack. Cables shall be managed so that the cable manufacturer's specified minimum bend radius is not violated.

Testing and Commissioning - Cabling

8.36   For ports that will have equipment connected at handover, Channel Tests to Class EA shall be performed by the Contractor. Channel tests include all patch cables (including those connected to equipment). Once the channel tests have been completed, those patch leads shall not be relocated or replaced, or the channel tests will be invalidated.

8.37   For all unused ports, Permanent Link tests to Class EA shall be performed by the Contractor.

8.38   In the event of a Channel Test or Permanent Link Test failure, the fault shall be rectified and the test repeated until an unconditional pass is achieved.

8.39   Full test records (including failures and re-testing after rectification) shall be provided to the Principal prior to equipment commissioning / handover. Provision of test records shall constitute a **Hold Point**.

8.40   All optical fibre connectors on Fibre Optic Breakout Trays (FOBOTs) shall be of a type that uses angle-polished connectors (e.g. SC-AP). Fibre optic patch cables shall be selected in accordance with RD-ITS-C3 "Telecommunications Cables".

8.41   Optical Fibre shall be tested in accordance with ITU-T G.650.3 and the requirements laid out in RD-ITS-C3 "Telecommunications Cabling" Clause 4 (Optical Fibre Testing).

8.42   All testing and commissioning is subject to the requirements laid out in RD-ITS-C3 "Telecommunications Cabling" Clause 4 (Testing and Commissioning).

8.43   All connectivity between switches devices of the same type (e.g. switch-to-switch, router to router) should be made using network cross-over cables of suitable configuration. Reliance on auto negotiation of cable pin outs is to be avoided.

8.44   The network design within the building shall be based on the Cisco 3-layer network concept.

8.45   Consideration shall be given to the need for interconnection with the Metropolitan Adelaide Broadband Network (MABN) in the building and network design.

8.46   Where possible, network attached devices should support and use redundant network connections.

8.47   All cabling to and from racks shall be via overhead cable trays. Separate trays shall be provided for electrical, data and optical fibre cables.

8.48   All Network (and other) cables are to be labelled at both ends so as to adequately describe the function it is performing.

8.49   The Contractor shall provide a full set of records compliant with (as a minimum) the requirements set out in AS/NZS3085 "Telecommunications Installations – Administration of Cabling Systems", covering all telecommunications cabling installed in the building (including optical fibre cabling). Provision of the cabling records shall constitute a **Hold Point**.

Server Console Access

8.50   Provision shall be made for console access to all servers.

8.51   Preference shall be given to server hardware that incorporates a separate "lights-out management" facility such as Dell's iDrac Enterprise (or equivalent).

8.52   Where Dell servers with iDrac Enterprise facilities are supplied, the iDrac port shall be configured and connected to the network to provide remote console access. The required network configuration shall be agreed with the Principal's authorised TrafficNet representative.

8.53   If there are servers supplied that do not provide this facility, a rack-mounted IP-based KVM (Keyboard-Video-Mouse) shelf shall be supplied and installed to provide local console access to all such servers.

9   Hold Points

9.1   The following is a summary of Hold Points referenced in this Part:

Document Ref.	Description	Response Time
3.6	Provision of building plans	10 Working Days
7.3	Delivery of equipment for configuration and testing	15 Working Days
8.39	Structured cabling test records	5 Working Days
RD-ITS-C3 4.1	Calibration Test Certificates for test equipment	2 Working Days
RD-ITS-C3 4.1	Details of personnel conducting testing	2 Working Days
RD-ITS-C3 4.1	Notification of testing	48 hours
RD-ITS-C3 4.1	Submission of completed TCA1 forms (Telecommunications Certificates of Compliance)	5 Working Days
RD-ITS-C3 4.2	Optical Fibre test records	5 Working Days
8.49	Provision of cabling records	10 Working Days

10   Verification requirements and records

Table RD-ITS-D2 10-1 Verification requirements

Document Ref.	Subject	Record to be provided
RD-ITS-C3 4.2	Testing and Commissioning	TCA1 Forms
8.39	Testing and Commissioning	Structured Cable Test Records
8.49	Testing and Commissioning	Cabling Records