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Communications equipment room brief

Telecommunications

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Document owner

Name	Title	Date
Kathryn Shoolman	Manager Infrastructure Design	31/07/2018

Document Author

Name	Title	Date
John Berti	Manager Standards & Specifications	31/07/2018

Document Endorsers

Name	Title	Date
Na	NA	NA

Approval Authority

Name	Title	Date
Leon Qu	Acting Group Manager Engineering	31/07/2018

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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:
 - i) The referenced item cannot be adequately explained with an amount of text that could not reasonably be inserted into the body of the Standard.
 - ii) The reader is not referenced to another Controlled Standard necessary for the item to be adequately explained i.e. one document link only.
 - iii) 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 numbering system for the VRIOG Standards is chronologically sequential from the point of introduction, and is not based on any form of interpretive system.
- 8) 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.

2.1. Definitions

The following terms used in this document have the meaning defined below:

Terminology	Definition
'Shall'	Identifies mandatory requirements which must be adhered to and verified through the system acceptance process.
'Should'	Identifies optional requirements which are desired but not mandatory. Where delivered they shall be verified through the system acceptance process.
'Provide'	Supply, install, connect, configure, commission and include in as-built documentation.
Superintendent	The party responsible for superintending the station works contract as defined in project "Conditions of Contract" documents.
Design Authority	The Public Transport Victoria SISD ICT Group (under Manager, Systems and Information Services)

Table 1. Definitions

2.2. Abbreviations

Terminology	Definition
24x7	24 hours per day, 7 days per week
a/c	Air conditioner
AFFL	Above Finished Floor Level
AIRAH	Australian Institute of Refrigeration, Air Conditioning and Heating
ARO	Accredited Rail Operator

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Terminology	Definition
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
CCTV	Closed Circuit Television
CET	Communications Earth Terminal (to AS/ACIF S009)
CER	Communications Equipment Room
DB	Dry bulb (in the context of temperatures) Distribution board (in the context of electrical wiring)
PTV	Department of Transport
EPR	Earth Potential Rise
ERDB	Equipment room distribution board
GPO	Electrical general purpose outlet (10A unless otherwise specified)
FFE	Fittings, Furniture and Equipment (supplied by purchaser)
ICT	Information and Communications Technology
IDF	Intermediate Distribution Frame
IEC	International Electro technical Commission
IPnn	Where nn = 2 digit number – Ingress protection rating
LED	Light Emitting Diode
MDB	Main Distribution Board
MDF	Main Distribution Frame
MTM	Metro Trains Melbourne
OCS	Operational Control Systems (Generic term for systems installed and maintained by specialist contractors separately to the base building infrastructure works. OCS includes Security and Access Control, CCTV, Public Address, Clocks, Passenger Information Displays, Customer Help Points, Telephones, other digital signage).
PRIDE	Passenger Real-time Information Dissemination Equipment
SISD	Systems and Information Services Division of Public Transport Victoria
SNMP	Simple Network Management Protocol

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Terminology	Definition
VT	VicTrack
WB	Wet bulb

Table 2. Abbreviations

3. Scope and general

3.1. Scope

3.1.1 This Documents purpose is to provide a brief for detailed design by architects, civil, structural and services engineers.

- a) It is NOT a specification to be provided directly to trades for tendering and shall not be appended to “issue for construction” designs or documents developed for such purpose
- b) The relevant aspects of design shall be incorporated as adapted to the site in the respective trades’ drawings and accompanying trades specific specification sections as delivered against clause 6.6

3.2. Application

3.2 1 This Communications Equipment Room Brief describes general requirements which apply to:

- a) Most suburban or regional new station projects;
- b) Suburban or regional station upgrade projects; or
- c) The construction of a new Communications Equipment Room at an existing station.

3.2 2 It is intended to be read in conjunction with site or project-specific documents such as briefing specifications and drawings that will state the location and any design options to be adopted (if applicable), and indicate any departures required as a result of the project specific design.

3.3.3 In the context of a Design and Construct project delivery, this document will provide the brief for production of a detailed design by the appointed Design and Construct (Principal) Contractor.

- a) The designer shall produce architectural and engineering plans and specifications to “Issued for Tender” and “Issued for Construction” level and obtain VicTrack in conjunction with PTV and the relevant ARO approval via the appointed PTV Project Manager for the respective drawings and documents specifying all scope and finishes.
- b) This document shall not be issued to construction trades and contractors as a specification.

3.3. Exclusions

3.3.1 This document does not specifically cover the requirements for the following installation scenarios, although the same principles will generally apply.

- a) Major facilities containing many racks of equipment in a “computer room” or “data centre” arrangement which will typically have hot and cold aisle air distribution, access flooring and fire detection and suppression.
- b) The accommodation of equipment in a staffed office, which may require special measures for security, noise abatement and climate control comfort.
- c) The provision of prefabricated buildings away from the main station permanent buildings and platform infrastructure. Where the Equipment Room is in the form of a prefabricated shelter away from the platforms and station buildings, the design shall conform to the VicTrack Standard Specification for Prefabricated

Communications Huts. In such instances, any conflicts between this equipment room brief and the VicTrack standard for Prefabricated Communications Huts shall be resolved via consultation with PTV and VicTrack.

3.4. Background

3.4.1 The Communications Equipment Room shall provide a controlled and secure environment capable of accommodating the following equipment, facilities or services:

- a) Network boundary (Main Distribution Frame) for services of public network carriers, notably VicTrack and Telstra
- b) CCTV equipment rack and uninterrupted power supplies
- c) VicTrack network and telephone system equipment including 48V DC power supplies and backup batteries
- d) Public address equipment
- e) Train radio equipment (if applicable)
- f) Backend equipment for station systems including ticketing, PRIDE, master clock, passenger information displays, franchisee-wide area network equipment (where additional to VicTrack equipment)
- g) Security, access and environmental control panels
- h) Space and facilities for monitoring, maintenance, and repair of equipment including temporary test equipment and tools outside cabinets; as well as space in racks for laptops and monitoring equipment

3.4.2 This document specifies requirements for the following items:

- a) General layout, size and finish of the room including equipment access requirements
- b) Cable entry and fire barrier provisions
- c) Rack space allowances and cable support systems
- d) Mains power distribution, lighting and earthing provisions
- e) Dust filtering and climate control
- f) Electronic access control to the room, security and environmental kit sensors (to be included in respective OCS scope of works)

3.4.3 PTV Systems and Information Services CCTV Team Consultation retains the design authority on all CCTV and ICT projects and shall be directly involved in all scope change decisions and technical information exchanges throughout the project lifecycle.

3.4.4 Consultation with PTV SISD on equipment accommodation shall be undertaken by station project consultants prior to the commencement of civil and architectural design, to:

- a) Ensure that appropriate space allowance is made for equipment accommodation (including access clearances), and that the space provided is to the standard of an “equipment room” environment as defined in this document, including appropriate lighting levels, dust sealing, climate control and door access.
- b) Ensure that climate control and other support equipment is alarmed through the CCTV Environmental Monitoring System (EMS) or another SNMP based alarm system. An alarm shall be reported if the air conditioning is switched off.
- c) Confirm maximum and average demand estimates for VicTrack, ICT and CCTV equipment for the purposes of incoming supply assessment (validate default load given in clause 4.7.3 (c) and address clause 4.8.1).

3.4.5 Consultation shall be undertaken with VicTrack via PTV SISD facilitation to confirm VicTrack’s accommodation, power and rack requirements for the site.

3.4.6 Liaison with PTV's SISD team regarding delivery of the CCTV system shall be instigated by:

- a) Tender documentation consultants (or the Contractor's designer under "design and construct" projects) - regarding review / approval of specifications and drawings.
- b) Principal Contractors or sub-Contractors via the Principal Contractor, regarding review of shop drawings, maintenance support and as-built documentation review.

4. General Requirements for All Equipment Rooms

4.1. Equipment locations

4.1.1 For the purposes of interpreting AS3084 with respect to this specification, the term “Equipment Room” (ER) shall incorporate the functions of both “Equipment Room” and “Entrance Room” (or “Entrance Facility”).

4.1.2 The ER shall be planned and equipped to comply with all normative requirements of AS3084 for ERs, notably clauses 6.4, ZA (including all referenced standards applicable in Australia) and ZB2.3, ZB2.4 and ZB6.

4.1.3 In summary, this shall include:

- a) Avoidance of locations that:
 - I. restrict future expansion.
 - II. are below water level.
 - III. are close to sources of electromagnetic interference (like substations).
 - IV. are inside an Earth Potential Rise hazard zone.
 - V. contain asbestos that may require removal or containment.
 - VI. do not guarantee 24x7 access.
- b) Consideration of factors listed in clause ZC3 in choosing the location.
- c) Floor load capacity of 4.8 kPa.
- d) Minimum clear height of 2400 mm below any ceiling fittings or suspended items like cable tray.
- e) No suspended false ceiling or removable acoustic tiles below the true ceiling or slab above.
- f) Minimum door size 900 mm x 2000 mm.
- g) Cable tray clearance of 300 mm from any fluorescent light fittings.
- h) Connections to site entrance pathways and backbone cable pathways around the station (penetrations as required to connect pit and pipe, wall/ceiling duct or cable tray infrastructure, sized to minimum requirements in Appendix ZB where no further data is provided in this document).
- i) Air filtering to provide protection from contaminants.
- j) Walls and ceiling painted in a light colour.
- k) Anti-static floor covering with anti-slip surface.
- l) Rising entry conduits to be within 10 mm to 250 mm of a wall and cut off 100 mm to 200 mm above floor. (Any through slab penetrations for CERs above the ground floor of a building to be similarly sleeved or provided with minimum 100 mm bund).
- m) Protective cages over any sprinkler or fire suppression heads inside the room and over any external air conditioning components.
- n) 24x7 climate control via thermostatically activated air conditioning.
- o) Positive pressure differential with respect to surrounding areas.
- p) Lighting level of at least 500 lux at 1 m above finished floor level (AFFL) throughout equipment access aisle space (after equipment installation).
- q) Maintained emergency exit lighting to guide egress in the event of power failure.
- r) Separate supply and power distribution sub-board within the room for the equipment (fed from essential power if available).

- s) Two circuits with at least two outlets per circuit of “convenience” double 10A power sockets at 1800 mm centres around the room (supplied from two separate phases – those being general light and power distribution).
- t) Powder type fire extinguisher suitable for Class E fires inside the door at the room entry.
- u) Fire stopping of penetrations (using a re-openable cable feed-through for communications system cables) for all penetrations through the fire rated walls or ceiling.
- v) Security detection and alarming of access.
- w) Provisions for environmental sensing including air conditioner switch off, air conditioner fail and equipment smoke.
- x) Provisions for earth bonding (to meet AS ACIF S 009).
- y) Provision of lightning protection and surge filtering on the incoming room supply (if not provided already on the main building distribution board).

4.1.4 Compliance with the standards referenced within AS 3084 (notably clause ZA2) shall be achieved.

4.2. Wall, Floor and Ceiling Finishes

4.2.1 Light colours shall generally be selected to promote uniformity of lighting levels around the room in support of tasks involving the correct identification of small colour-coded components.

4.2.2 Fixed ceilings or suspended slabs above acting as a ceiling shall be painted in ceiling white.

4.2.3 Walls shall be painted in a light colour generally consistent with other finishes at the same site.

4.2.4 Generally the paint seal to ceiling and walls shall be applied before mounting frames, equipment and surface fittings are installed, so that unpainted surfaces will not be exposed if equipment or fixtures are changed or moved in the future.

4.2.5 For temperature control, security and fire rating purposes, the equipment room shall not have any windows or skylights.

4.2.6 Ceiling and wall materials shall be consistent with the achievement of a one-hour fire rating.

- a) Access hatches and recessed mounts should be avoided where possible, and suitably fire rated if unavoidable after considering design alternatives.
- b) Wall or ceiling penetrations leading to roof space station distribution pathways for communications services and communications UPS power shall be by means of re-openable intumescent foam type fire rated cable transits. Other penetrations shall be permanently fire sealed.

4.2.7 Generally any walls and ceiling on the outside of the buildings shall be fully insulated to minimise the solar heat load during warm weather.

4.2.8 Floors shall be covered in a static dissipative material offering a smooth washable surface and a non-slip surface texture.

4.3. Ceiling Height

4.3.1 In order to achieve a tray suspended at or above 2400 mm AFFL and to allow clearance for surface mounted light fittings and fire suppression components, a minimum ceiling height 2700 mm AFFL shall be provided.

4.3.2 A head clearance of 200 mm above a 45RU rack to the base of the cable tray shall be achieved.

4.4. Technician Work Surface

4.4.1 A “fold away” work surface shelf shall be provided for itinerant maintenance technician use when visiting the site.

4.4.2 The work surface shall be located opposite the front access side of the rack bayline. The unused wall space under the air conditioner indoor unit (which is not suitable for permanent equipment due to the risk of leakage) may be used for this purpose.

4.4.3 The work surface shall comprise a fold down shelf that meets the following criteria:

- a. Width and depth to suit the use of a laptop computer and A4 writing pad (at least 350 D x 750 W)
- b. Front edges when folded down having radius corners or mouldings to minimise injury hazard.
- c. Height of top surface when folded up to working position: 1100 mm AFFL
- d. Maximum protrusion into the room when folded down: 400 mm
- e. Load rating: > 100kg
- f. Fixing: Anchored to masonry wall or fixed to wall structural frame.
- g. Shelf: Powder coated steel or 19 mm timber finished with melamine / laminex / Formica on all surfaces. Colour white, timber grain or black.

4.4.4 The candidate method for providing this facility is the provision of a standard pre- manufactured shelf meeting the specified size criteria, fixed to the wall using a pair of Häfele Light duty Hebgo folding brackets 380 mm deep model 287.42.412.

4.4.5 The following fixtures shall be provided adjacent to the work surface at a height of 1500 mm AFFL:

- a. Dual gang Cat 6 data outlet connected to the respective ARO's administrative/corporate IT Network patch panel (within the ICT01 rack, or VT Rack if ICT01 rack does not exist in the CER or within 90 m cable run from the outlet).
- b. Dual gang general purpose power outlet (wired to CER convenience outlet circuit).

4.5. Clearances

4.5.1 The room layout shall be designed to maintain the following minimum clearances assuming the VT equipment racks are 1000 (D) x 800 (W) and the other equipment racks are 1000 (D) x 640 (W).

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Dimension	Clearance mm
Front of rack to wall	1200
Front of rack to front of any equipment or frames on the wall	900
End of rack bay line to wall	900
Rear of rack to wall behind	900
Sides of public carrier MDF or VT Station distribution frames (when fully equipped) from wall either side	300

Table 3. Clearances

4.5.2 The electrical distribution board location and other wall panel fittings shall be coordinated to ensure that:

- the above clearances are maintained when the rack and other equipment doors are closed.
- the racks (when installed) do not prevent the doors of switchboards and other panels from being fully opened for maintenance access.

4.6. Lighting

4.6.1 Lighting shall comprise fluorescent batten fittings with diffusers selected to provide even illumination around equipment racks and walls, and inside racks when the doors are opened.

4.6.2 Ceiling mounted light fittings shall be provided both behind and in front of racks. Light fittings shall not encroach upon the space above racks, which shall be reserved for cable tray, power distribution and smoke detection sensors.

4.6.3 Light fittings shall be selected to ensure their installation does not detract from the room's one hour fire rating.

4.6.4 Light fitting colour temperature and spectrum shall be selected to facilitate unambiguous identification of colour coded conductors, fibres and components which will be installed in the ER.

4.6.5 A maintained emergency exit light / sign shall be provided above the door.

4.6.6 The lights shall be automatically switched on by a movement detector targeted at the door and remain illuminated for a hang time of 15 minutes after last movement was detected. A parallel manual start switch shall be provided inside the door.

4.6.7 The lighting level shall meet the requirements of AS/ACIF S 009 and AS/NZS 3084 (500 lux at 1 m AFFL) at equipment termination spaces (including on walls) and at the front and rear of cabinets.

- The lighting level shall be designed on the basis that the room is unoccupied (and therefore the shadowing effect of occupants is accounted for by virtue of the relatively high lighting level specified).

- b. The lighting level in access and circulation spaces within the room (such as the aisle providing access between the front and rear of the rack) may be lower, but shall exceed 150 lux at the centre of the aisle.
- c. An 80% maintenance factor shall be applied to the manufacturer's rated light output with new tubes fitted.
- d. The 500 lux requirement shall be achieved on average. The spot illuminance may be up to 30% lower than the average at any point between the rack front or rear and the wall opposite.

4.7. Physical Security of Doors and Walls

4.7.1 Any equipment room walls and doors on the outside of the respective building shall be of construction capable of withstanding malicious vandal attack.

- a. Access should not be readily gained by removing panels or in-wall air conditioners.
- b. Generally masonry construction is preferred for all walls.
- c. Conduits shall be inserted into walls during construction to provide a cable pathway to the electric lock power transfer hinge on the door and to the outside access control proximity card reader.

4.7.2 The door shall be of solid timber construction. It shall be a 45 mm thick, flush panel, block timber, solid core door, that meets AS 2688 and the one-hour minimum fire rating requirement.

- a. Where such doors are part of a masonry wall, the doors shall be contained within a steel door frame with triple pinned hinges to prevent door removal externally.
- b. Doors shall be provided with a cored cable pathway from the electric lock to the hinged side to allow cabling to be run from a power transfer hinge or flexible cable assembly through the door to the lock.

4.7.3 Doors shall be fitted with Lockwood 3570 series electric mortice locks (with cylinder to fit the standard respective rail operator key) and monitored free handle egress, in accordance with the respective project's ICT Systems Specification: Electronic Security and Access Control System.

- a. The single leaf door with access control fitted shall be opened by the access control system releasing the electric lock bolt (not the door striker plate).
- b. The door shall be fitted with a separate "door open" triple biased reed switch at the top of the opening (handle) side of the door to monitor door open status independently of built-in status monitoring inside electric locks.
- c. Where double doors are required to provide for access to unusually large equipment identified by PTV as a project specific requirement, magnetic locks with bond and status sensing shall be provided on both leaves together with a wall-mounted egress request button and emergency break-glass release in lieu of the free handle egress electric mortice lock. A triple biased reed switch shall be fitted to each leaf next to the electromagnetic lock, wired to a single junction box above the door and single security panel sector.

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4.7.4 Doors shall be fitted with adjustable weather and dust seals to prevent ingress of water, contaminants and insects into the room.

4.8. Climate Control

4.8.1 The ER air supply shall be fitted with filters to allow an ingress protection rating of IP54 to be achieved for the room air supply. At least 2% of the total air moved shall be fresh air.

4.8.2 Supply air discharge velocity shall not exceed 6m/s.

4.8.3 The air conditioning shall be provided to meet the following requirements:

- a. The peak solar load shall be calculated on the basis of AIRAH publication AIR- DA9 Melbourne outdoor ambient design conditions for critical process loads (36°C DB, 21°C WB).
- b. At peak outdoor ambient conditions and maximum equipment rack load, the supply air to the front of all racks shall not exceed 20°C.
- c. Room stakeholders shall be consulted to confirm the power consumption per rack space. Where data is unavailable or as a minimum, the total (maximum) cooling capacity shall meet or exceed the [peak solar load] + [500W per equipment rack space = 3000W for six racks].
- d. The unit selected shall be rated for continuous 24x7 operation with a minimum field service life of 3 years.
- e. The indoor unit shall blow cold air into the aisle in front of the equipment racks whilst drawing return air from above and behind racks.
- f. The indoor noise level created by the air conditioning system (as measured with other systems switched off) shall not exceed 60 dB (a).
- g. Outdoor unit noise levels shall comply with local authority requirements.
- h. In the event of power failure, the unit shall automatically restart when power is restored.
- i. Rooms with equipment cooling load exceeding 7 kW or advised as critical by PTV shall be provided with standby capacity in an N+1 redundancy configuration.
- j. The unit provided shall be of a make and model available with a remote monitoring interface as described in clause 4.8.9.

4.8.4 A split system shall be provided with a remote thermostat mounted on the wall behind the equipment racks at 2200 mm AFFL, set to cut in a/c if the temperature exceeds 28°C and cut out if the temperature declines below 26°C.

4.8.5 The indoor unit shall not be located above equipment racks or wall distribution frames to ensure that any leaks during the service life do not put equipment or interconnections at risk.

4.8.6 The outdoor unit shall be protected by a vandal resistant galvanised steel mesh cage fixed to the wall or mounting pad using anti-tamper fasteners.

- a. Any separate power outlet or switch for the outdoor unit shall be of a weatherproof type with key or padlock facility, preferably located within the protective cage.

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- b. Anti-tamper fasteners shall be Snake Eye or Barri bolt with type, size and strength to suit the mechanical installation requirements.

4.8.7 Condensate drains shall be fitted.

4.8.8 Any air conditioner or condensate pipes penetrating the room's fire rated walls or ceiling shall be fire sealed using a permanent method such as fire rated caulking compound.

4.8.9 Air conditioners shall be fitted with alarms wired via pairs in a Cat 6 cable to the station VT distribution frame to report the following conditions:

- a. Air conditioner switched off manually or power fail.
- b. Air conditioner fault.
- c. Where the air conditioner has an Ethernet LAN (IP) interface, the above functions shall be provided by SNMP trap reporting and routing and configuration of the Cat 6 cable as a standard patch to the CCTV cabinet site LAN switch.
- d. If the air conditioner does not have an IP interface, it shall be provided with a "Building Monitoring System" Remote Control card option or comparable interface capable of providing the signals described in a) and b) above.

4.9. Electrical Distribution

4.9.1 The site incoming supply and the Main Distribution board capacity shall be assessed for ability to supply the maximum equipment room demand and an upgrade allowed if required.

4.9.2 The ER light fittings (including battery backed Emergency Lighting), air conditioner and "convenience" outlets shall be fed from a general light and power distribution sub-board or the station Main Distribution Board.

4.9.3 The ER equipment outlets shall be fed from a separate ER Distribution Board (ERDB) within the ER. This is to ensure that communications services are not compromised or tripped by faults, transients and noise in general light and power circuits.

- a. The ERDB shall be located to meet the requirements for switchboard doors in the open position to ensure safe working, as per AS 3000.
- b. The ERDB shall be provided with engraved labels, or numbers with a machine printed legend, indicating the loads.
- c. The ERDB shall be provided with a Communications Earth Terminal (CET) to AS/ACIF S009 adjacent, capable of terminating up to 6x10mm² and 6x6mm² earth conductors comprising up to six rack earths, MDF and communication cable tray earths. The CET shall be connected to the ERDB earth link bar in 25mm² or larger G/Y cable.
- d. The ERDB shall be fed by 63A rated and protected sub-mains from the stations Main Distribution Board, 3-phase with full size earth and neutral if the MDB is 3- phase. The size of the supply is related to the peak inrush and protection coordination requirements rather than the actual load. The circuit breakers protecting such sub-mains shall be of a class suited to this duty.

- e. If the station MDB is not fitted with lightning surge protection, the ERDB incoming supply shall be via an “in-line” or “series” Surge (Reduction) Filter rated at a minimum of 50 A continuous load current and a minimum of 20 kA (Imax to AS/NZS 1768 / IEC Category B] surge. If the station MDB is already fitted with a lightning Surge (Reduction) Filter or Surge Diverter (to AS/NZS 1768 / IEC Category C1 or C2), a 20 kA (Imax to AS/NZS 1768 / IEC Category B] parallel surge diverter shall be provided at the ERDB. Installation shall be in accordance with manufacturer’s instructions. Surge protection shall have the same number of phases as the sub-mains supply and have a load current rating exceeding the maximum demand on the ERDB.
- f. All cabling from the ERDB to loads within the room shall be wholly routed to remain within the room’s fire rated compartment. (For instance, such cabling shall not be routed into the roof space above the fire rated ceiling then back down into the room).
- g. All cabling from the ERDB or UPS inside the room to loads outside the room shall penetrate the fire rated wall or ceiling via an intumescent foam type fire rated cable transit to facilitate moves, additions and changes.
- h. Each rack position shall be provided with two single phase flat pin, double pole switched, captive screw type, outlets; located 400 mm behind the rack centre line, both rated at 15A, (one designated main and one designated backup) unless otherwise specified. Depending on the ceiling height, outlets may optionally comprise:
 - i. Switched pendant captive screw type outlets (Clipsal 56SPO315) suspended from the ceiling with the outlet height being above the rack below (typically 2300 mm to 2500 mm AFFL to bottom of outlet).
 - ii. Surface mount type with rotary switch (Clipsal 56C315D) fixed to the ceiling (and facing the floor) where the ceiling height is 2700 mm AFFL or less.
 - iii. Surface mount type with rotary switch (Clipsal 56C315D) fixed to the side of a suspended electrical cable duct, typically 2300 mm – 2500 mm AFFL to centre.
- i. If the site has been designated a CCTV archival site or control station with 6 kVA UPS, a 32A single phase “main” supply shall be provided to the CCTV rack (UPS input circuit only) by means of a 32A 3-round pin rotary switched outlet, Clipsal 56P332, fixed to the ceiling or a suspended duct or pendant mount.
- j. Each rack outlet shall be supplied by its own non-RCD circuit breaker. Where 3- phase supply is available, the two outlets serving a particular rack shall be fed from different phases and the rack loads distributed evenly between phases.

4.9.4 Note that PTV confirms that in accordance with AS/NZS 3000 Amendment 1 – 2009 Clause 2.6.3.2.1 Australia item 6a “the connected equipment is required by the owner or operator to perform a function that is essential to the performance of the installation and that function would be adversely affected by a loss of supply caused by the RCD operation”. [All the equipment in the CER racks has one of the functions of essential system for security, patron safety, emergency management or direct operation of the rail signalling and control systems. These functions cannot be put at risk by interruptions resulting from routine RCD testing or from stray tripping due to the consolidated earth leakage of the mains EMC filters inside rack mounted IT equipment.]

- a. Two circuits, each with three 10A dual gang standard wall-mount Power Socket (GPO) shall be provided on ER walls to power wall mounted equipment such as any security and

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access control panels over and above the master panel in the VicTrack rack (such as fence detection processors for stabling yards).

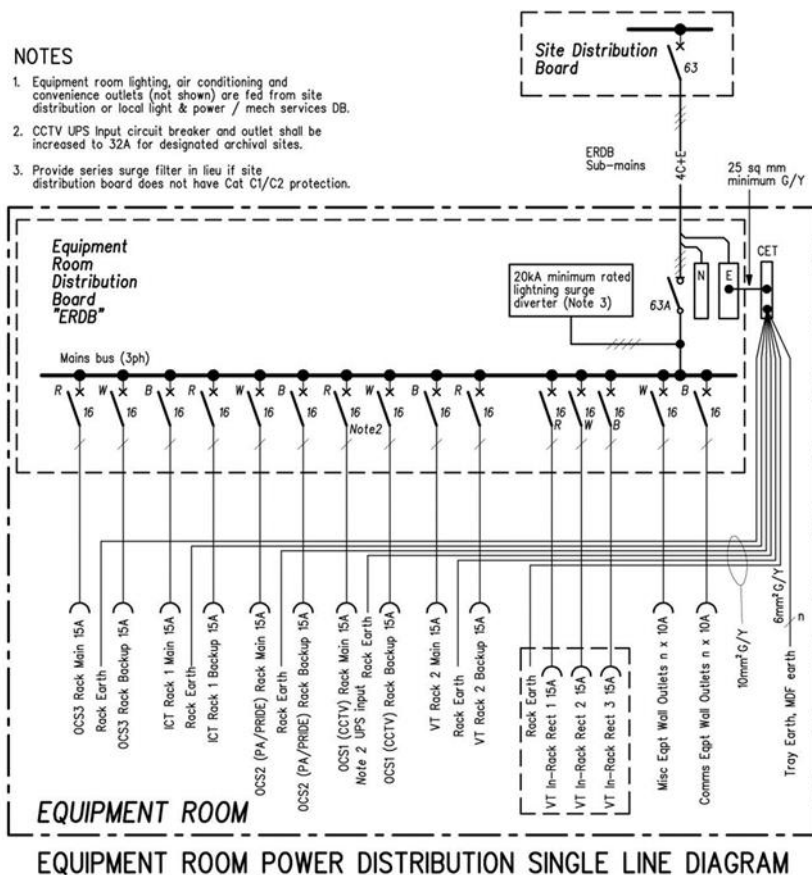
- b. For sites having a workstation in the station office or a control room, a single phase power inlet socket shall be provided above the CCTV rack and isolated single phase 2-pole RCD breaker rated at 6A provided on the ERDB or in a separate mini load centre to protect the circuit to the workstation 10A outlet Power Socket.

4.9.5 All outlets shall be identified with an engraved label indicating the serving DB and circuit breaker number.

4.9.6 A 10mm² Green/Yellow earth bonding conductor shall be run from the CET to each rack position and left with 3 m slack coiled above the rack (on the tray) for future termination to the rack by others (the respective rack installer).

4.9.7 Supply cables for mechanical, general light and power loads fed from distribution boards outside the room shall be fire sealed where the cables penetrate fire rated walls or ceilings. As the respective loads are permanent, the sealing method shall be of a permanent type such as fire rated caulking compound.

4.9.8 The electrical distribution is summarised in the single line diagram below.



4.10. Cable Trays

4.10.1 A suspended basket type cable tray system shall be provided at (or above) 2400 mm AFFL to route cables between racks and to support cables from the racks to (i) wall mounted trays connecting underground entrance pathways and wall mounted frames and equipment, and (ii) station overhead communications distribution trays in roof spaces outside the equipment room.

- a. The entire overhead suspended communications tray shall be of the same make and model range. Basket tray shall not be joined or coupled to ladder tray or Admiralty pattern tray.
- b. The basket cable tray shall be a minimum of 450 mm (W) × 50 mm (D) comprising epoxy powder coated steel mesh, Cablofil CF54/450 or approved equivalent.
- c. Generally the tray shall be supported on a centre tee suspension system allowing cables to be dropped in from either side without being obstructed by suspension rods.
- d. The suspension system shall permit extension or attachment to support the installation by VicTrack of Optical Fibre Ducting 130 mm wide and 20 mm offset from the basket tray.
- e. Above the racks, the tray route shall be centred 100 mm behind the rack centre line.
- f. Cable trays shall be fitted with “waterfall” cable radius guides at least 100 mm wide above each equipped or future rack position.
- g. Basket tray bends and tees shall be provided to route cables to wall penetrations to station pathways.
- h. A 90° vertical bend shall be provided where the cable tray routes cables to a tray down the wall to reach underground conduit and floor penetration appearances. 450 mm minimum admiralty pattern cable tray shall be provided down walls.
- i. Where the basket tray routes cables to (i) intumescent foam filled fire rated cable transits at a similar level (for wall penetrations) or (ii) to an Admiralty pattern tray fixed vertically to the wall and running along the length of the room to fix horizontal cable runs to the wall; the tray shall continue to within 100 mm of the cable transit wall tray (to leave clearance to run cables down past the end or to open cable transit).
- j. Bend radius protection fitted to the basket tray end shall be provided for cables leaving the overhead tray to run down the wall. This shall be achieved by a method suited to the volume of cables and the installation, such as a vertical basket tray bend, “Waterfall” guides, or 50 mm or greater PVC rigid conduit sleeve.
- k. Ladder tray shall be provided down walls on the main route between the overhead basket cable tray and conduits below. The tray size shall be 450 mm W×50 mm D minimum, but increased to 600 mm W×50 mm D if there are four or more conduits entering the equipment room.

4.10.2 On walls containing the MDF or security equipment, Admiralty pattern trays shall be provided mounted vertically to the wall (fixed flat/inverted to the wall with clearance set by the tray depth) to route cables along the room, into and between frames and equipment as follows:

- a. 300 mm wide Admiralty pattern tray running horizontally at high level along the length of the room above all wall mounted communications equipment and frames. The purpose of the tray is to fix horizontally run cables to the wall and to link various wall areas to the overhead basket tray system.

- b. 230 mm or 150 mm admiralty pattern spur trays shall be provided vertically and horizontally to reach up to (and around) wall mount termination frames and security alarm panels. The size of tray shall be consistent with the prospective number of cables which could be supported and the tray shall route cables to top, bottom and side entry points as applicable.

4.10.3 All communications cable trays shall be earthed to the CET via 6 mm² or larger G/Y cable to AS/ACIF S009. Only one cable run with connection lugs to each tray section is required for each tray run.

4.10.4 If separate electrical cable tray is also provided to carry pendant outlet circuits, it shall be mounted at least 300 mm above, or 50 mm spaced behind, the communications cable tray.

4.10.5 Allowance shall be made for VicTrack to install a suspended fibre troughing (duct) pathway alongside the basket tray and along the wall to the VT Optical Fibre MDF wall cabinet. This will be exclusively used for VicTrack optical fibre patches and will supplement the basket cable tray system. The system will comprise:

- a. Trough with maximum cross-section 150×150 mm (130×130 mm nominal).
- b. Minimum radii “waterfall” guides with a single flexible tubing down from the trough.
- c. Conduit extending from the tube into each rack and fibre distribution frame.
- d. Attachment to the basket tray suspension tee-bar system where practical.

4.11. Underground Cable Entry Conduits

4.11.1 Underground cable conduits shall enter the CER from a pit located as close as possible to the outside of the CER and no more than 10 m away from the CER.

- a. Wherever possible, arrangements whereby site entry or site distribution conduits from other buildings or areas enter a station building elsewhere, rise to the ceiling space and then run across the ceiling to the CER on ceiling tray shall be avoided by design.
- b. Reasons include underground cables usually being of flame propagating construction and thereby increasing the fire load and risk of fire spread, and difficulty or complexity of arranging access to such pathways when executing future moves, additions and changes on an operational station.

4.11.2 The entry conduits shall not cross tracks between the room appearance and the pit.

4.11.3 On sites having PTV SISD Level 1 security classification, dual entry pits and conduits with maximum available route diversity shall be provided.

4.11.4 When planning conduit placement, ease of pulling in new cables and routing to cable trays or the MDF shall be considered.

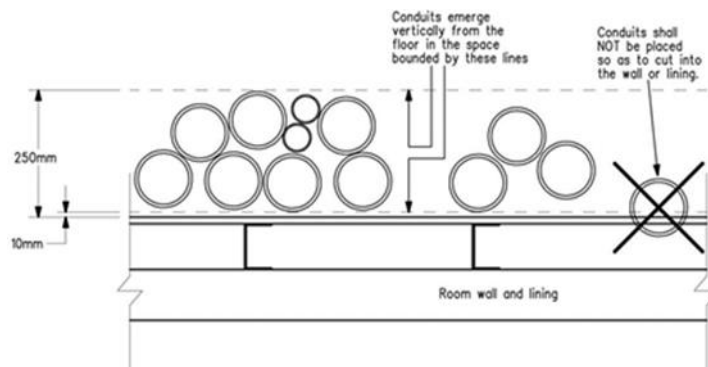
- a. By design, it shall not be necessary to physically pull cables past equipment after the room is fully fitted out.
- b. Conduits shall not terminate in aisle space or under racks.

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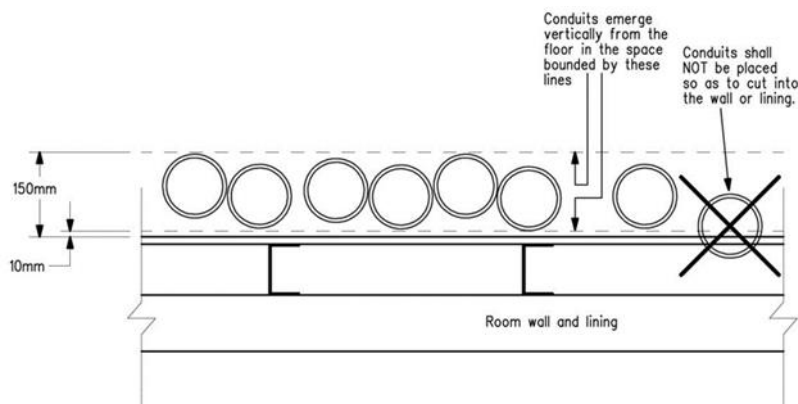
- c. Conduits shall NOT terminate horizontally into pits or trenches located inside the equipment room.

4.11.5 Entry conduits shall be set out prior to floor slab pours so that they emerge close to a designated wall (but outside the wall and inside the room).

- a. The exact entry arrangement will depend on the quantity and size of conduits, with conduits set out in a maximum of two interleaved rows along the wall, occupying a space within the range 10 mm to 250 mm from the wall between the outside surfaces of conduits.
- b. Where practical or achievable by design, all 100 mm bore entry conduits shall enter in a single row along the wall occupying a space within the range 10 mm to 150 mm from the wall between the outside surfaces of conduits [vertical exit conduit centres nominally 65 mm to 95 mm from the wall].
- c. Conduits shall be cut off in the range 100mm to 200mm above finished floor level.
- d. All spare conduits shall be plugged at the entry pit outside the room.
- e. All used conduits shall be sealed after the completion of works using a steel- wool-impregnated foam pack at the CER end to prevent pit gases, rodents and insects entering the room via the conduits.



PLAN VIEW OF CER ENTRY CONDUITS – DOUBLE ROW



PLAN VIEW OF CER ENTRY CONDUITS – SINGLE ROW

4.11.6 Ensure that the site entrance (VicTrack and Telstra) and distribution pit and pipe system provides pits near the room and supports entry conduits into the room from those pits.

4.11.7 Pits terminating the entrance conduits outside the room shall have sufficient footprint size to accommodate and effectively manage the high concentration of cables and multiple entrance conduits entering one side, and be deep enough to accommodate the 600 mm sweeping bend radius of the entry conduits (which will leave them at a depth of cover of the order of 700 mm). This will typically require a site distribution pathway pit of dimensions exceeding 500 Wx800 Lx800 D.

4.12. Telecommunications Cabling

4.12.1 Wall space shall be reserved for the provision of VicTrack carrier network boundary facilities comprising copper and optical fibre MDF's (Main Distribution Frames) with a minimum aggregate footprint of 1500 mm linear wall length x 300 mm deep.

4.12.2 Allocate space for the copper MDF comprising at least 4x270 pair frames (840 Wx 720 D mm) centred ~1300 AFFL.

- a. The selected location shall generally comply with AS/ACIF S009 MDF clearance requirements.
- b. A cable tray support pathway to the ER overhead cable tray, to the public carrier entrance cable penetrations, and to site distribution pathways, shall be provided.
- c. The frame allocations shall be as follows:
 - I. Vertical A: Exclusively for VicTrack use. Copper site connection cable (if applicable), Telstra MDF tie (if applicable), and VT Rack ties.
 - II. Vertical B: Tie cables to other OCS and ICT racks in the CER and distributors around the station or site.
 - III. Vertical C: Facility cabling for train control phones, clocks, CHPs, lift phones, signal post phones, CER wall phone and the like.
 - IV. Vertical D: Not normally equipped. Reserved as future spare space.

4.12.3 At least 300 mm (of the 1500 m total) linear wall space from floor level to a height of 2200 mm AFFL shall be allocated for VicTrack fibre distribution frames or a VicTrack optical fibre cabinet.

- a. The selected location shall generally comply with AS/ACIF S009 MDF clearance requirements and should be adjacent to the copper MDF where space and room shape permits.
- b. Allowance shall be made to ensure that higher level fittings on the wall do not encumber the installation by VicTrack of an optical fibre duct system of cross-section up to 150x150 mm² over the fibre cabinet and parallel to the wall (and then following communications basket tray to the rack bay-line).

4.12.4 A wall phone outlet / plate shall be provided 1400 AFFL on the wall directly in front of the equipment racks, or on the wall at the end of the bay line (front rack side, beyond door swing range).

- a. Cat 6 cable shall be provided back to the designated rack IDF for the Rail Operator's phone services (normally OCS01), and terminated on a Highband10 module on vertical C.
- b. An ERDB fed Power Outlet shall be provided 300mm below to power a cordless phone base.
- c. The outlets and the subsequently installed phone must not be located under the air conditioner indoor unit.

4.12.5 ARO corporate network data outlets shall be provided in accordance with clause 4.4.5 a).

4.13. Electronic Security and Access Control System

4.13.1 A system shall be provided for intruder detection and access control in accordance with the respective project "ICT Systems Specification: Electronic Security and Access Control System".

- a. The equipment, sensors and wiring within the Equipment Room to satisfy the requirements detailed in this clause (below) shall be included in the respective project "ICT Systems Specification: Electronic Security and Access Control System" and executed as a part of the OCS works.

4.13.2 The system master panel and door controller shall be wall mounted on the front equipment room wall or in another position that does not impact on equipment rack clearances.

- a. The system shall operate in silent mode within the CER apart from low level audible alerts. Alarm screamers shall not be installed in the CER.
- b. An alarm sector shall be wired in four core 7/0.2 security cable to each equipment rack position. After racks are installed, the sector shall be connected to the rack door tamper switches and End-of-Line resistors fitted (at the first switch).
- c. The system shall incorporate its own DC power supply and 8-hour backup batteries and operate from wall power outlets fed from the ERDB and sharing a circuit with the power outlet serving the ER telephone.

4.13.3 A 16 area remote arming station ("RAS") shall be provided inside the room and near the door. Its function is to allow technicians to:

- a. View the status of all sectors and arming areas.
- b. Arm and disarm other station areas.
- c. Maintain and administer the arming and user codes.

4.13.4 A proximity card reader shall be mounted in a secure manner on the outside wall adjacent to the CER door. This shall be installed and configured to release the CER door and provide arming and disarming operations.

4.13.5 An industrial grade triple biased balanced reed switch, Sentrol 2707A, shall be provided inside the door on the top corner of the opening (non-hinged) side, with end-of-line resistors fitted inside a tamper-alarmed junction box, and connected via conduit enclosed wiring to the station security alarm system Master Panel.

4.13.6 In respect of equipment room alarming and control, the system shall be configured for one alarm arming area for the room space itself, one area per room tenant or user group, and one smoke detection area. These shall be configured to function as follows:

- a. When the system is initially armed, a valid user card badge will disarm the room area (including reed switch and forced door alarm) together with the rack tamper alarm area for the respective user (if applicable). The status change shall be indicated on the card reader by indicator LED colour or mode change.
- b. If another user badges the reader, the rack tamper alarm area for that user shall also be disarmed.
- c. When the last user leaves, that user will badge the reader outside three times to re-arm all CER alarm areas and the card reader status LED shall change to "armed" colour or mode. A rejection audible and visual alert shall be provided if the operation has failed due to one or more sectors being in alarm.
- d. The system shall automatically issue a warning alert (from the RAS) and then re-arm all CER areas of the system (not being in an alarm state) after two hours of inactivity. Alarms shall be reported for any sectors in an alarm condition at this time.
- e. User groups may include ARO(s), VicTrack, PTV, Telstra, and Ticketing system operator.
- f. The smoke detector shall remain armed at all times unless isolated (disarmed) by an authorised maintainer.
- g. "Forced door" and "door open too long" alarm conditions shall be sensed and reported in accordance with the general requirements of the respective project "ICT Systems Specification: Electronic Security and Access Control System".

4.13.7 A smoke detector wired to the station fire alarm system shall be provided on the ceiling towards the centre of the equipment room.

- a. If the station does not have a monitored fire alarm system, the detector shall be of a type having a relay alarm extension base and be powered by 12V DC alarm panel power or 240V mains power. It shall be treated as an equipment environmental sensor, wired to a security panel sector configured for 24-hour arming.

4.14. CCTV Pre-Cabling

4.14.1 A Cat 6 cable wired to the CCTV rack location (left with 2 m slack coil at each end) or an accessible cable pathway shall be provided at the nominated CCTV camera location (which shall be chosen to offer a clear view of anyone entering the room).

- a. When planning the placement of the camera, the occluding effect of any cable trays or racks below the camera in the path between the camera and the sides of the room doors shall be taken into account. This may require the camera to be mounted on a wall below tray level.
- b. The CCTV camera, housing and terminating connectors shall be provided as part of CCTV security package outside base building scope of work. The Cat 6 camera cable shall be included in the CCTV security package if it is not included in the equipment room construction scope.

4.15. Fire Barrier Penetrations

4.15.1 All fire barrier penetrations for communications cables and UPS power distribution shall be achieved by provision of re-openable compartmentalised intumescent- foam-filled fire-rated cable transits.

- a. The Abesco CT120 series and Cablofil EzPath series (EZD33) are candidate products meeting this requirement.
- b. Transits with cable cross-section capacity to match the tray cross-section beyond the penetration shall be achieved by the use of multiple intumescent- foam-filled cable transits mounted adjacent to each other in a bank.
- c. Fire barrier penetrations supporting communications shall not be sealed by means of pillows or solid setting caulking compounds.

4.15.2 Fire resistant caulking may be used to seal:

- a. Electrical switchboard glands.
- b. General light and power cable penetrations.
- c. Air conditioner pipes.

4.16. Fire Rating

4.16.1 The room construction shall achieve a minimum 1 hour ("60/60/60") fire rating.

4.17. Stand-Alone Room External Requirements

4.17.1 Stand-alone rooms shall be provided with a compacted gravel, bitumen sealed or concrete path suitable for the use of furniture trolleys for moving racks and equipment in all weather.

5. Standard Station Communications Equipment Rooms

5.1. Background

5.1.1 The Communications Equipment Room shall be provided where advised by PTV in the project brief, or where the requirements of the station project identified during design planning (including allowances for VicTrack services and future growth) cannot be accommodated in the existing equipment room.

5.1.2 VicTrack, in conjunction with the PTV and the relevant ARO, must approve any final Communications Equipment Room layout and specifications. (Refer to Clause 3.2)

5.2. General Space Requirement

5.2.1 The Communications Equipment Room shall be designed and constructed to provide accommodation, power and climate control for at least four standard 640 (W)×1000 (D) and two standard 800 (W) × 1000 (D) IEC60297 equipment racks.

5.2.2 A space of approximately 15.5 m² or greater shall be provided, laid out to achieve the minimum clearances specified in clause 4.5.

5.2.3 The exact dimensions will depend on the building structure and shape and may align with a structural or architectural grid.

5.2.4 Additional space requirements for Radio or DTRS transceivers or system equipment shall be confirmed with PTV.

5.3. Typical Layout and Facilities

5.3.1 The room design shall generally meet all the requirements of clause 4.5. A typical layout showing the implementation of these requirements is shown below. The symbols used are generally in accordance with standard practice as specified in AS/NZS 1102.111.

- a. The actual CER layout and size will be influenced by building lines and the position of doors and entry conduits, which are in turn impacted by surrounding services.
- b. Alternative layouts meeting all the design criteria (SECTION 4.0) will be accepted.
- c. The diagram is a composite of items provided under the full range of architectural, engineering and OCS services contributing to the room construction and facilities, to be detailed in various drawings and packages as summarised in clause 6.6.

5.3.2 The lighting layout is based on the following assumptions:

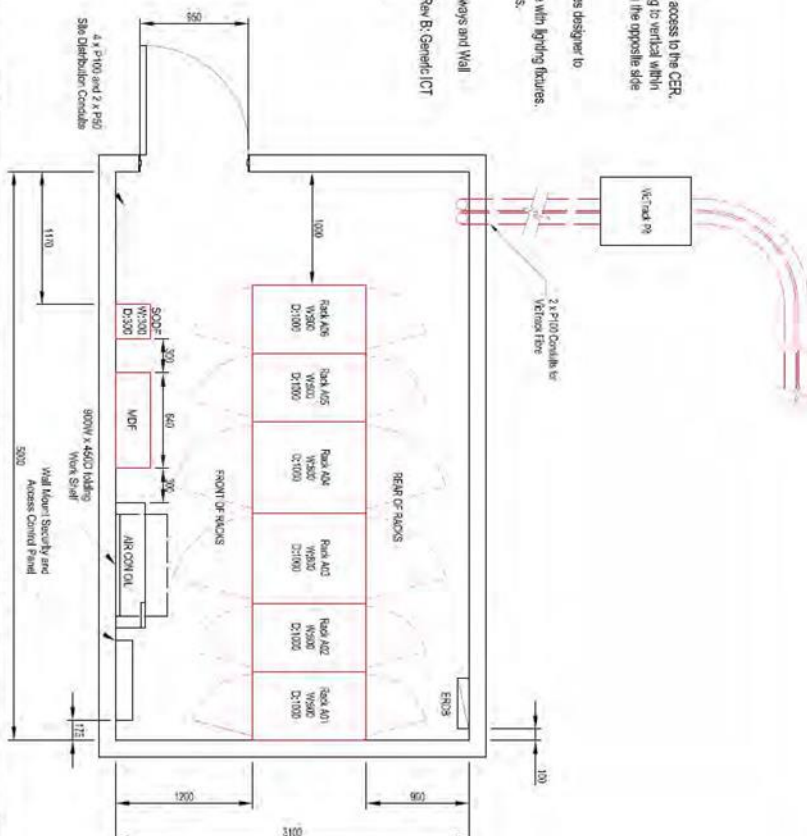
- a. Compliance with the assumptions and design basis stated in clause 4.6 generally and clause 4.6.7 in particular.
- b. The ceiling height is in the range 2700 – 3000 mm.

- c. Fittings are fixed directly to the ceiling (not suspended). [If the ceiling is higher than 3000mm, suspended fittings of the specified size at 2700mm AFFL may be substituted.]
- d. Equipment racks are up to 45 Rack Units or 2200 mm high.
- e. Trays are suspended at 2400 mm AFFL (to underside of tray) and routed as shown on the diagram.
- f. Walls and ceiling are painted white, or in a light pastel shade with a reflectance factor 95% as high as white.
- g. Reflectance factor of 75% to 80% for ceiling and walls, 20% for floors and 30% for cabinet surfaces.
- h. Compliance with BCA requirements for lighting and energy efficiency is achieved (or does not apply) by virtue of the intermittent occupancy of the room and automatic switch-off of lights when the room is unoccupied.

5.3.3 The air conditioner indoor unit location has been selected with the aim of providing a reasonably even supply air flow to the front of all racks (via appropriate aiming of the lower diffuser to achieve a “cold aisle”) and to draw return air from warm air flow over the tops of racks.

- a. The location also provides maintenance access to the ends of the unit without needing to work hard up against or over equipment racks or cable trays.
- b. The appropriate air conditioner location for other room shapes, layouts or door positions must be determined by the mechanical designers, considering effectiveness of air flow, and taking maintenance clearances for the air conditioner and between adjacent equipment items into account.

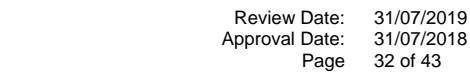
1. The Communications Equipment Room to be located with clear and safe access for Personnel and delivery of equipment. Vc1 rack, MTU and PTU requires 24 Hour access to the CER.
2. 2 x P100 conduits to enter the CER from nearest Vc1/rack Communications RIT, rising to vertical within 150' of fields wall, 4 x P100 and 2 x P50 Silo Distribution conduits to enter CER from the opposite side and rise to vertical within 150' or wall.
3. The CER has its own Customer Room Distribution Board (CRDB)
4. The CER to have its own Customer Room Terminal as per ASIA/CIF/S103, Building Services designer to provide compliant Electrical Schematic for CER.
5. Cable Tray to be suspended minimum 2400 Hous and located to prevent interference with lifting fixtures
6. Provide 15A power outlets (Class 15 series or similar) to be mounted above racks.
7. CER shall be designed to provide a 1 hour fire rating.
8. Layout is typical and shows minimum required dimensions.
9. All Actual Tray Routes shall be designed to connect to the respective Facilities. Pathways and Wall Mounted Facilities placed above the Vertical Tray Runs.
10. Refer to R100/S3.13.1 Rev A Communications Equipment Room Bldg and 013.3 Rev B Generic ICT Communications Room.
11. For Typical Power Diagram See Drawing SER-D10932, Sheet 02.
12. For Typical Lighting Diagram See Drawing SER-D10932, Sheet 03.
13. For Typical CER Inroom Elevators See Drawing SER-D10932, Sheet 04.

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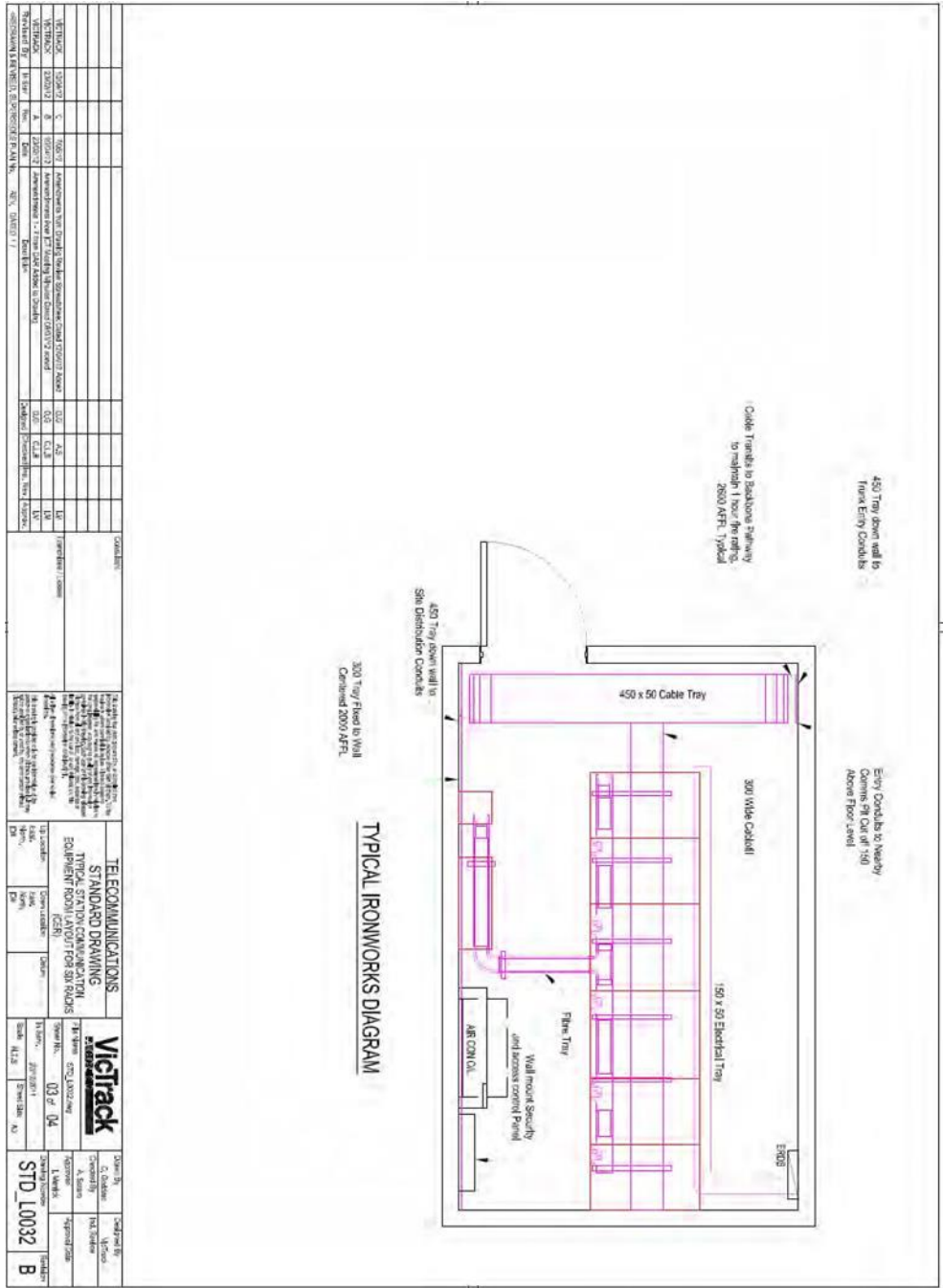
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Approval Date: 31/07/2018
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6. System Delivery Process

6.1. Overview

6.1.1 The Requirements of the respective project “ICT Systems Specification: General Requirements and Infrastructure” shall apply.

6.2. Installer Accreditations and Compliance

6.2.1 All trades shall be executed by contractors or persons holding relevant statutory licences or registrations.

6.2.2 The overall package requirements for each of the individual architectural and engineering services shall apply.

6.2.3 The requirements of the respective project “ICT Systems Specification: Electronic Security Services and Access Control” shall apply for the electronic security system.

6.3. PTV Approvals

6.3.1 The requirements of the respective project “ICT Systems Specification: General Requirements and Infrastructure” shall apply.

6.4. Contract Data Requirements List

6.4.1 The Requirements of the respective project “ICT Systems Specification: General Requirements and Infrastructure” shall apply.

6.4.2 The following lists those items of documentation deliverable as part of the respective projects Equipment Room design and construction, along with a delivery schedule.

CDRL Item	Reference Clause	Delivery Schedule (& Hold Point)
Architectural and engineering services drawings and specifications	6.6.2	1. Prior to Issue For Tender 2. Prior to Issue For Construction

Table 4. Deliverables

6.5. Transition Plan (At Commencement)

6.5.1 Where the project involves the transition of equipment and services from an existing room to a new CER provided under the project, the requirements of the respective project “ICT Systems Specification: General Requirements and Infrastructure” shall apply.

6.6. Design Review and Shop Drawings

6.6.1 The requirements of the respective project “ICT Systems Specification: General Requirements and Infrastructure” shall apply.

6.6.2 The drawings and specifications submitted for the CER to demonstrate compliance with this CER brief shall include:

- a) Mechanical services showing CER air conditioning units, wiring and condensate drainage, including:
 - I. Basis of design for air conditioner load.
 - II. Method used for achieving specified fresh air.
 - III. Air conditioner details including BMS remote control option.
 - IV. Thermally fused air dampers (if applicable) to achieve one hour fire rating.
- b) Electrical services including:
 - i. Electrical distribution single line diagrams for both
 - ii. the site (showing CER Distribution Board incoming supply and separate supplies to CER lighting and air conditioning); and
 - iii. The CER Distribution Board itself, including showing the CET and rack earthing.
 - iv. Floor plan to scale (typically 1:20) showing rack footprints, wall mounted equipment, fittings (such as air conditioner, electrical board) and facility (outlet) locations, entering conduit positions, re-openable fire rated cable transits to scale, and plan view of entering conduits and wall riser trays.
 - v. Reflected ceiling plan to scale (typically 1:20) showing ceiling mounted outlets and lighting, lighting control movement detectors, suspended cable trays and intumescent-foam-filled fire-rated cable transits at penetrations for cables rising through the ceiling.
 - vi. Wall elevations and sections showing communications cable trays around, and up and down, walls; linking room cable entries and conduits with wall- mounted equipment and overhead distribution, wall-mounted power outlets, emergency exit light, air conditioners and technicians workstations.
 - vii. Lighting level calculations.
 - viii. Entering conduit routes and linkages to site distribution pits (in both plan and elevation if necessary for clarity of intent).
 - ix. Schedules or legends showing all major components such as surge filters, light fittings, all types of power outlets, cable trays, motion switching sensors.
- c) Structural services showing:
 - i. Wall, floor and ceiling / roof plans and sections and materials.
 - ii. Studs or block work suitable for MDF and wall mount device fixing.

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- iii. Block-outs or penetrations for entering cables including provision for inserting fire barrier cable transits and entering conduits through footings and floor.
- iv. Demonstration of attributes meeting floor load rating and one-hour fire rating.

d) Architectural services showing:

- i. General room layout including racks and door opening space.
- ii. Door with door hardware and finishes to suit fire rating, strength criteria and access control.
- iii. Door weather seals.
- iv. Floor finishes are anti-slip and anti-static surface.
- v. Wall and ceiling seal method and paint finishes.

e) Fire Services (or inclusion in architectural) showing fire extinguisher inside the door.

f) Security and Access Control shall include details as called up in the respective project "ICT Systems Specification: Electronic Security Services and Access Control". This will generally include showing the equipment room smoke detector, rack cabinet door tamper switches, room door reed switch, door access control components (to suit door type), RAS, security master panel and door controllers in the following documents:

- i. Security system wiring schematics.
- ii. Security system input/output schedules (may be included as tables on schematics).
- iii. OCS/ICT Cable Record List
- iv. Equipment room floor, reflected ceiling and wall elevation plan layouts (may be either combined with electrical layouts or shown on dedicated Security (+ ICT) System layouts.

g) ICT Services shall include voice and data outlet requirements for the CER to be included in the following documents:

- i. IT Facilities cabling schematics.
- ii. Telephone cabling schematics.
- iii. Equipment room floor, reflected ceiling and wall elevation plan layouts (may be either combined with electrical layouts or shown on dedicated ICT (+Security) layouts.
- iv. OCS/ICT Cable Record List

6.6.3 The Information shall be of sufficient detail to enable PTV to verify that all the criteria in this document have been met by the design and finished applied.

6.7. Commissioning Tests

6.7.1 The overall package requirements for each of the individual architectural and engineering services shall apply.

6.7.2 The requirements of the respective project "ICT Systems Specification: Electronic Security Services and Access Control" shall apply for the electronic security system.

6.8. Verification (Acceptance)

6.8.1 The overall package requirements for each of the individual architectural and engineering services shall apply. For the CER, this shall include demonstrating that all aspects of the approved design have been implemented by inspection or functional test.

6.8.2 The requirements of the respective project "ICT Systems Specification: Electronic Security Services and Access Control" shall apply for the electronic security system.

6.9. As Built Documentation and Manuals

6.9.1 The overall package requirements for each of the individual architectural and engineering services shall apply.

6.9.2 The requirements of the respective project "ICT Systems Specification: Electronic Security Services and Access Control" shall apply for the electronic security system.

7. Support Services and Spares

7.1. Warranty (Defects Liability Period) Support

7.1.1 The overall package requirements for each of the individual architectural and engineering services shall apply.

7.1.2 The requirements of the respective project "ICT Systems Specification: Electronic Security Services and Access Control" shall apply for the electronic security system.

7.2. Spares

7.2.1 Spares are not required for general room architectural and service elements.

7.2.2 The requirements of the respective project "ICT Systems Specification: Electronic Security Services and Access Control" shall apply for the electronic security system.

8. Design Check List

8.1. Purpose

8.1.1 The items in this section shall be confirmed as having been addressed by the design (and incorporated in drawings and specifications) prior to submittal to the PTV Project Manager for review and approval.

8.1.2 This list is not a substitute for a clause by clause check of the main body of the document, but it covers the most commonly overlooked aspects of room designs.

8.2. General Layout and Architectural

8.2.1 The room location does not have pipes running across, through or over it, is above water (and flood) level, away from electromagnetic interference sources and suitable for 24x7 access.

8.2.2 Light coloured paint finishes are specified for walls and ceiling. Paint to be applied before room fit-out.

8.2.3 Anti-static non-slip floor finish specified.

8.2.4 Single door has electric lock with free handle egress and key override, power transfer device and cored hole for cabling. (Double door has dual leaf Electromagnetic lock, key override switch outside, request to exit and emergency break glass release inside).

8.2.5 Door weather seals specified.

8.2.6 Minimum 1500 mm of wall width with a minimum depth of 300 mm reserved for public carrier network boundary facility.

8.2.7 Around the above space allocation, a minimum of 300 mm clearance either side of wall maintained for any copper verticals (which will occupy a space 840 mm wide).

8.2.8 Floor is rated for equipment rack load.

8.2.9 The room doesn't have any windows or sky lights.

8.2.10 The door is high enough and wide enough to pass an 800mm W x 2200mm H rack through and positioned for easy movement of equipment and people in and out of the room.

8.2.11 Folding down technician work shelf is provided on the wall facing the front of racks.

8.3. Electrical

- 8.3.1 Entering conduits terminate at the bottom of perimeter walls.
- 8.3.2 Entering conduits terminate in pits near the room outside.
- 8.3.3 Track crossing conduits do not enter the room directly (but terminate on pit outside the room).
- 8.3.4 Cable trays up walls link the conduits to overhead tray pathways.
- 8.3.5 A cable basket style tray is specified for communications distribution above the racks (but within the room), with guides to manage cable drops at each rack position.
- 8.3.6 Space and provision for fixing has been allowed for a VicTrack fibre duct system and fibre cabinet.
- 8.3.7 Cable tray is at least 300mm from any fluorescent light fittings.
- 8.3.8 Cables between racks and other equipment within the room can be run on the pathways provided without having to pass outside the fire rated compartment.
- 8.3.9 Three power outlets within the VT rack and two above each rack position on all immediate and future positions are provided, and serviced by individual dedicated non-RCD circuit breakers.
- 8.3.10 Equipment room DB (ERDB) provided. Air con and lighting are fed from another board.
- 8.3.11 ERDB single line diagram produced. Surge diverter or filter (as applicable) included. No RCDs on rack circuits. CET and earth cabling shown.
- 8.3.12 The ERDB door and position does not clash with opening of rack doors or placement of racks.
- 8.3.13 The ERDB is positioned for ease of electrical maintenance.
- 8.3.14 Convenience GPOs are spread around the room perimeter.
- 8.3.15 The lighting level achieved in the aisle in front of racks and behind averages 500 lux.
- 8.3.16 Lighting is under movement detector automatic control and time out.
- 8.3.17 A maintained emergency exit light is provided over the door.

8.4. Mechanical Services

- 8.4.1 Air conditioner indoor unit is not directly over any equipment.

8.4.2 Air conditioner is central to the main loads and will deliver cooled air into the front of the racks.

8.4.3 Protective steel cage specified for outdoor unit. Power feed for this by locked outlet, preferably inside cage. Fixings are secure head fasteners.

8.4.4 Pipe work is designed to not detract from room fire rating.

8.4.5 Air conditioner has remote control interface with "A/C off" and "Fault" contact outputs wired back to MDF or an Ethernet LAN interface with fly lead extended to the CCTV rack position.

8.4.6 Thermostatic control provided with sensor on rear wall.

8.5. Fire Considerations

8.5.1 All components selected for one hour fire rating.

8.5.2 The ceiling is of solid fire rated material and any penetrations or hatches (if unavoidable by design) are selected to maintain fire rating.

8.5.3 Cable entries through the fire barriers are fitted with protective re-openable transits or glands.

8.5.4 Any inlet or outlet air ducts are fitted with fusible link fire dampers.

8.5.5 A portable fire extinguisher (powder type suitable Class E fires) is provided near the door.

8.5.6 A relay base smoke detector is provided on the ceiling towards the centre of the rack bay line.

8.6. Security

8.6.1 Card reader specified next to the door outside on the same side of the door as the door handle.

8.6.2 High security (triple biased) reed switch at top of door provided.

8.6.3 Space allowed for the alarm panel which is readily accessible for maintenance.

9. References

9.1. Australian Standards

The following Australian Standards shall be complied with and have been referenced in this document:

Document No	Title
AS 1102.1xx	Graphical Symbols for Electro technology (full set parts 101 to 113)
AS/NZS 1768	Lightning Protection
AS/NZS 3000	[Electrical] Wiring Rules including published amendments to date
AS/NZS 3084	Telecommunications installations – Telecommunications pathways and spaces for commercial buildings
AS/NZS 4383.1 – 4	Preparation of documents used in electro technology
AS/CA S008: 2010	Requirements for customer cabling products
AS/ACIF S009: 2006	Installation requirements for customer cabling (Wiring Rules)
BCA	Building Code of Australia

Table 5. Australian Standards

9.2. Rail Industry Standards

The following Rail Industry standards shall be complied with:

Document No	Title
VRIOGS 007.2-2011	Infrastructure Drawing Standards
VRIOGS 012.2 – 2007	Specification for Signalling Supply, Construction and Installation (primarily in the context of equipment rooms and cable pathways within the track)

Table 6. Rail Industry Standards