Te Whatu Ora
Health New Zealand

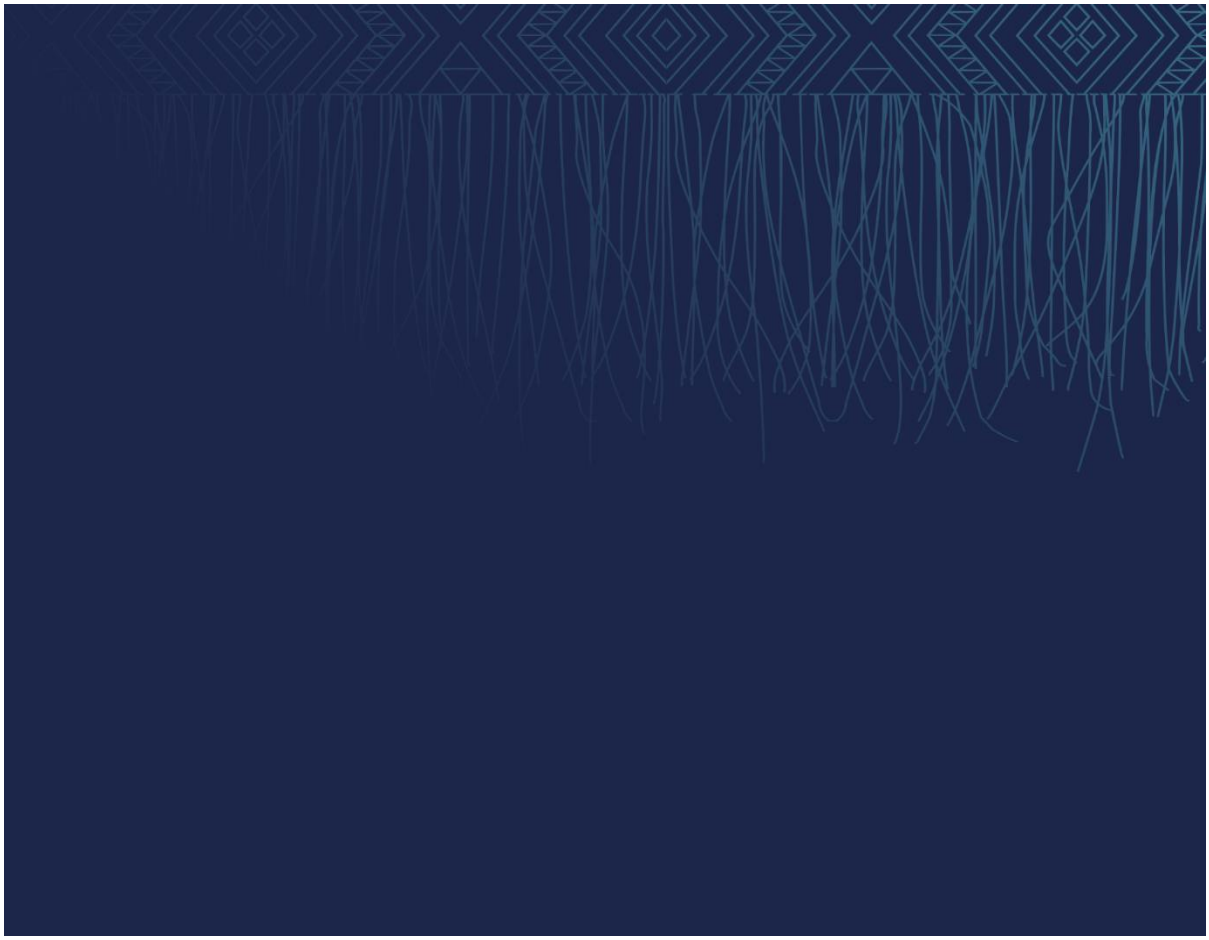
hiso Health Information Standards Organisation
PAEREWA PĀRONGO HAUORA

National Digital Communication Systems and Structured Cabling Standard

HISO 10105:2024

V1.0

Data & Digital – 23 April 2024



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Te Whatu Ora
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This document **shall** be reviewed regularly to address changes in standards and guidelines as they impact cabling infrastructure design, installation, commissioning, and testing. When the review process identifies the requirement for amendment a new or refurbished version will be released.

Acknowledgement: is made to the four regions that provided their existing communication systems and cabling standards / guides and expertise, to enable the creation of this National Standard, as well as Torque IP.

Approvals

The following officer has approved this document on behalf of the Technical Design Council

Name: Leigh Donoghue

Position: Chair, National Data & Digital Technical Design Council

Signature  Date: 20/5/2024

Endorsement

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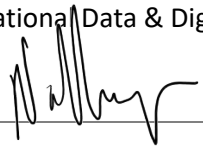
Signature  Date: 10th May 2024

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1. Introduction

1.1.Purpose

The Healthcare environment provides one of the most challenging areas for the design, installation and operation of ICT infrastructure and solutions. It has exceptionally high demands for reliability, fault tolerance, and service availability, and must address the complex demands required to support clinical technology, clinical operations, staff, and equipment throughout the nation.

The purpose of this document is to define the minimum standards and to provide guidelines to be followed when undertaking communication systems, data cabling design and installation services for Te Whatu Ora – Health New Zealand, (referred to from this point onwards as Te Whatu Ora).

All employees, manufacturers, accredited installers, cabling contractors, and design consultants involved in Te Whatu Ora ICT cabling projects **shall**:

- Contact the relevant Data & Digital Representative to confirm they are working on the current version of this standard before proceeding with work.
- Comply with this standard.
- Have a copy of this standard with them while on site or access to an electronic copy on site.
- Contact the Data & Digital Representative to clarify/confirm site specific information.

This standard also provides guidance for cabling designers to provide converged and integrated cabling solutions for equipment including IoT, CCTV, Building Management Systems (BMS), Access Control, Security and Nurse-call systems.

The intent of this document is to:

- Ensure that a “fit for purpose” installation is provided.
- Promote installation consistency.
- Ensure the safety of system installers and operators.
- Provide uniformly documented systems.
- Provide structured communication facilities that enable efficient system expansion.

1.1.1. Ownership and Confidentiality.

1.1.1.1. Intellectual property

All submissions, drawings, schematics, policies, and procedures related to the network and its premises are the property of Te Whatu Ora.

1.1.1.2. Confidentiality

All drawings, specifications and other information supplied by either Te Whatu Ora or by the consultant (on Te Whatu Ora’s behalf) are regarded as confidential.

The contractor **shall not** disclose any such information to a third party without the written consent of Te Whatu Ora.

1.1.1.3. Periodic Review

Version 1.0 is the first approved version of this standard. This standard will be reviewed at minimum annually and updated to reflect changes to other relevant standards and general improvements.

1.2.Scope

The scope of this document is limited to the passive cabling system and minimum standards for telecommunication and equipment rooms owned by Te Whatu Ora, including:

- Cable Pathways including pits, tunnels, trenches, cable trays, catenary wire, conduit etc.
- Telecommunication & Equipment Rooms including power, lighting, cooling,
- Cabinets and Racks
- Electrical grounding and bonding
- Backbone cabling including optical fibre, loose tube, tight buffer, air blown and micro-ducts
- Distribution cabling (horizontal)
- Data Outlets, Patch Cords, and Fly Leads
- RF Systems including WIFI and Distributed Antenna Systems, (passive components only)
- Testing, documentation, and labelling

1.2.1. Out of scope

- Active network layer including application layer,
- Rooms other than Equipment or Telecommunication rooms, (e.g. data centres, audio visual rooms,),
- Full listing of contractual obligations.

1.3.Criteria for use

This document does not provide a comprehensive design guide resource on its own. It is intended to be used in conjunction with other reference sources including New Zealand legislation, New Zealand, and Australian published standards, the BICSI TDMM, manufacturers design and installation instructions for detailed design and installation guidance. The document defines the minimum criteria for Generic Cabling Systems and includes references for other Structured Cabling systems to be used in all design and construction activity.

The requirements in this Standard are in line with the appropriate New Zealand Standard Specifications and/or additional to the accepted international industry standards, as well as any special contract requirements. Where a site or region has a more detailed standard they may use it in addition to this standard, noting that in the event of any conflicts, this national standard takes precedence.

All contractors, working on any Te Whatu Ora owned cabling, cable-related infrastructure, or buildings (when installing cable or associated infrastructure) **must** be familiar with the contents of this standard and **must** always comply with its intent.

1.3.1. When to apply this standard

1.3.1.1. Upgrade of existing infrastructure

Any new installations or alterations to existing Te Whatu Ora communications cabling **must** conform to this standard requirement including, where applicable, product selection, colour codes, cable installation management and labelling conventions as well as the latest documentation processes.

In some instances, the contractor may be asked to aid in the design of certain elements of the infrastructure, they should be confident that they are qualified to do this and that they follow the criteria laid down in this standard, if in doubt guidance **must** be sought from the relevant Te Whatu Ora representatives.

If a site is currently vendor specific (one product type) then this product should be “called out” in the design and specified in the requirements.

New equipment locations **must** be positioned in consultation with the relevant Te Whatu Ora representatives and abide by relevant governance processes.

NB: Consideration should be given to the requirements of other trades involved in the works including civil, mechanical, fire, security, and electrical engineering services.

Unless an upgrade of existing cabling infrastructure is being undertaken to address a mandatory code or legislation violation, or to correct a performance, security or operational requirement, there is no requirement for existing installations to be proactively upgraded to these standards and guidelines.

1.3.1.2. Required upgrade

When Te Whatu Ora determine an existing installation needs to be upgraded, this work will be undertaken as an upgrade project with a defined scope of works provided and **shall** meet the standards set in this document.

1.3.1.3. Moves, Adds, Changes

When MACs are undertaken on existing installations, and where a warranty is already provided for the existing installed system, the MACs **must** be consistent with the installed product and the warranty extended to cover the MACs.

Where work is taking place that may impact IT Services, formal change control (request for change) process **must** be followed.

1.4. Categories of criteria

Two categories of criteria are specified - ***mandatory*** and ***advisory***.

1.4.1. Mandatory criteria

Mandatory Criteria generally, apply to protection, performance, administration, and compatibility; they specify the absolute minimum acceptable requirements.

Mandatory requirements are designated by the words '***Must***' or '***Must not***', '***Shall***' or '***Shall not***' all other references are recommendations only.

1.4.2. Advisory or desirable criteria

Advisory or desirable criteria are presented when their attainment will enhance the general performance of the system infrastructure in all its contemplated applications.

Advisory or desirable recommendations are designated by the words '*Should'*, '*May'* or '*Desirable'*.

1.5. Generic Cabling System definition

A Generic Cabling system is a specific form of Structured Cabling System that defines the criteria for the support of a wide range of standardised applications. This standards-based design is typically applied for IP connectivity in horizontal and vertical (backbone) distribution but may also support many other protocols that can exist within the defined limited of cabling performance and length.

1.6. Structured Cabling System definition

A Structured Cabling system is a specific cabling solution designed with a set of cabling and connectivity design parameters and products that are constructed (engineered) according to standardised rules to facilitate specific connectivity requirements.

Structured Cabling Systems may be designed to support specific protocols and applications that have product and performance requirements not aligned to the Generic Cabling System limits. These may include Nurse Call systems, building control systems, security systems and new or refurbished technologies such as Single Pair Ethernet.

1.7.Principles

1.7.1. Design Intent – Te Whatu Ora Digital Hospital capable

Te Whatu Ora Hospitals and facilities **must** adhere to the design principles for

- Privacy

- Cyber Security

- High Availability (HA)

- Flexibility

- Resiliency

Te Whatu Ora Hospitals and facilities with high availability requirements that support critical systems, including digital patient care and building safety systems, require a robust foundational infrastructure that can deliver the high availability they demand. All components providing or supporting critical systems **must** be architected for high availability.

Examples of these services that required HA include:

- An Emergency Department (ED)
- Surgical Theatres
- Intensive Care Unit (ICU)
- Secure Mental Health Wards
- An Emergency Operations Centre

1.7.2. Digital Hospital design principles and responsibilities

Te Whatu Ora has committed to ensuring all major hospital redevelopments and new hospitals are being designed and built to be digital hospital infrastructure ready, (Inframe level 6 or equivalent).

This includes the passive infrastructure enabling data, voice, and location grade to exceed 81% for all specified buildings and a fully redundant network that can recover with no downtime. It also includes the ability to conduct maintenance with zero downtime.

a) Redundancy to protect against typical failure modes, including localised faults (such as equipment failure, cabling damage, localised power faults).
b) Highly resilient.
c) Secure by design at all levels.
d) Simplified access and easy to maintain.

1.8.Convergence

New facilities will have an Integrated Communications Network (ICN). This is the converged communications infrastructure that allows all systems and services to easily connect and communicate over a common IP network.

1.9. Applicability

1.9.1. Inclusions (**must**)

- Design and construction of new or refurbished communications rooms.
- Design and construction of new or refurbished data cable pathways: Tunnels, underground ducts, cable tray, cable basket, cable ladder, conduit, and any other cable containment/reticulation system.
- Design and installation of cabinets and racks for hosting networking and storage & compute equipment.
- Design and installation of all fibre optic cabling systems.
- Design and installation of all copper balanced cabling used for networking equipment including IoT, CCTV, Building Management Systems (BMS), Access Control, Security and Nurse-call systems.

1.9.2. Exclusions (may)

- Existing data cabling, cable pathways and spaces. When utilising these elements for provision of new or refurbished services, all aspects that can comply to this standard **must** do so. When submitting plans and commercial documentation related to cabling works all non-compliant elements of the proposed build **shall** be itemised.
- Sites co-owned by Te Whatu Ora. Cabling standards on these sites are to be determined on a per site basis. If the co-owner does not have a cabling standard this standard **shall** apply.
- Sites with existing structured cabling systems purchased by Te Whatu Ora may not comply with these standards. In such a case, a migration to these standards may need to be staged.
- Temporary installations such as conference cabling or cabling to portable buildings. A temporary installation is defined as having a known removal date at the time of installation. This **shall** be no longer than 24 months – sites which are to be used for more than 24 months **shall** be considered permanent and conform to all the standards in this document.
- Sites where the Te Whatu Ora has network equipment provided as a third-party provider.
- When undertaking design or construction in non-Te Whatu Ora owned facilities the designer/contractor **shall** confirm site specific requirements with the Data & Digital representative.
- Mobile facilities such as mobile surgical units and mobile screening trucks.
- Data Centre specification is outside the scope of this standard.
- Passive Optical Network solutions are not to be specified or built within Te Whatu Ora.

All exclusions **must** be agreed with the relevant Te Whatu Ora representative.

1.10. Compliance management

Compliance with the requirements of this document will be monitored by Te Whatu Ora and applied directly and/or through engaged 3rd party consultants and project managers.

Project managers, design consultants, and installation contractors are reminded that compliance may be compromised by other trade contractors, facilities, and maintenance staff, or by other 3rd parties working on site. Non-compliance caused by other parties **must** be advised to Te Whatu Ora, or their representatives immediately to allow rectification of any issues.

All parties are to advise Te Whatu Ora of cases where non-compliance is determined onsite and not previously recorded and annotated in site information and drawings.

The designer and contractor **must** get written approval from Te Whatu Ora Data & Digital representatives and abide by relevant governance procedures for any deviation from the requirements of this document.

1.11. Labelling

Te Whatu Ora has developed a National Digital Communications Systems and Structured Cabling Labelling Standard to be used at all its buildings and facilities. The designer and contractor **shall** obtain the latest version of this labelling standard from the Data & Digital team and comply with this standard for all labelling. Refer to the following specification document: "National Communication Systems & Structured Cabling Labelling Standard".

2. Reference documents

Designers and installation contractors **must** ensure that work performed by them complies with all relevant legislation, codes, regulations, and standards.

- Compliance with legislated standards is mandatory and required by New Zealand laws and statutes.
- Compliance with non-legislated standards references in the following table is expected for all design and installation works. Note that some content of AS and other international standards may not be applicable in New Zealand and may conflict with New Zealand regulatory requirements.
- When compliance cannot be achieved because of applicability in-situ, or due to a conflict between referenced standards, the design and installation contractor **must** advise Te Whatu Ora and get clarification or exemption before continuing.

In all cases, the latest published version of the standard at the time of design or tender release are to be used.

2.1.Reference standards

The following standards are advised:

Mandatory / legislated standards (required for regulatory compliance)	
AS/NZS 3000	Electrical installations “Wiring Rules”
AS/NZS 3003	Electrical installations – Patient areas
AS/NZS 3009	Electrical installations – Emergency power supplies in hospitals
NZS 4121	Design for access and mobility – buildings and associated facilities
NZS 4219	Seismic performance of engineering systems
	New Zealand Building Code
AS/NZS 2430.3.1	Classification of hazardous substances
AS/NZS 1768	Lightning protection
AS 3996	Access Covers and Grates
Referenced non-legislated standards	
AS 11801.1	Information technology – Part.1 Generic cabling for customer premises
AS 11801.2	Information technology – Part.2 Office premises
AS 11801.3	Information technology – Part.3 Industrial premises
AS 11801.5	Information technology – Part.5 Data centres
AS 11801.6	Information technology – Part 6 Distributed building services
AS/NZS 3084	Telecommunications pathways and spaces for commercial buildings
AS 3085	Telecommunications installations administration of communication cabling systems
AS/NZS 14763.2	Information Technology - implementation and operation of customer premise cabling, part-2 Planning and installation
AS/NZS 14763.3	Information technology – implementation and operation of customer premise cabling, part-3 Acceptance testing of fibre cable

AS/NZS 14763.4	Information Technology – implementation and operation of customer premise cabling, part-4 Measurement of MPTL, E2E, and DC cabling
AS/NZS 60950	Information technology equipment – Safety – Part 1: General requirements
IEC 61935.1	Specification for the testing of balanced and coaxial information technology cabling – part-1, Installed balanced cable as specified in AS IEC 11801.1
AS/NZS 62368.1	Audio/video, information, and communication technology equipment. Part-1: Safety requirements
AS/CA S009	Installation requirements for customer cabling (wiring rules)
AS/NZS 2967	Optical fibre communications systems safety
AS 1367	Coaxial cable and optical fibre systems for the RF distribution of digital television, digital radio, FM radio and in-house television signals in single and multiple dwelling installations
AS 3811	Patient alarm systems
AS/NZS 60825.1	Safety of laser products – Part 1: Equipment classification and requirements
AS/NZS 60825.14	Safety of laser products, Part 14: A user's guide
SA TS 29125	(Standards Australia) information Technology – Telecommunications cabling requirements for remote powering of terminal equipment
Referenced publications for guidelines	
BICSI-TDMM	BICSI Telecommunications Distribution Methods Manual
BICSI – COOSP	BICSI Customer Owner Outside Plant reference manual
ANSI/BICSI-D002	ANSI/BICSI Data Centre Design and Implementation best practices
BICSI-D004	BICSI IT systems design and best practices for healthcare institutions and facilities
BICSI-007	Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
AusHFG	Australasian Health Facility Guidelines

Table 1 - Standards and references

2.2.Abbreviations and terms

The following abbreviations and terms are used within this document.

2.2.1. Abbreviations

Abbreviations used in this document	
ABF	Air Blown Fibre
AFFL	Above Finished Floor Level
APC	Angled Physical Contact connector
ATS	Auto Transfer Switch
BD	Building Distributor
BER	Bit Error Rate
BMS	Building Management System
BICSI	Building Industries Consulting Services International

CAD	Computer Aided Design
CD	Campus Distributor
CES	Communications Earth System
CoC	Certificate of Compliance
CP	Consolidation Point
DO	Data Outlet, (analogous for telecommunications outlet)
DB	Electrical Distribution Board
EMC	Electromagnetic Compatibility
EMI	Electro Magnetic Interference
ER	Equipment Room, (e.g. server room, comms room, computer room etc - building or campus serving)
ES1	Energy Source Class I
ES2	Energy Source Class II
ES3	Energy Source Class III
ESC	Electrical Safety Certificate
FD	Floor Distributor
FOBOT	Fibre Optic Break Out Termination
F/UTP	Overall screened cable with unscreened twisted pairs (often referred to as FTP)
GbE	Gigabit (per second) Ethernet
GPO	General Purpose Electrical Outlet
GCS	Generic Cabling System
HNZ	Te Whatu Ora – Health New Zealand
IT	Information Technology
ICT	Information and Communications Technology
IDC	Insulation Displacement Connection
IP	Internet Protocol
LAN	Local Area Network
LC	Lucent Connector
LSPM	Light Source and Power Meter
MAC	Moves Adds Changes
MATV	Master Antenna television
MCB	Miniature Circuit Breaker
MER	Main Equipment Room
MMOF	Multimode Optical Fibre
MCB	Miniature Circuit Breaker
MPTL	Modular Plug Terminated Link
MSSB	Mechanical Services Switch Board

MUTO	Multiuser Telecommunications Outlet
O&M	Operations and Maintenance manual
ODF	Optical Distribution Frame
OFCS	Optical Fibre Communication Systems
OTDR	Optical Time Domain Reflectometer
PE	Polyethylene
PiMF	Pairs in Metal Foil (cable construction, refer to S/FTP and U/FTP
PL	Permanent Link
PoE	Power over Ethernet
RCBO	Residual Current Breaker (with overcurrent protection)
RCD	Residual Current Device (No overcurrent protection)
RJ45	Registered Jack Number 45
RU	Rack Unit
SCS	Structured Cabling System
SCP	Service Concentration Point
SD	Services Distributor
S/FTP	Overall braid screened cable with foil screened twisted pairs (often referred to as STP or PiMF)
SFF	Small Form Factor
SMOF	Single Mode Optical Fibre
SO	Service Outlet
SPD	Surge Protection Device
SSSP	Site Specific Safety Plan
SWMS	Safe Working Methods Statement
TEO	Terminal Equipment Outlet
TR	Telecommunications Room, (e.g. hub room, switch room, pabx room, rack room – only serves a floor)
TRC	Telecommunications Reference Conductor
U/FTP	Cat. Cable with each pair individually in foil, no overall shield (alternative to F/UTP construction)
UPC	Ultra Physical Contact connector
UPS	Uninterruptible Power Supply
uPVC	Un-plasticised polyvinyl chloride
UTP	Unshielded Twisted Pair
UV	Ultraviolet
WA	Work Area
WAP	Wireless Access Point
WLAN	Wireless Local Area Network
SPE	Single Pair Ethernet

SPPOE	Single Pair Power over Ethernet

Table 2 – Abbreviations

2.2.2. Terms and definitions

Definitions for terms used in this document	
Application Specific Cabling	System manufacturers design
As-built	Final set of drawings produced at the completion of a construction project, including all changes made to the original construction drawings
Building backbone cabling	Cable that connects the building distributor to a floor distributor
Campus	An area or site which contains several University buildings, and includes the grounds in which a cabling system is installed
Campus backbone cabling	Cable that connects the campus distributor to the building distributor(s)
Campus distributor	Distributor from which the campus backbone cabling starts
Category 5 (Cat 5)	For the purposes of this document, cabling components which provide a permanent link that, when tested, do not meet AS 11801.1 Class D performance
Category 5e (Cat 5e)	For the purposes of this document, cabling components which provide a permanent link that, when tested, meet AS 11801.1 Class D performance
Category 6 (Cat 6)	A definition of cabling components which provide a permanent link that, when tested, meet AS 11801.1 Class E performance
Category 6A (Cat 6A)	A definition of cabling components which provide a permanent link that, when tested, meet AS 11801.1 Class EA performance
Catenary wire	A wire supported at two points kept under mechanical tension to provide a support to which cabling may be fastened.
Consultant	A person who plans the look, or workings, or both, of something prior to it being made, by preparing drawings or plans
Channel	End to end transmission path connecting two pieces of application specific equipment (includes patch cords and work areas cables)
Clear working spaces	A ventilated working space allowing quick unrestricted egress or escape in the event of emergency
Consolidation Point	Connection point in the horizontal cabling subsystem between a floor distributor and a Data outlet
Contractor	Where the term “Contractor” is used within this document it shall be interpreted as the “Communications Contractor”. The term contractor is also used to define any ‘contractors’ performing third party activities on behalf of Te Whatu Ora regarding communications systems and structured cabling, e.g. Security systems, Audio Visual, Nurse Call etc.
Comms Room	Refer to Telecommunication’s Room
Core Room	Refer to Equipment room
Data Centre	Data Centre / Server room – a secure centralised facility hosting storage and compute and including core networking devices.
Designer	A person who plans the look, or workings, or both, of something prior to it being made, by preparing drawings or plans

Distributor	The term used for a collection of components (such as patch panels, patch cords) used to connect cables
Enclosure	A housing for accommodation of equipment and cabling that includes mounting rails and protective panels
Equipment footprints	The vertical and horizontal planes occupied by a piece of equipment in normal operation
Equipment Room (ER)	An equipment room hosts carrier equipment, routers, core switches, aggregations switches and central fibre termination panels It may also host. Also referred to as the Core Room when on a campus site.
Generic Cabling System	Generic and Structured data cabling system, capable of supporting a wide range of standardised applications. Standards based design
Horizontal cabling	Cable connecting the floor distributor to the terminal equipment outlets
Hub Room	Refer to Telecommunications room
Installer	A person that places or fixes equipment or machinery in position ready for use. The party(s) responsible for the supply, installation, testing and warranty of cabling systems
Integrator	A person that places or fixes active IT equipment e.g., network switching, Wireless Access Points, servers, desktop computers etc. in position and configures, programs them ready for use. The party(s) responsible for the supply, installation, testing and warranty of active equipment systems
Manufacturer	A person or company that makes cabling goods for sale
Power over Ethernet	Power over Ethernet (PoE) is a technology for wired Ethernet local area networks (LANs) that allows the electrical current necessary for the operation of each device to be carried by the generic cabling system rather than by power cords. Typical uses include VoIP phones, WAPs, IP CCTV cameras, or lighting.
Power Over SCS or GCS cabling	Power over structured data cabling (application specific cabling) or power over generic cabling (non-application specific cabling)
Permanent link	Transmission path between the data outlet and the floor distributor
Service Distributor (SD)	Equivalent to distributor 1 in AS 11801.1
Service Outlet (SO)	Equivalent to a TE Outlet in AS 11801.1
Single vendor system	A system provided by a single vendor to help reduce operational, configuration, and management complexity
Site	See Campus
Structured Cabling System	Specific cabling solution designed with a set of cabling and connectivity products that are constructed (engineered) according to standardised rules to facilitate specific connectivity requirements e.g., Nurse Call (Staff Assist). Legacy design.
Suitably qualified person	A person with the professional qualifications and experience in the industry to undertake the design and supervision of the works
Telecommunications Room (TR)	Also referred to as a Hub Room, a Comms Room, or a Patching Room. The room will contain the LAN cabling for an area as well as the edge switches and any 3rd party equipment servicing the area. Analogues with Data Room.
Terminal Equipment Outlet (TEO)	Fixed connecting device which provides and interface to the terminal equipment. N.B. The term data outlet is used in some other parts of the AS

	11801 series, while the term terminal equipment outlet is used within AS 11801.1 and this document.
Velcro™	A proprietary form of Hook & Loop fastener/cable tie

Table 3 - Terms and definitions

3. General requirements

3.1.Occupational Health and Safety

This standard includes mandatory requirements imposed under the Health and Safety at Work Act 2015 legislation intended to ensure the safety of all health personnel and its clients, cabling contractors and the public.

Designers and installation contractors are to ensure that work performed complies with all relevant codes, regulations, standards, and scope requirements provided by Te Whatu Ora.

All information **shall** be governed by reference to the latest editions and amendments of such documents in descending rank order:

a) Relevant New Zealand Government legislation and Regulations e.g., Occupational Safety and Health regulations.
b) Relevant policies appropriate to the site, environment, project, health, and safety policies as deemed by the Te Whatu Ora - project manager.
c) Site specific information provided by Te Whatu Ora, or their representatives.

3.1.1. Site conditions

The designer and installation contractor **shall** familiarise themselves with the site conditions prior to undertaking any work or providing any quote or estimated prices for work.

Specific conditions to be observed include those presented in this document, and all conditions with respect to the building or facility as advised by the project manager. This includes site access requirements, PPE requirements, building heritage restrictions, OSH requirements, qualification of service providers, and the carrying of personal identification required onsite.

3.1.2. Site Identification

Contractors working onsite **must** always wear a visible identification lanyard or similar visible identification while on-site.

All contractors working on Te Whatu Ora facilities **must** carry or wear identification tags on lanyard which should include the company name, the individual's name, and preferably include a photo.

3.1.3. Safety in Design

Design and installation of communications systems can create risks to personnel, equipment, and facilities. The designer and the installation contractor are required to always maintain a safety in design and construction methodology in their work. The contractor **must** keep a 'safety in design' register and issue it to Te Whatu Ora on a regular basis.

Considerations for safety in design:

a) Telecommunication Room, (Hub Room) locations to be outside of clinical and patient areas.
b) Cable basket installations should follow hallways where possible.
c) Cable catenary wire installations should not extend over patient bed areas.
d) Cabling (copper/fibre) cabling in Operating Theatres should terminate in the ceiling void above the lighting and equipment booms. From there run new cabling or patch cabling through the boom arms to the end devices. This assists in the replacement of the frayed cables every few years.
e) Do not install the copper RJ45 patch panels any higher than the 42RU (counting from the bottom of the rack). This allows the Desktop staff to patch in devices without requiring a stepladder.
f) Allow for 900mm working space around racks and wall mounted cabinets.

g) Install wall mounted equipment at chest height so that technicians do not have bend down or reach up or require step ladders to access their systems.
h) Labelling in ceiling spaces should be visible and legible once tiles are moved without need to use ladders for entry into the ceiling space.
i) Outside Plant work including thrust boring, trenching, and the installation of direct burial cabling **must** be done in accordance with WorkSafe practices.
j) Consider the risk of ligature/self-harm/unauthorised ingress or egress, (e.g. in mental health facilities) in all aspects of design and installation.

In areas requiring infection control (Labs, Theatres, Infections Disease Inpatient Units, etc). find opportunities to install on the wall or on the ceiling tile and not in the ceiling voids. In these areas an opened ceiling tile requires an infection prevention and control process which is requires the area to be enclosed and checks done by the hospital's Infection Prevention & Control Team.

Outlets in infection prevention control areas can be safely installed within the ceiling void if the proper methodology is followed, i.e. with the use of IPC barriers and adhering to the recommended controls under the permit conditions.

3.1.4. Aesthetic design

In all cases the cabling systems should be designed using the AusHFG room layout and finishes requirements as a reference and be installed in a manner that is suitable for the building and not in conflict with the surroundings. Where compliance cannot be met with this standard, the contractor **must** alert the relevant Te Whatu Ora representative for guidance. Removal of all packaging materials, waste, painting, other materials left over from the installation on completion of all works **must** be done.

Should cabling unused be left in place for later use, written approval **shall** be obtained from an ICT team designated representative prior to the decision to be made. The redundant cables retained should be tagged and labelled to reflect its purpose for future use, and the relevant as-built documentation **must** show the existence of these cables and their associated pathways.

3.2. Qualifications

Installation **shall** be carried out only by communications cabling system installers who hold current accreditation from the manufacturer of the cabling and connecting hardware as qualified to perform the cabling work relevant to the performance standard of the cabling system.

3.3. Authorities

All work **shall** comply with the requirements of the appropriate authorities having jurisdiction over cabling work and associated materials and workmanship.

3.4. Security

All security and external access by contractor personnel **shall** comply with the Te Whatu Ora security requirements and all IT Security Standards. Where an access device (card, fob, key, etc.) is issued to a person that person **shall** sign for the receipt of the device and **shall** be responsible for its safekeeping, appropriate use, and return (either on completion of the project or on demand).

3.5. Uniformity

Uniformity of type and manufacture of each individual fitting or item of equipment **shall** be maintained throughout the installation.

When a particular manufacturer has been adopted for fittings or equipment, all such fittings and their components **shall** be uniform throughout the installation.

3.6. Accessibility

Cabling plant both indoors and outdoors should be readily accessible and **shall** be in accordance Workplace Health and Safety requirements.

3.7. General Design Requirements

The drawings provided as part of the documentation for a project **shall** show the location and route of all components of the ICT cabling infrastructure. These details are approximate unless a specific measurement is shown.

The actual location of ICT cabling pathways **shall** be determined by the accredited installer on site. This **shall** be as close as possible to the proposed location, considering hazardous situations (electrical and non-electrical), EMI and obstructions. Where the proposed and actual locations vary the accredited installer is to inform Te Whatu in writing. The Te Whatu Ora representative **shall** reply in writing detailing what course of action is to be followed.

The actual location of outlets **shall** be coordinated with the installers of electrical services and workstation furniture. Where the proposed and actual locations vary or where there is a dispute, the accredited installer is to inform the Te Whatu Ora representative in writing. The Te Whatu Ora representative **shall** reply in writing detailing what course of action is to be followed.

If not specified in the documentation, work **shall** be performed in normal working hours, with any cutovers of services that may disrupt customers, to be performed at a time agreed with the customer representative.

3.8. Building Works

Any building works required in relation to the installation of the ICT cabling system **shall** be performed in accordance with the relevant building codes and Local Authorities.

Any building works required in relation to the installation of the ICT cabling system **shall** be the responsibility of the cabling contractor unless otherwise agreed in writing from the Te Whatu Ora representative.

The cabling contractor **shall** be responsible for the supply and installation of any building signage and labelling required in relation to the installation of the ICT cabling system. (This includes temporary signage and labelling required during construction and permanent signs and labels at the completion of construction).

Before proceeding with any building work, the cabling contractor **shall** obtain the appropriate approval for the works from the Te Whatu Ora representative.

Where the works are likely to cause major disruption and inconvenience to, or pose a safety problem for, the site the cabling contractor **shall** seek and obtain written approval, from the Te Whatu Ora representative.

The cabling contractor **shall** make good all surfaces affected by the building works to the same standard as before the commencement of the building works. Where applicable the penetration and the fire stopping of fire rated walls **shall** be in accordance with the New Zealand Building Code.

3.9. Materials, Equipment, Components, Devices and Workmanship

3.9.1. Mechanical Protection

The ICT infrastructure and cabling system **shall** be adequately protected during installation where it is reasonable to expect that any part or all of it might be damaged, caused to malfunction, be tampered or interfered with, resulting from: misadventure, vandalism, mechanical injury, exposure to the weather (including direct sunlight), water, excessive dampness, corrosive fumes, an accumulation of dust, steam, oil, high temperature, or any other adverse conditions and/or contaminates which may be reasonably encountered during its use.

The accredited installer **shall** be responsible for familiarising themselves with the cabling environment at the site and **shall** provide adequate protection to the ICT infrastructure and cabling system to protect it from the impact of that environment.

3.9.2. Best Practice

Workmanship **shall** be aligned to current standards.

Workmanship and warranty **shall** be verified on 100% of the channels by the manufacturer. Cabling Manufacturer **shall** have an employee capable of performing onsite inspections as required by Te Whatu Ora.

3.10. Sustainability

Te Whatu Ora is committed to sustainability in design and construction of all ICT systems within its facilities. The following provides some guidelines for designers and contractors however is not considered a complete list. Project specific sustainability issues are to be addressed in both design and construction to support the building sustainability objectives.

a) Use of LSZH sheathed cables wherever possible. PVC jacketed cables may only be used when no alternative exists.
b) Waste material and packaging is to be recycled where possible and sustainably disposed of if not.
c) Energy efficient mechanical and electrical equipment is preferred, use LED lighting.

Unless otherwise specified, all cabling materials, equipment, components, and devices **shall** be new, of current manufacture, and of suitable quality and durability for the installation.

All abandoned/redundant cabling **must** be removed in construction areas that are hoarded.

All abandoned/redundant cabling should be removed in areas that are not hoarded.

When removing cabling materials, equipment, components, and devices no longer required in service – seal any holes in walls, floors, and ceilings, ensure any compromised fire-stopping is reinstated.

Communication to the Te Whatu Ora is required for all removed cabling. For documentation purposes, an updated drawing showing the removed components is to be included in the O&M documentation.

3.11. Heritage environment

Where design and cabling works are being performed for existing sites the designer and cabling contractor **shall** be responsible for determining whether a Te Whatu Ora building is heritage listed.

For those heritage listed buildings the designer and cabling contractor **shall** make available the plans detailing the work to be performed in or on the listed building and this includes its environs to Heritage New Zealand and Te Whatu Ora.

The designer and cabling contractor **shall** abide by the guidelines set by Heritage New Zealand for the installation.

3.12. Expansion and future growth

The designer **shall** allow sufficient capacity for growth over the projected operational lifetime of the installation:

a) ER/TR spaces – 50% growth in cabinet space required and in MEP (Mechanical, Electrical and Plumbing) provision. Consideration should be given to the installation of an additional cabinet and associated infrastructure as part of the initial installation.
b) Cable pathways – 50% growth provision.
c) Risers – 50% growth provision.
d) Buried conduits – a minimum of one spare conduit with draw wire installed.

3.13. Obsolete equipment and components

When design and construction cause existing equipment and components to become obsolete, the following **shall** be applied by the designer and contractor:

3.13.1. Major refurbishment and MACs

When an area is undergoing a significant refurbishment programme:

a) Obsolete cabinets, equipment, and active components **must** be identified, removed, and returned to the Te Whatu Ora Data and Digital team for future use.
b) Cable trays and pathways that need to be removed during construction works due to in-ceiling changes are wherever possible to be retained and reused in the refurbishment.
c) Obsolete cables **must** be removed and appropriately recycled unless not viable or feasible to do so, in which case an exemption **must** be agreed with the relevant Te Whatu Ora representative.
d) Any unused cables that are unable to be removed (as per exemption process) **shall** be tagged and identified using the labelling system, these cables are to be included in the as-built drawings.
e) Where cables and cable pathways that are removed had passed through firestop penetrations, the fire stopping **must** be reinstated and certified.

Where work is taking place that may impact IT Services, formal change control (request for change) process **must** be followed.

3.13.2. Exit from leased premises

When Te Whatu Ora is exiting from leased premises the following **shall** apply:

f) Obsolete equipment, and active components owned by Te Whatu Ora **shall** be identified, removed, and **must** be returned to Te Whatu Ora Data & Digital team for future use.
g) Confirm with Te Whatu Ora Data & Digital and Facilities teams if cabinets, cables, and cable pathways are to be removed during the withdrawal from the leased property. Note that the leaser may either own these as part of their asset or may elect to retain these components for future tenant use reducing cost impact on both Te Whatu Ora and future tenants.

3.14. Penetrations

Penetrations through or in the building structure associated with the ICT cabling infrastructure **shall** meet the following requirements:

3.14.1. Acoustic sealing

Wherever services penetrate walls, floors or ceilings, acoustic sealant **shall** be supplied and installed to maintain a degree of acoustic separation at least equal to the materials penetrated.

3.14.2. Airtight Seals

All penetrations of trays, risers and/or ducts through the building fabric of chambers subject to suction or pressurisation **shall** be sealed in accordance with relevant NZ Standards and to the satisfaction of the Te Whatu Ora.

3.14.3. Core Drilling

Approval of the Te Whatu Ora representative in consultation with a structural engineer **shall** be obtained prior to undertaking any core drilling of building structural members.

3.14.4. Fire Stopping (passive fire)

Fire stopping' is a design and construction specialism requiring time, collaboration, and knowledge to do well. Collaboration should occur during the project design stage between the passive fire engineer, the fire engineer, the architect, the building services engineer the structural engineer (etc) and with the client and council to agree the basic requirements of the design and documentation.

Where cabling penetrates fire rated barriers, those penetrations **shall** be sealed (fire stopped).

The accredited installer is responsible for ensuring all penetrations through fire rated partitions within the scope of works are fire-stopped as per the requirements of the NZBC. The installer **must** provide photographic / digital evidence to prove correct installation.

Appropriate re-enterable firewall penetration systems such as Speedsleeves or equivalent should be used.

3.14.5. Painting and Corrosion Protection

The cabling contractor **shall** be responsible for corrosion protection and the painting treatment to the relevant New Zealand standards.

Paint containing solvents (acrylic, enamel) will damage cable jackets over time. Ensure cables are protected from painting overspray and not covered in paint products.

3.14.6. Roofing and external walls

Wherever services penetrate the external roof or walls, continuous welded weather collars for over flashing **shall** be supplied and installed for all external ducts and pipes forming part of the cabling work and sealed with an approved sealant, to the relevant Building Codes and Standards. This **must** be signed off by a suitably qualified person.

3.14.7. Vermin proofing

All opening, voids, entries to conduits, equipment, components, and device enclosures **shall** be effectively plugged and sealed to prevent the entry of vermin. The sealant **shall** be durable, long lasting and allow re-entry to the space and not prevent the effective re-sealing of the opening.

3.14.8. Waterproofing

All penetrations of floors, trays, risers and/or ducts **shall** be made weatherproof during and after construction of the cabling works to prevent weather damage or effects of internal flooding within the facility.

3.15. Coordination with other design disciplines

3.15.1. Electrical Engineer

Electrical requirements for ER's and TR's are to be provided to the electrical engineer. Service coordination is to be undertaken to ensure separation requirements are followed. Earthing and bonding of cable containment systems and data cabinets is to be specified by the electrical engineer.

Networking and ICT cabling requirements for electrical systems are to be obtained from the mechanical engineer. These include lighting control systems and metering devices.

3.15.2. Mechanical Engineer

Mechanical requirements for ER's and TR's are to be provided to the mechanical engineer. Cooling requirements are to be calculated from room loadings.

Networking and ICT cabling requirements for mechanical control systems are to be obtained from the mechanical engineer. These include actuators, fan control units and monitoring equipment.

3.15.3. Architect

Spatial requirements are to be coordinated with the Architect, as documented in section 2 of this standard. Data outlets for ceiling mounted services are to be coordinated with the architect and included on the BIM model and/or reflected ceiling grid plans. Acoustic requirements are to be coordinated with the Architect, or an acoustic engineer if the project has one. Data outlet placement is to follow the architectural FF&E plan and room data sheets. 'As Constructed' (installed) drawings are to be provided following installation.

3.15.4. Structural Engineer

Structural requirements of cable pathway penetrations, ER & TR floor loadings, and cable containment devices are to be coordinated with the structural engineer. Seismic bracing of data cabinets and cable containment systems is to be defined by the structural engineer.

3.15.5. Network Designer

Active network architecture is required to define the cabling topology and sizing. Active equipment specifications are required to define rack layouts, room power requirements and room thermal loadings. Data outlet count and PoE loadings are required to inform the network designer's specification. A comprehensive wireless network model prepared by the network designer is required to determine the number and position of the Data outlets for APs.

3.15.6. Security designer

ICT cabling and rack space requirements for security systems **must** be obtained from the security designer, (the security designer will collaborate with other professionals, as required). Data Outlet's for security cameras and access control are to be coordinated with the security designer. TR and ER security requirements are to be provided to the network designer.

3.15.7. Data & Digital Information Services

Storage and compute hosting requirements are to be obtained from the Data & Digital Information Services department. Networking functional requirements are to be obtained from the Data & Digital Information Services department.

All ICT plans are to be approved and signed off by the Data & Digital Information Services department.

4. Cable pathways

4.1.General requirements

The following general requirements are advised for all cable pathways and cable pits.

Cable pathways **shall** be selected and designed to:

a) Be concealed wherever possible.
b) Provide physical path diversity where required.
c) Avoid areas of potential future disruption to services.
d) All cable pathways containment systems **shall** support future cable installation with allowance for growth. Initial fill rate at first installation **shall not** exceed 50% unless otherwise noted in the Scope of Works or design.
e) Maintain minimum segregation from other services as mandated by AS/NZS 3000 in accordance with AS/NZS 14763.2 and AS/CA S009.
f) Communications cable pathways and pits **shall not** share with fire alarm or low voltage (230V/400V) services, however sharing with extra low voltage cabling is allowed, (not exceeding 42.4V peak or 60V DC).
g) Suspended cable pathways such as cable basket, tray, ladder, or catenaries **must** be installed so that they are able to sustain the weight of the cables installed at initial installation, plus the weight of the cables that may be installed in subsequent MACs. A minimum of 100% weight load increase on the suspended cable pathway over time **must** be provided for in design.
h) Every pathway should be clearly labelled at both ends and within 300mm of every wall penetration, designating the source and destination.
i) Draw boxes should be labelled on the exposed exterior.

4.2.Accessibility

Contractors **SHALL NOT** commence work that permanently:

a) Renders main trays inaccessible or unserviceable.
b) Causes trays to be cut, bent, or otherwise altered, or in any way depletes their future usefulness.
c) Limits or impedes access to the ceiling void.
d) Causes services to be run directly across accesses, ceiling walkways, catwalks, etc., or in any way lessens their future usefulness.
e) In any way degrades any communications room or other such area.
f) Causes significant amounts of debris or dust to gather in any communications room or other such area.

4.3.Existing infrastructure

Existing service ducts underground or housed in walkways between buildings or structures that are designed for the purpose of routing services around the facility unobtrusively, **shall** be used where they are present and when there is enough spare space.

4.4.Seismic movement

The designer and contractor **shall** obtain the location of all seismic joints from the structural engineer or building architect. For seismic joints, the designer and contractor **shall** ensure:

a) The crossings occur at the lowest point in a high-rise building, where possible.
b) Cable trays, cable baskets, and conduits crossing seismic joints or penetrations shall be designed to allow for the required vertical and horizontal movement expected in the building.
c) Allowance shall be made for draw boxes each side of the seismic joint for a flex tube to be attached and to allow for cabling installation before and after the seismic joint flex tube connection points, to minimise pull tension on the cables.
d) Seismic support shall be provided for all communications systems pathways and cabinets in accordance with the requirements of NZS 4219.
e) Transverse seismic restraints must be provided at the ends of the rigid run lengths either side of the flexible lengths that cross the seismic joint.

4.5.Outside Plant

This section deals with infrastructure that is external from the buildings, this could be underground systems commonly referred to as “Pit and Pipe” or any pathways that is or are open to the elements in any way. It also covers building entry.

4.5.1. Excavation

Any civil works required in relation to the installation of the ICT cabling system **shall** be performed in accordance with the relevant civil engineering codes and Local Authorities.

Excavation **shall** be the responsibility of the cabling contractor unless otherwise agreed.

The cabling contractor **shall** be responsible for all excavation, cable protection, back fill, surface restoration and the installation of cable markers.

Before proceeding with any excavation work, the cabling contractor **shall** ascertain details of any underground services in the area.

Where excavations are required near footings, foundations, and concrete floors, the cabling contractor **shall** ensure that the earthworks do not interfere with these structures and backfill is well consolidated.

Unless otherwise agreed by Te Whatu Ora, the cabling contractor **shall** arrange the installation so that all trenches are excavated and backfilled on the same day.

The cabling contractor **shall** ensure that Workplace Health and Safety practices are observed at all excavations, providing safety barriers, warning notices, shoring and any other items as deemed necessary by the Te Whatu Ora representative.

Where the works are likely to cause major disruption and inconvenience to, or pose a safety problem for, the site the cabling contractor **shall** seek and obtain written approval, from the Te Whatu Ora representative within ten (10) working days before commencing.

All surfaces **shall** be made good to the same standard as before the commencement of excavation works with particular care to maintain safe access for wheelchair users, blind and low vision pedestrians, or other occupants with mobility requirements.

4.5.2. Inter-building pathways

Inter-building pathways **shall** be constructed to accommodate the cabling between buildings. Underground pathways are required in all instances where no suitable connecting structure exists.

When planning communications pathways between buildings, street-based ducting is preferable to multiple inter-building links.

When high availability and/or redundancy is required, the communications ducting **must** be designed to support physically diverse backbone cabling circuits. To achieve this each building with a high availability requirement needs two separate ducted pathways to the site's main or secondary equipment rooms. These pathways **must** have a minimum separation of five metres.

Open and unsecured crawl space under elevated buildings **must** be considered an external environment and proper consideration **shall** be given to the choice of components used in this space. Cable should be protected within a conduit if there is less than 500mm ground clearance. Factors to be considered include dampness, flooding, UV radiation, vermin, Health & Safety, and future access.

4.5.3. Underground pathways

Underground pathways **shall** be designed and constructed in accordance with AS/NZS 3084. To effectively minimise the risk that damaged may be done to existing underground services, the contractor **shall** ensure that coordination is undertaken with existing records and a 'beforeUdig' service before commencing on site work. A copy of all information provided in response to the enquiry **shall** be included in the cabling documentation.

4.6. Directional drilling

Directional drilling is a technology for installing underground ducts or conduit without the need to use open trenches/trenching.

Conduit may be installed by directional drilling providing the minimum cover to the natural ground surface can be maintained.

In directional drilling, a surface-operated drilling device is angled into the ground from the surface and subsequently directed to its destination by remote control. After the drilling unit reaches its destination, ducts or conduits can be attached to the unit and pulled back to the origination point.

Directional drilling is particularly valuable where traditional excavation is difficult.

Because of the potential for the drilling unit to strike other critical and high voltage services the underground utilities **shall** be located before directional boring is commenced.

4.7.Trenches

Trenches for communication cabling under trafficable or non-trafficable areas should be constructed to provide a minimum depth of **450mm** cover between the natural ground surface and the top surface of the communications conduit. Any deviation from this **must** be approved by the appropriate authority.

Warning tape **must** be laid at a minimum depth of 100mm above the cable or conduit but not less than 200mm below the surface.

Excavation plans **must** be submitted to the project manager prior to excavation, digging or thrusting occurs.

Approval **must** be obtained from appropriate authorities prior to excavations beyond site boundaries.

Saw cut existing concrete or bitumen surfaces should be built in a straight line, to a depth of 75 mm, before excavation is commenced. Lift and store paving slabs for later reinstatement.

After excavation, clear trenches of sharp projections.

Installation depth **must** be referred to the appropriate Project Manager when rock is encountered in the excavation that will cause an impact to cost or schedule.

All trenches **must** be backfilled with fine grit up to the duct level and original excavated material removed from site.

Backfilling **shall** be performed with due care to avoid distortion of the cable inspection pits and the conduit **shall** be supported firmly and evenly on all sides.

4.8. External conduits

Ensure all site plans accurately define the conduit pathway to reduce risk of damage by other services and during other works.

External conduits **must** be clearly shown in the drawings, ideally on the civils set with locations and depths etc. documented, on large sites also geo references. Other services will also be shown on the civil drawings.

If site drawings are not available, ground penetrating radar survey may be required to ensure the digging of new trenched or thrust boring does not compromise other services such as water, sewerage, gases, electrical.

Conduits **shall** generally enter pits on the vertical centreline of the pit end with a minimum clearance of 50mm to the bottom of the pit and spaced not less than 25mm away from other conduits. The conduit **shall** protrude into the pit by a minimum of 50mm and not more than a maximum of 100mm.

Conduits **shall** be laid into a trench at a minimum depth of 300mm in a location other than a public footway or roadway, and at 450mm under public footways or roadways, or at any depth under aggregate concrete with a minimum width of 50mm.

External communication conduits **shall** be green and a minimum of 100mm OD between pits and between pits and building entrance facilities.

Fibre Rings **must** be a minimum of two 100mmØ conduits or ducts between pits/chambers.

Underground conduits or ducts **must** be sized to accommodate backbone cables such that the total conduit fill at the time of installation does not exceed 50% of rated total conduit capacity.

Conduits to car park barrier arms and ticket dispensers from their associated pit **must** be a minimum of 32mmØ.

Sweeping bends should be used to allow for cable bending radii.

Installers **must** provide clean sand around conduits installed underground. The sand should be flooded with water during installation to achieve maximum compaction levels.

Adopt the manufacturer's recommended procedure for making joints.

All conduits within pits and at building entrances **shall** be sealed with a T-Dux or similar product to prevent the ingress of water and gases. A spray foam sealer is not permitted. All empty conduits are to be fitted with a removable bung or cap.

Seal the buried entries to ducts and conduits with a pliable AND non-setting waterproof compound (e.g. T-Dux or similarly effective solution). Seal spare conduits immediately after installation and seal the others after the cable installation.

Installers should provide polypropylene draw cords in all conduits.

A Trace wire **shall** be installed in all ducts to aid in locating cables. The trace wire is to be presented in the pit/chamber and secured to the permanent structure.

4.8.1. External Conduit Colour Guidelines

Prohibited colours identified in S009 and in the following table **shall not** be used as these are associated with other services. Use of these colours for GCS cable pathways may present a risk of exposure to hazardous voltages and substances to the contractors when accessing them:

Colour	Services normally associated with the colour
Orange	AC mains power / electrical
Yellow	Fuel, process, toxic or medical gases
Silver-grey	Steam
Brown	Flammable or combustible liquids
Violet	Acids or alkalis
Light blue	Compressed air

Table 4 - Conduit prohibited colours.

Note: all data ducting should be green.

4.8.2. Clearances between services:

When crossing other services 150mm separation is required.

When running in parallel to other service ducts or conduits a minimum separation of 300mm is required of well-tamped earth or a minimum separation of 75mm of concrete.

All metallic pathways **shall** be bonded to an appropriate earthing system at both ends. In outside plant systems the aim is help equalise the voltages between conductive surfaces, during Lightning strikes, electrical system faults and EMI.

Any damage to the physical or installed infrastructure (e.g. ducts broken, pits caved in) **shall** be resolved before new installations take place.

4.9.Innerduct (or Subduct)

The use of innerduct is acceptable where required for the running or air-blown fibre tubes or if required by Chorus or another carrier service.

If there are two or more 100mm diameter ducts in a trench, then use the least used duct for the sub-duct conduits.

4.10. Building entry points

The following list are the guiding principles for building entry points:

a) Carrier providers installing services via underground ducts or conduit should maintain redundant. pathways for maintenance purposes.
b) Diversely routed pathways should be physically separated by at least 20 metres at all points along their routes.
c) All external gel-filled cabling should transition from external grade to internal grade cable within 15m of entry point, preferably in a communications room, unless using the gel filled cable is rated for internal/external use.

d) All ducts that enter buildings, external communication boxes or structures need to be sealed. This is to alleviate issues such as water ingress and rodent infestation.
e) Above ground entry points require appropriate fire stopping to be re-instated after installation.
f) If it does not already exist, advice should be sought from the appropriate Te Whatu Ora Representative.

4.11. Internal conduits

Standard size wall junction boxes **must** be of the same material as the conduit. Where special size boxes are specified and where such boxes are not obtainable in UPVC, use of prefabricated metal boxes is allowed.

Use inspection-type fittings in accessible and exposed locations.

Adopt the manufacturer's recommended procedure for making joints.

Install flexible couplings where structural expansion joints occur in buildings and in straight runs not embedded in wall chase or floor slabs.

In situations where the conduit may be damaged, provide mechanical protection to UPVC conduit to a height of at least 3m above ground or platform level.

Maintain at least 200 mm clearance from hot water pipes and 500 mm clearance from boilers or furnaces, 300mm from fluorescent light fittings/ballasts and 25mm from adjacent walls.

4.12. Pits

When designing the number of pits and pit locations, future growth and building locations need to be taken into consideration.

The contractor **shall** comply with AS/NZS 3084 (section 9.2.7.5), pits **shall** be selected based on overall fitness for purpose and to address the following:

a) Ground conditions such as stability around the pit and pressure on side walls.
b) Lid loading criteria arising from placement location.
c) Lid finish and security locking criteria.
d) Cable hauling access and radius.
e) Cable slack and joint accommodation.
f) Depth of cover, conduit entry and drainage.

Pits **shall** have the following requirements:

g) Pit dimensions will generally be 1200mm x 600mm.
h) For pit applications off major ducting routes the minimum pit dimensions **shall** be 600mm x 600mm x 600mm deep.
i) All pit lids **shall** be lockable, keyed alike and of aluminium or metal construction.
j) Communications pits **shall** be of robust construction and suited to the conditions.
k) **Shall** be installed at distances not exceeding 150m along underground cable pathways.
l) **Shall** be installed where a significant change of direction to the route occurs.
m) **Shall** be installed at road crossings or culverts.
n) **Shall** be installed where the duct enters a building.
o) Sharing of service pits with other services (e.g., gas, power, and water) **shall not** be permitted.
p) If an existing pit is recognised to have power cables running through it, it is the contractor's responsibility to bring this to the Te Whatu Ora Project Managers attention.
q) Secured and correctly rated (lockable) pedestrian covers.

r) Secured and correctly rated (lockable) trafficable covers where applicable.
s) Bushes (PVC) for conduit entry.
t) Gaskets and seals (T-Dux or equivalent).
u) Where spare fibre cable is stored in the pit then a cable wheel or J hooks to be used
v) All cables passing through the pit **shall** be labelled.
w) Pits **shall** be located such that conduit entries **shall** be achieved using a straight section wherever practicable.
x) Pit locations **shall** be selected to be unobtrusive and installed to leave the pit covers flush with the ground level. Pit covers **shall** be securable to reduce the potential for opportunistic vandalism or sabotage.
y) **Shall** be labelled with a Te Whatu Ora compliant label, (reference labelling standard).

4.12.1. Pit lids/chambers Load Classifications (AS 3996-2006)

The following table is the complete standard and lists different classes of pit lid requirements for various trafficable areas.

Class	Typical use	Ultimate state design load (kN)
A	Areas (including footpaths) accessible only to pedestrians and pedal cyclists –closed to other traffic	10
B	Areas accessible to light vehicles (excluding commercial)	80
C	Areas open to slow moving commercial vehicles (medium duty)	150
D	Carriageways of roads and areas open to commercial vehicles (heavy duty)	210
E	General docks and aircraft pavements	400
F	Docks and aircraft pavements open to high wheel loads	600
G	Docks and aircraft pavements open to very high wheel loads	900

Table 5 - Pit Lid Requirements

NB: It should be noted that pits that are in pathways adjacent to roads where there is potential for commercial vehicles to temporarily come off the road, **shall** be classed to withstand that class of vehicle.

4.13. External Communications Cabinets

These **shall** always be securely installed onto a solid foundation and have the following attributes:

Each External communications box needs to have a unique identifier and be recorded on the local DHB system. Refer to the Te Whatu Ora Data and Digital labelling standard for labelling requirements.

Each External box **shall** be fitted with an Earth rod.

Appropriate care **shall** be taken at time of installation not to impact other services.

4.14. Tunnels

This document does not address requirements for tunnels. If tunnel pathways are required, the design and appropriate specifications **shall** be prepared by suitably qualified personnel in conjunction with the designers for other services contained within the tunnel.

a) Observe all separation requirements for both performance and safety requirements.
b) Review Safety in Design requirements for maintenance and MACs.
c) Provide guidance on worker safety, working in confined spaces, and working alone requirements.

4.15. Aerial pathways

Exposed aerial pathways **shall not** be used other than providing temporary connectivity to portable structures. Temporary is defined as having a known removal date at the time of installation.

Cables used for temporary external aerials **shall** be rated for both UV stability and water ingress for the environment in which they are installed.

Aerial pathways **shall** meet the requirements of AS/NZS 3084 and AS/CA S009, and the following:

a) Aerial pathways **shall** be selected to avoid crossing power lines.
b) Where aerial pathways are indicated on the site plans, the contractor **shall** install UV resistant, PVC-coated, flexible metal conduit between buildings. In this instance the length of conduit may be greater than 1m.
c) The use of gel filled cables in aerial installations **shall not** be permitted as per AS/CA S009 due to the increased health and safety risk.
d) The conduit **shall** be sized such that fill at the time of installation does not exceed 60% rated capacity.
e) The catenary wires **shall** be terminated and sized to support the load of the conduit with 80% fill of cables under extreme weather conditions.
f) Catenary wires **shall** be PVC coated galvanized steel and in no circumstances **shall** be less than 3.4mm diameter. Catenary wire **shall** be fixed to the buildings using eyelets and turnbuckles and bonded to the protective earth as required.
g) The conduit **shall** be tied to the catenary with stainless steel cable ties.

4.16. Intra-building pathways

4.16.1. Building risers

Communications risers are to be sized appropriately for a known cabling capacity at build time, with a minimum of 50% spare capacity for future growth. Communications risers **must** be accessible on every level for cable installation.

A building with a High Availability (HA) requirement **must** have two physically separate communications risers at least 5 meters apart to allow for diverse backbone circuits to increase resiliency.

Communications risers **must** only carry backbone fibre services and an exemption **must** be sought from the relevant Te Whatu Ora representative for other uses.

In the exception where an existing Telecommunications Room services multiple floors, risers will be required to carry high volumes of copper cabling. In such cases a thorough and documented assessment of the following elements **must** be undertaken:

a) Service separation, particularly from electrical services,
b) The total cable length,
c) The looming requirements of the cable.

Where a building has vertically stacked Telecommunications Rooms the TR's may host the riser however each comms room must have a redundant path).

Communications risers **must:**

d) be fitted with appropriately sized cable tray for affixing cables.
e) be fitted with re-enterable passive fire separation systems at each fire cell entry/exit point.
f) be constructed in a way that eliminates any fall hazard for installers working on/in the riser.
g) not reduce clear circulation width from the minimums set out in the AusHFG and New Zealand Building Code, (including in accessible bathrooms).

4.17. In ceiling pathways

In ceiling communications pathways are comprised of large distribution pathways and minor lateral pathways. They should run in parallel with the axis of the building.

Cables **shall** be supported within the ceiling space above the ceiling grid and ceiling tiles, such that they do not rest on the ceiling tiles or rely on them for support.

Ceiling distribution systems **shall** meet the following conditions:

a) Inaccessible ceiling areas, such as those without access hatches behind lock-in type ceiling tiles, drywall, or plaster, **shall not** be used as distribution pathways unless provision is made for the future (e.g., continuous ducts/conduits with draw wires between accessible areas, ceiling access points).
b) Adequate and suitable space **shall** be made available in the ceiling area for the distribution layout recommended.
c) Ceiling tiles should not be used due to infection prevention/control. Where ceiling tiles are used, they should be of the removable or lay-in type to allow contractor and support personnel re-entry for MAC and maintenance. Coordinate installation with the main contractor/ceiling contractor so that drop ceiling supports are not left with wire hangers with dangerous excess that may present a safety hazard to personnel.
d) Cable basket **shall** be used.
e) Coordinate space requirements with MEP services before construction begins.
f) Cable tray and cable basket may be installed by the electrical contractor in conjunction with the installation of electrical cable trays to provide cost effectiveness and coordination.
g) When electrical and data cable trays are installed in a vertical plane on common threaded rods, the electrical cable tray **shall** be the higher containment and the data containment the lower containment.
h) Vertical separation between electrical and data cable containment in a common vertical plane **must** comply with the requirements of AS/NZS 14763.2 and S009. For low voltage cables there **must** be at least one hundred and fifty (150) millimetres from the top of the tray/basket wings to the bottom of the tray above to allow for re-entry and MACs. For high voltage cables there **must** be at least three hundred (300) millimetres.
i) Horizontal separation between electrical and data cable trays **must** comply with the requirements of AS/NZS 14763.2 and S009. In all cases there should be a minimum of 300mm horizontal separation between cable trays in a common horizontal plane or have a suitable metal barrier.
j) Seismic restraint conditions defined in the NZS4219 **shall** be met.

k) Pathways over clinical spaces should be avoided, use corridors and non-clinical spaces wherever possible. Cable pathways **shall not** pass over theatres or medical procedure spaces.

All cable trays **shall**:

l) Have no sharp edges.
m) The cable tray **shall** be run from the data cabinet outwards and is to be installed above the main passageways (to enable easy access for the accredited installer to perform Moves, Adds and Changes.
n) Floor and vertically mounted trays **shall** be supported by manufacturers recommended method.
o) Seismic restraint requirements as per the NZBC.

4.18. Cable tray / basket

Cable basket is the preferred in-ceiling cable containment system and should be used in preference to catenary wire.

Cable basket **shall** be sized to support the initial installation requirements with a 50% minimum growth provision. Cable baskets **should** be a minimum of 300mm wide. For small volumes a 30-50mm basket wing may be used but for larger cable volumes a minimum 300mm with a 100mm wing will be required.

All communication baskets and barriers **shall** be earthed or bonded as appropriate.

Cable basket **must** be galvanized, or zinc coated, after manufacture, to a minimum AS 1650 standard.

If CAT6.A cables are running along a cable basket, they should be loose laid and not bundled, especially in roof voids where the ambient temperature may rise significantly.

When entering and exiting trays routes, ducts and access-ways, cables **must** cascade away in such a manner that allows for other access to the trays, etc., without future uses being impeded, causing risk of burning or in any way limiting further laying of cables in the trays.

Use preformed bends and joiners to extend and change direction in cable pathways wherever possible. When minor bends either laterally or vertically are required, cut the cable tray accordingly so that no hazards or spikes that may prevent injury are left.

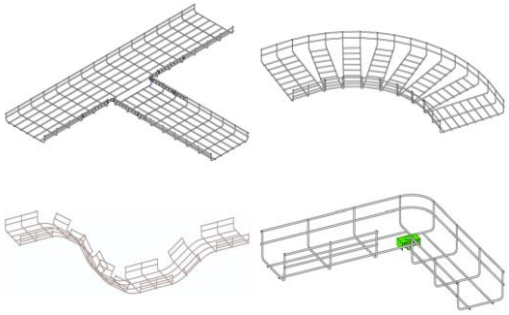


Figure 1 – cable basket installation examples

4.19. Catenary Wire

Catenary wire pathways **shall** be installed to support internal cabling within ceiling spaces and under floors in the instance where cable trays are not able to be used. The design and installation **shall** meet all the following requirements.

a) PVC insulated steel wire **must** be rated for the weight the catenary wire holds. It **must** be of a minimum diameter of 2.6mm (green type) or 3.2mm (black type).
b) Securely fixed to structural members of the building and tensioned using heavy duty commercial grade turn buckles.
c) The maximum size bundle of 4 pair Cat 6_A cables supported by a single catenary wire **shall** be 24.
Note: Thought should be given to the location of the support mechanism and if the temperature is likely to exceed the cable limitations due (manufacturers recommendations) to the ambient temperature and/or the PoE heat rise expectations, if the expected heat is above these criteria, then bundle size should be reduced accordingly.
d) Cables are to be loosely fixed with a minimum of 12mm wide Velcro cable ties every 300mm to 400mm. Plastic Cable ties **shall not** to be used and will not be accepted.
e) All cable ties **shall** be Hook and Loop (Velcro style) type, with a minimum width of 12 millimetres.
f) The cable ties **shall** be loosely fixed, where loosely fixed is defined as the ability to insert one additional cable through the Velcro tie without the need to loosen.
k) The catenary wires **shall** be terminated and supported to sustain the maximum possible load of attached cables (24 x Category 6_A FUTP).
l) Catenary wire supports **shall** be spaced at distances not exceeding 3 metres.
m) A maximum sag of 150mm for any catenary run, **shall not** be exceeded between any two supports when the catenary wire is fully loaded.
n) **Shall not** ceiling use supports, pipes or other ceiling services.
o) Where CAT6.A cables are run together in roof voids utilising catenary wires, no more than twenty-four (24) cables can be attached to the cat wire.
p) All fixings and fixture of the catenary wire support system **shall** be galvanised equivalent to hot dip galvanising or approved equal.
q) Bundles to contain no more than 24 cables **shall** be supported by each catenary cable at final installation.
Where cables of more than 1.5m length before the next support leave a catenary, they should be supported by another means and protected as necessary.

4.20. Perimeter Trunking

Perimeter trunking should be considered for use in environments where frequent MACs and changes are made and where aesthetic considerations allow a highly conspicuous cable pathway feature.

Surface mounted trunking **shall** be installed where alternative methods for concealment of cables are not possible. Twin compartment trunking **shall** be used to segregate power and ELV cabling. No exposed conduit or duct is to be used within buildings without prior approval from the Data & Digital team.

Surface mounted trunking and ducting **shall** follow the natural vertical and horizontal lines of the room structure. It is preferable to install vertical trunking where possible in a corner if it is close to the outlet location or in a location to make it look as aesthetically pleasing as possible while maintaining expandability and flexibility.

The fixing of surface mount trunking directly to the ceiling or other horizontal surface (lid facing down) should be avoided.

When installing cabling (horizontal or backbone) within timber or steel framed wall cavities, cabling **shall** be installed vertically where practicable and vertically in line with the outlet or point at which the cabling exits the wall cavity.

a) Perimeter trunking **must** be a two-compartment type with the top compartment dedicated to power and the bottom for communications.
b) **Must** be a minimum of two (2) segregated cable channels, one for power and one for data. The outlet mounting **shall** be in the centreline of the duct.
c) **Must** be sized to meet the installation requirements of the cabling vendor with particular emphasis on the cable bend radius.
d) **Must** be filled to no more than 50% at initial installation.
e) Metal perimeter trunking **must** be appropriately earthed.
f) When using perimeter trunking preformed bends, tees and caps **must** be used.
g) The perimeter trunking pathway **must** extend all the way to the main cable pathway at full capacity, rather than being fed from an in-wall pathway or a smaller conduit.
h) Consideration **must** be taken where power and data cross – a metal divider **shall** be supplied and fitted to separate these.
i) The use of perimeter trunking in a new or refurbished build should be specified in consultation with the architect and the electrical engineer.
j) Unless otherwise stated, use CAT.6A compatible 2-channel duct, providing metallic shielding. Where wall mounted cable trunking is used, it **must** be capable of supporting 8-way modular outlets (RJ-45) and faceplates. Minimum depth requirements should adhere to the manufacturer's guidelines.

4.21. Internal ducting and conduits

Ducting **shall** be selected to provide capacity for the minimum bend requirements of the cables to be installed. Ducting and conduit **shall** use preformed bends, tees, crosses, and caps throughout the installation.

Ducting and conduit **shall** be selected to be aesthetically matched to the building as far as practicable. Although data ducting is typically green, alternative colours (white) may be required to match aesthetics., (although care **must** be taken to highlight ducting in areas where harm may occur).

Conduits and ducting **shall** be sized to suit the number of cables. New installed ducts and conduits should be selected to have 50% spare capacity after completion of the works.

a) Intermediate wiring joints **shall not** be permitted in conduit or wiring ducts.
b) All bends **shall** be fixed at no more than one hundred (100) millimetres from each change of direction.
c) All PVC conduit and their fittings **shall** be jointed using PVC jointing cement, to the manufacturer's directions.
d) In long continuous conduit runs an expansion joint **shall** be installed at least every twelve (12) metres.
e) All conduit ends **shall** be reamed or filed free of burrs and conduit threads entering junction boxes or fittings **shall** be at least ten (10) millimetres long.
f) Any conduit cast in-slab should protrude the surface of the slab a minimum one hundred (100) millimetres, and located as close as practical to sidewalls, and should exit the slab perpendicular to the surface.
g) Suitable draw cords **shall** be provided in all conduits housing data cables. The installer **shall** install at least one draw cord for every draw cord used.
h) Have a calculated fill rate capacity of fifty per cent (50%) at completion of initial installation.
i) Where the fixing surface of a conduit run either changes level or direction adequate support **shall** be provided to the conduit to relive any stress.
j) The conduit run **shall** be fixed in accordance with manufacturers specifications.

k) All conduits **shall** be securely fixed to its supporting structure using full saddles, with effective anchorage provided and installed through the saddle each side of the enclosure. Unless physically constrained by the only available fixing location, single sided saddles should be used, for example, hard up against the ceiling on a wall.
l) Spring Girder Clips may be used to fix conduit to flanges of building structural members where the member is not readily accessible and at least four (4) metres above floor level.
m) Flexible conduit **shall** be used only where rigid is not practical.

4.22. Underfloor cabling

Backbone and distribution cabling may be installed under floors when access permits. For all under floor cabling the following requirements are to be adhered to:

a) Cables **shall** be suitable for the environment in which they are installed.
b) Exposed standard distribution cables may be used when the under-floor space is dry and not subject to spray or splashes. Cables **shall** be installed clear of access and vent points.
c) External grade cables (gel-filled or water-block) and rodent resistant cables **shall** be installed when the cables are at risk. Alternatively, sealed conduits may be used to protect cables from possible damage by water or rodents.
d) A minimum separation of 500mm **shall** be observed between fibre optic cabling and ground level. Where this cannot be achieved cabling **shall** be installed within plastic conduit of 50mm diameter.
e) Where practical all internally rated copper cable should maintain a minimum distance of 500mm from finished ground level, externally rated cabling may be used for cabling positioned between 200mm and 500mm from ground level.
f) Any cabling installed within 200mm of ground level **shall** be provided with additional mechanical protection, that is, installed within 50mm plastic conduit maintaining the minimum bend radius and expansion requirements.
g) In all cases the manufacturer **shall** be consulted to ensure the installation meets the specifications and requirements for warranty.

4.23. Service Columns, Umbilical Drops, Conduit, Ducted Screens and Ducted Workstations

Service columns, umbilical drops, conduits, skirting duct, ducted screens and ducted workstations **shall**:

a) Have a minimum of two (2) channels (one (1) for ICT cabling and one (1) for power) with the power cabling in flexi-conduit when entering or exiting the ducting.
b) Be designed to ensure the minimum bend radius of ICT cabling is not exceeded (especially when the channel is full) with particular attention to be paid at the junction between different components (for example, service pole to ducted screen).
c) Have no sharp edges.
d) Have no protrusions of rivets or screws into the channels.
e) Have removable panel(s) for entry to each channel for access to the cabling (umbilical cords are exempt from this requirement).
f) Have a calculated fill rate capacity of fifty per cent (50%) at completion of initial installation.
g) Be coloured to match the workstation / existing office decor.
h) Be located where they are inconspicuous, where possible.
i) Meet infection prevention and control, and accessibility requirements.

If there is a requirement to install surface mounted conduit due the nature of the construction, or heritage listing of the building, prior to installation, approval **shall** be obtained in writing from the Te Whatu Ora representative.

5. Telecommunications rooms and spaces

5.1.General

The equipment rooms or telecommunications room's primary purpose is to house equipment and support the distribution of Generic Cabling Systems. This standard identifies the following types of Telecommunications Rooms:

5.1.1. Comms Room Definitions

- Equipment Room (ER) – An equipment room hosts carrier equipment, routers, core switches, aggregations switches and central fibre termination panels It may also host. Also referred to as the Core Room when on a campus site.
- Telecommunications Room (TR) - Also referred to as a Hub Room, a Comms Room, or a Patching Room. The room will contain the LAN cabling for an area as well as the edge switches and any 3rd party equipment servicing the area.
- Campus Distributor (CD), Building Distributor (BD), or Floor Distributor (FD) – the functional requirements of the CD, BD, and FD may be combined in one space of required.
- Entrance Facility (EF) - This room is commonly found in shared premises where carrier circuits are terminated and feed off to several customers.
- Data Centre (DC) / Server room – a secure centralised facility hosting storage and compute and including core networking devices. Data centres may be offsite in hosted facilities. Data centres **shall** be designed as required as a bespoke facility and are beyond the scope of this document, (although cabling for data centres still needs to comply with this standard).

5.2.Designer responsibilities

The designer **shall**:

a) Be responsible to inform the architect and electrical/mechanical engineer of these requirements and to do this early in the schematic design phase of the project.
b) Coordinate all Mechanical, Electrical & Plumbing (MEP) design elements with the room layout.
c) Coordinate spaces and cable pathways required for non-IP services such as AV, Security, Nurse Call, DAS, and other services.

Where these design requirements cannot be met, the designer **shall** advise the Te Whatu Ora Data & Digital team and develop an alternative set of requirements for approval.

5.3.Comms Room cleanliness standards

a) Food or drink is not to be consumed in telecommunications rooms.
b) Active gear or power cords or data cords **must not** be removed or in any way interfered with in "live" comms rooms.
c) No rubbish is to be left in any comms room. All rubbish, including, but not limited to cable off-cuts and obsolete comms gear, **must** be removed by the technician when they vacate the room.
d) The floor is to be vacuumed free of any building dust, (care **must** be taken regarding static discharge).
e) The room **shall not** be used for storage.
f) For 'new' builds, equipment **must not** be installed until the room construction is deemed complete and the environment is clean and accepted by Te Whatu Ora.

5.4.Comms Room location guidelines

INTENT: This section to advise the designer of the aspects to consider when deciding on a location for a new communications room.

When determining the location of a new communications room the following requirements and recommendations are to be considered:

a) There should be at least one comms room per floor level, and preferably in the same location on each floor, (noting maximum total cable distance including fly leads **must not** exceed 100m).
b) This follows the recommendations in the BICSI TDMM standards and provides the following benefits:
   i. If each level in a building has the same layout and location of the comms rooms then they are easier to find by newer operations staff (IT, Building Facilities, maintenance contractors).
   ii. The rooms need only be designed once and replicated between floors.
   iii. Rooms can share the same UPS system.
   iv. The IT Staff know that a data cable or system fault can be traced back to the comms room on the same floor.
   v. The layout of the system is logical which makes fault finding by remote staff faster as less investigation is required.

Considerations to this requirement:

c) If the building has a small floor space on every floor, then a comms room can feed both the level above and the level below. This includes Te Whatu Ora owned and leased premises.
d) Use common sense when planning to feed cabling to other floors. The preference should always be to have a comms room per floor. Cable feeds between floors mean that a riser needs to be used or core drilled holes are required between floors. Drilling core holes is an expensive process and can render the building unsafe if a pre-tensioned steel rod is drilled through.
e) However, it is understood that in certain circumstances the most pragmatic solution is to feed cabling between floors.
f) It is always easier to feed cabling down to the ceiling void of the floor below than it is to feed up to the floor surface of the floor above.
g) If you need to feed two floors with a single comms room the feed down to the floor below. The cables will drop down through the ceiling and onto the cable basket in the ceiling void below.
h) Care should be taken when designing ERs and TRs to ensure the total maximum cable distance **must not** exceed 100m.
i) The maximum distance of a cable installed from the comms cabinet RJ45 patch panel to the wall data outlet is to be 90m. This leaves 5m at the patch panel end and 5m at the wall outlet end for patch cables.
j) This maximum cable length is reduced by thermal factors that **shall** be ascertained by the cabling designer during planning and design, as per ISO/IEC 14763-2. The 90m maximum Permanent Link **shall not** be assumed without a thermal rise calculation being carried out by the cabling designer.
k) An architectural arrangement that allows TRs to be stacked vertically through the building has significant advantages. The architect **shall** have this requirement conveyed in the concept and preliminary design phases of a construction project.
l) If the usable floor space to be served exceeds ≈2000m^2, consider additional TRs so that the horizontal cabling requirements are still met.
m) The comms room **shall** be able to service locations in the most distant corner of the building's roof locations. This is to provide services to external security cameras, WiFi bridges, 3rd Party Carrier services, in roof mounted BMS monitoring devices, etc.

n) Take into consideration the additional cable length required at the user end. Examples of this are feeding through Operating Theatre overhead boom arms, feeding down to patient bed service panels, feeding across channelled floors for X-Ray equipment or to Auditorium Plinths.
o) Consider vertical and horizontal adjacent areas, including fire loads, chemical stores, wet areas etc.

5.4.1. Do not install comms rooms in clinical and patient areas.

The Clinical staff do not like non-clinical staff (IT Network staff, Electricians, Desktop staff), coming into clinical areas where patients may be recovering, getting treated, partially undressed, and so on.

IT technicians (male and female) do not like intruding into clinical areas such as Neonatal, Operating Theatres, Mental Health Units, Maternity Wards, Child Care units, Infectious Wards, and Labs.

Design the location so that the non-clinical staff do not need to walk through a clinical area to get to the comms room. Non-clinical staff **must** change into Blues or Greens (scrubs) before entering or transiting the Operating Theatres.

Do not put comms rooms or cabinets into high pressure infection control areas. This puts the staff at a risk of infection.

Do not put communication rooms into areas requiring a higher level of security such as In-Patients Pharmacy, SCBU (Special Care Bay Unit) and the secure Laboratories. These may require additional approvals for IT staff as well as an escort while doing their work.

5.4.2. The comms rooms should be installed next to passageways that will carry the cable basket to locations around the building.

To reduce overall expense of the cable basket and cable installation understand the path that the cable basket will need to follow around the passageways and across any offices to where it needs to feed cabling.

Note that future cabling installs will be required. Design the location of the comms room so that this future installation will have the least impact on the admin and patient areas.

Any ceiling voids that require opening to pull cabling will need the infection control process to be complied with by the contractors. This adds cost and time to every cable pull point left open.

5.4.3. The comms rooms should be installed next to risers that go up and down a level.

In some buildings the cable may need to feed to lower and upper floors of the building. Take note of the riser locations between floors so that the risers are near the comms room. A riser far from the comms room may mean that the cable loses distance as it first needs to run to the riser before going up or down a level.

5.4.4. The comms rooms should be located away from building outer walls which could provide a better office environment with externally facing windows.

The Comms Rooms **shall not** have windows. Leave these locations free for office or patient locations.

If the area allocated does have windows, then these **shall** be boarded up for environmental and security reasons.

5.4.5. The comms rooms should be installed close to the location of stairwells and lifts.

The Comms rooms should not be installed side by side with lift shafts but within a 15m radius if practical to allow the staff to use them to carry heavy equipment to the comms rooms. It also reduces the time it takes for staff to reach the comms rooms.

If the comms riser is on one side of the lift, then the comms room should be installed on this side so the cable tray does not have to go past the lift shaft before reaching the riser.

The comms room should be located out of the preferred public path. i.e. If the public turn left when they get out of the lift to the patient areas then install the comms room on the passageway to the right.

5.4.6. The comms rooms shall not be installed into areas that could have an electrical or mechanical hazard for IT staff.

The space **must not** be shared with mechanical equipment that might cause injury to staff, e.g., Lift rooms, boiler rooms, vehicle workshops. If the space **must** be shared with mechanical equipment, then an exemption **must** be agreed with the relevant Te Whatu Ora representatives due to Health and Safety considerations.

5.4.7. The Comms rooms should not be located horizontally or vertically next to toilets, showers, kitchens, or other areas where the piping may run in the wall adjacent to the comms room.

They **must not** have fluids or gasses running through them. If this is unavoidable then mitigation **must be** agreed with the Te Whatu Ora Project Manager to capture and redirect any leaks.

5.4.8. Do not locate them in areas that could get flooded or have moisture ingress.

Examples of this are:

a) Open roof levels where the rain or dampness can get in.
b) Under buildings that are not weather sealed.
c) In building lower levels (basement garage) that could get flooded in an extreme rain event.

5.4.9. Be aware of the locations of high voltage cabling and devices producing large EMI fields.

MRI Scanners and similar types of hospital equipment require high voltage circuits and produce a large EMI field when powered up.

Keep away from these locations both in horizontal and vertical directions as the EMI field can affect the floors above and below.

Generators and Lift Motor Rooms (min 1.2m away).

High Voltage cables (min 600mm away).

5.5. ER and TR Comms Room Design Differences based on Tier

There are 2 Design Tiers:

- High Availability and
- Standard Availability

High Availability comms rooms will provide services for areas that provide direct patient care or services that are considered “Critical” to the running of patient or business services.

Standard comms rooms will be those areas where the service that is being supported can afford a data outage for a business day by either working in another building, work remotely or reschedule patient visits. These are commonly general business units working weekdays from 8am to 5pm.

High Availability TR and ER rooms

The High Availability rooms are generally located at campus sites. Their design has the following differences over the Standard Room design:

a) The room **shall** have N+1 independent split-air units each independently capable of providing sufficient cooling for the room.
b) One of the air-con units **shall** be set to maintain a temperature of 22 degrees Celsius with the second air-con unit **shall** be set to start if the room temperature exceeds 25 degrees Celsius.
c) The room **shall** have Water Sensor spot detectors to detect and monitor moisture levels.
d) The room **shall** be provided with dual power feeds, from different Distribution Boards, terminated in a wall-mounted bypass panel, (of which at least one feed **must** be 'essential' power). Power will switch automatically in the event of an outage.
e) The room **shall** have diverse fibre feeds to the campus core and building distribution switches.
f) If this is a remote site, then the comms room **shall** have two WAN feeds.

5.6. Design requirements

The design of the telecommunications room **must** meet the standards and requirements as set out in this document.

Spaces **shall not** be located:

a) In emergency escape ways where they cause obstruction. Doors may not open outwards into evacuation paths.
b) In areas that are subject to risk of flooding. Where risk of water ingress exists, a means of evacuating water from the space **shall** be provided, e.g., a floor drawing with back-flow protection.
c) Rooms should have either self-contained air conditioning, or positive pressure.
d) Air should not be brought in from outside unless via a filtered system designed to circulate air.
e) Radiators **shall not** be installed in these spaces.
Comms Rooms **shall not** have windows.

5.6.1. High availability

Each Te Whatu Ora hospital or facility will have differing room requirements based on the size of the site, the services that are required, and the High Availability requirements of the site.

High availability requirement hospitals require a spatial arrangement that can host a converged network architecture meshed with physically diverse backbone circuits.

a) The rooms **shall** have a minimum of 2 x 24-core Singlemode fibre cables back to the Equipment Rooms where the core switches are located.
b) Each set of 24-core fibre **shall** take a different path back to their respective ER core room with a minimum path separation of 5 meters both inside and outside of the building.
c) The fibres **shall** be terminated in fibre panels at the top RU locations.
d) If the number of fibre panels exceeds the space allocated at the top of Rack 1 then the next set **shall** be installed at the top of rack 2 and so on.

5.6.2. 3rd Party Equipment

The rooms **shall** be designed to accommodate 3rd Party equipment such as Nurse Call, Security Camera recorders, MATV systems, Video Conference systems, Audio Visual systems, Building Management systems.

The 3rd Party systems are considered hospital support systems and be provided power, environmental, security and network services.

3rd Party systems **must be** rack-mounted and not wall mounted so that the workspace around the racks is not intruded on.

All 3rd Party devices **shall** be labelled with the circuit details, name and contact details of the vendor support company as well as the hospital business department responsible for the equipment. This is so that these people can be contacted when a scheduled outage is expected to the room.

In the smaller one rack rooms the 3rd Party equipment can share the same rack as the network equipment.

The medium and larger comms rooms should have a rack, or racks allocated for 3rd Party equipment.

Where rack space is limited then space should be reserved at the lower RU locations in the data racks for 3rd Party equipment. The preference is to keep 3rd Party support staff away from the data racks where practical.

Sites **must** consider how they manage third party security considerations.

5.7.Typical room layouts and design examples

Room layouts need to be consistent with the space provided. The following typical room layouts are provided for guidance only on spacing and access. The concepts are the same for all sizes of room.

Note: The Power, UPS and Air-conditioning for new comms rooms will be provided as a part of the Building Services, (for new buildings).

5.7.1. Telecommunications Room: Single rack typical example.

A room with a single frame or cabinet to be dedicated Telecommunications Room typical example.

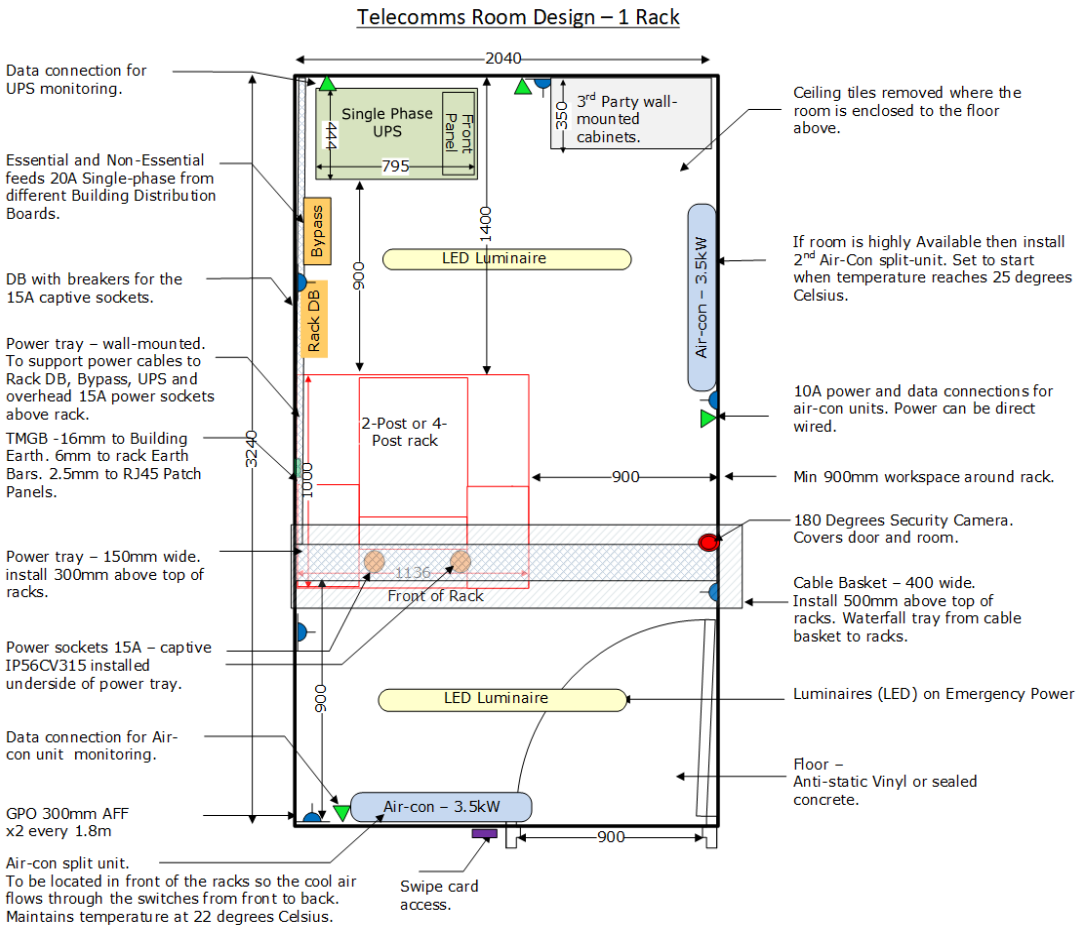


Figure 2 - Telecommunications Room Design for a single rack example

Minimum room dimensions 3240mm x 2040mm. The room should not contain windows.

5.8. 2-rack Telecommunications Room typical example:

Minimum room dimensions 3240 x 2860

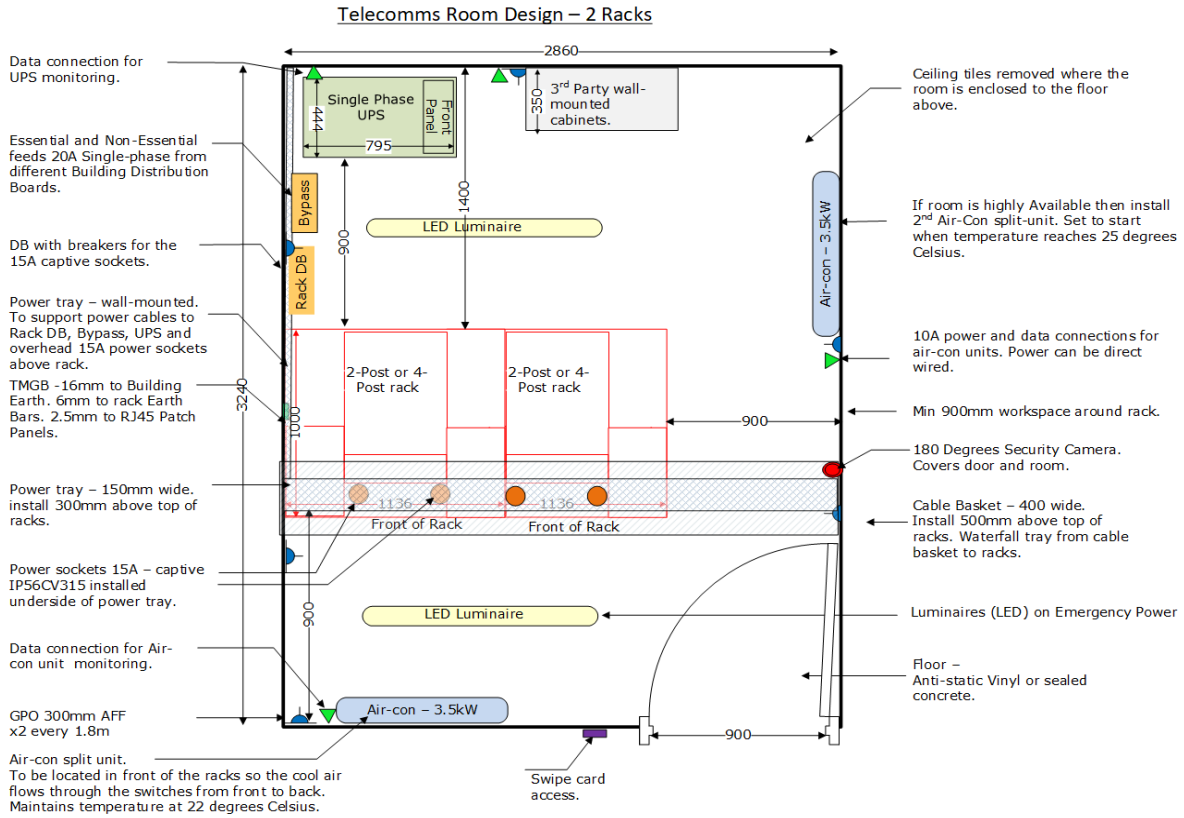


Figure 3 - Telecommunications Room Design - dual rack example

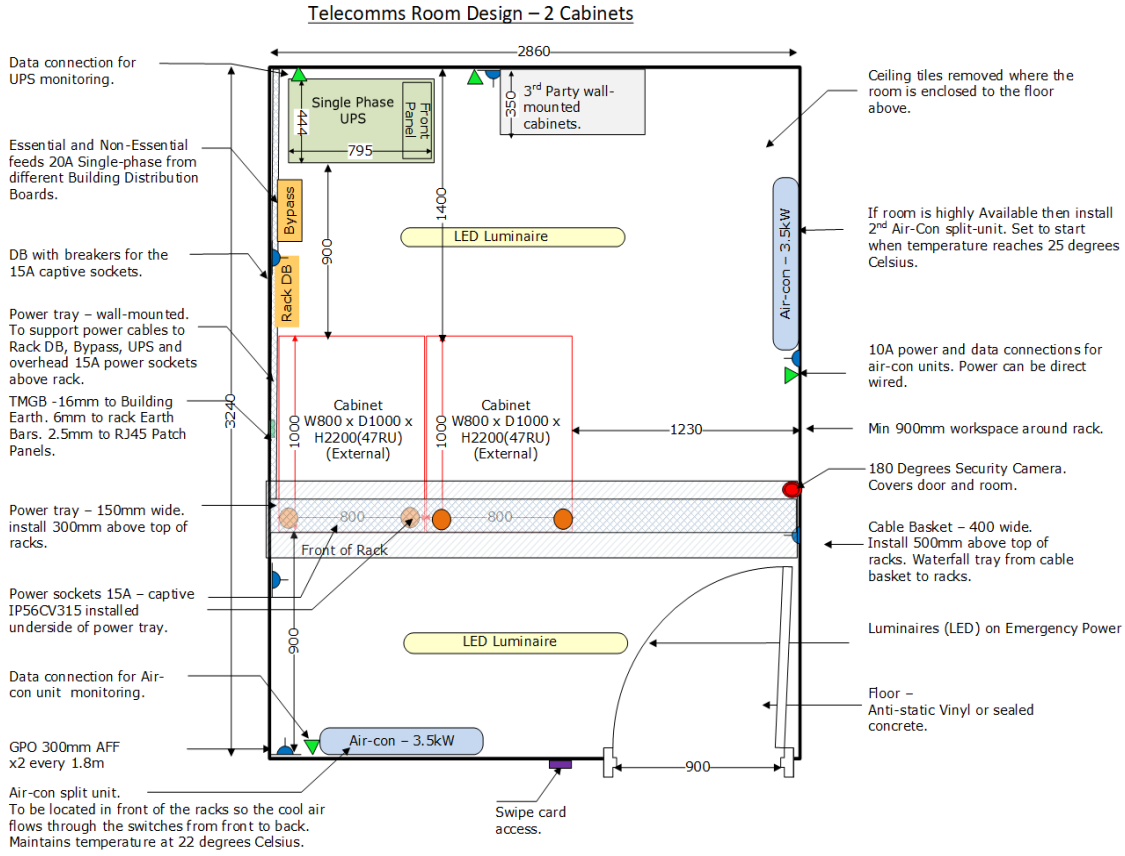


Figure 4 - Telecommunications Room Design Dual Cabinet example

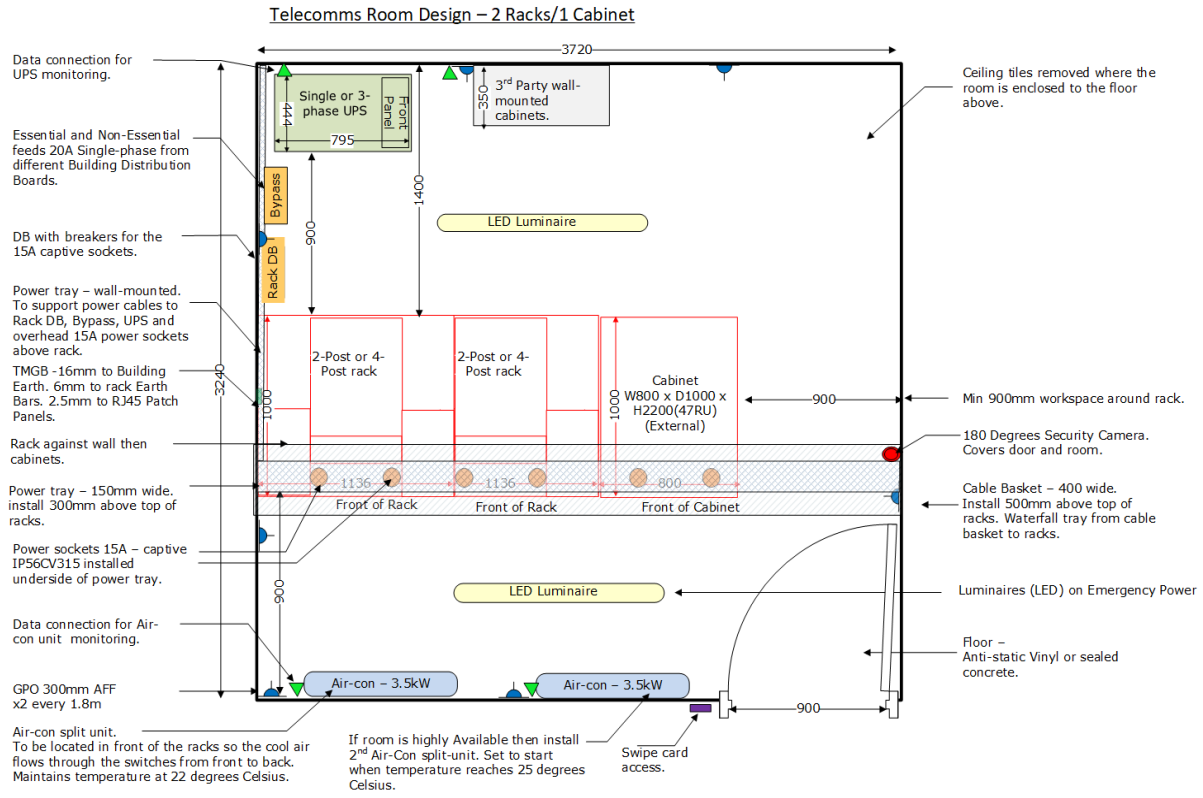


Figure 5 – Telecommunications Room Design dual racks & single cabinet

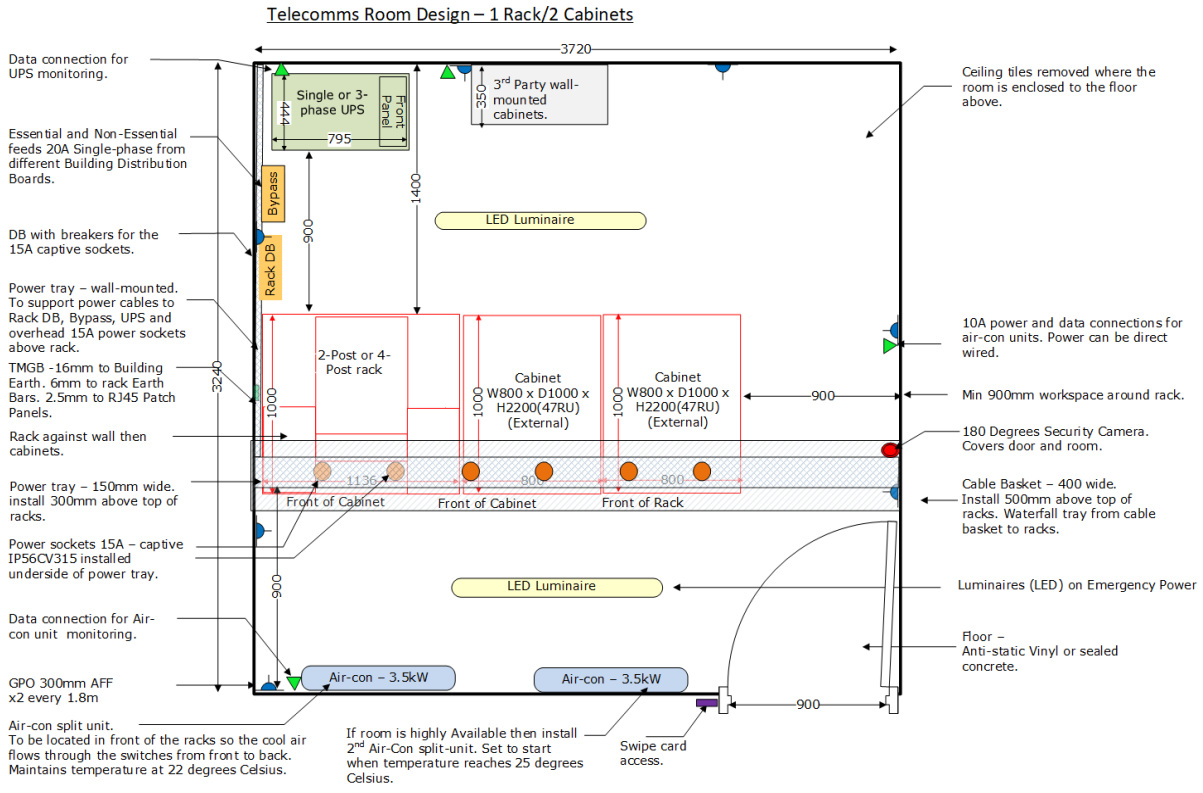


Figure 6 - Telecommunications Room Design single rack & dual cabinets

5.9.Security

5.9.1. Access control

ER and TR spaces **shall** be supported with Access Control.

a) The rooms **shall** be securely managed so that only authorised people are allowed to enter the comms room and those that do are either monitored during the visit or have a record logged of their entry.
b) Consider dual factor authentication for Equipment Rooms, e.g. a swipe or fob access, together with a keypad.
c) A swipe or fob with a temporary keypad pin may also be provided when contractors are to be given temporary access for maintenance work. A key code may be issued to the contractor with an expiry after the required period.
d) Key access should be available for business continuity / disaster recovery situations.
e) Any remote or leased sites that are unable to have a swipe card access fitted **must** seek an exemption from the Te Whatu Ora representative.
f) All doors **must** have a key override.

5.9.2. CCTV

ER and TR spaces **shall** be provided with CCTV coverage with camera views covering the entrance doors and cabinets to provide security and lone-worker support.

5.10. ER/TR ceilings

The minimum ceiling height should be 2700mm AFFL without building obstructions.

When an overhead pathway distribution system is used, the room **shall not** have a suspended ceiling system. The designer **shall** allow for adequate pathways or openings through walls and other obstructions into the accessible adjacent ceiling space.

Where a suspended ceiling system cannot be avoided, for example within existing facilities where MACs are being undertaken, the walls **shall** remain full height to the underside of the structural slab or roof to prevent dust from the ceiling cavity.

The ceiling finish **shall** minimise dust and be light in colour to enhance the room lighting.
The ER and TR **shall** have a minimum height clearance of 2.4 metres to any overhead fixtures (e.g. cable tray/basket, light fittings) from the finished floor level. A minimum clear accessible space of three hundred millimetres above cable raceways will be provided.

If the ER or TR requires a raised access computer floor, the raised floor **shall** have a minimum of six hundred (600) millimetres clearance to the base floor and **shall** have a ramp entry with a 1:14 gradient. For raised floors, all floor-standing equipment and equipment cabinets **shall** be securely anchored to the sub floor. For concrete subfloors, concrete floor anchors **shall** be used.

The ER and TR flooring **shall** be slip resistant and should have anti-static properties. Carpet is not acceptable in telecommunication spaces. The ER and TR walls, floors and ceilings **shall** be sealed to reduce dust, fire retardant, and finished in a light colour to enhance lighting. False ceilings are not acceptable in telecommunication spaces.

5.11. TR Cable trays and baskets

The ICT designer is responsible for the design and coordination of cable trays and baskets within the Telecommunications Room.

Design the cable tray and basket layouts to support the power and data cabling requirements. When cable trays for power and data are stacked, the power tray **shall** be the lower of the two trays with a minimum of 150mm vertical clearance to the data cables trays.

5.12. Safety in TR design

The cable trays and cable baskets within the TR are frequently re-entered and reconfigured. Threaded rod support systems may pose a safety or an impalement risk to the ICT team and their contractors when climbing ladders underneath the cable support systems.

a) Threaded rod supporting cable trays and baskets are to be cut short, approximately 1.75x the width of the fitted nut. Provide double nut support and cover the nut with a brightly coloured soft boot or cap, orange or red preferred, to reduce the risk of injury or impalement to personnel climbing underneath.
b) If a TR has a suspended ceiling installed, the suspending ceiling supports must be tightly wrapped and cut short to reduce risk of injury to personnel needing to access the ceiling space.

To avoid injuries to staff the following requirements **shall** be followed:

RJ45 Patch panels – not above 42RU

No data cabling to be installed above the RU42 rack height. Above this height requires some staff to need a step ladder to access the panels.

Cabinets at a comfortable height.

Wall-mounted cabinets should be mounted at a comfortable height so that technicians do not have to bend down or reach up high to access the cabinet. There should be no need to require a step ladder to access any cabinets.

UPS systems in racks or cabinets.

UPS systems **shall not** be installed into racks or cabinets if the rack/cabinet is in a secure room and the room has been designed for space for a UPS.

UPS systems can be installed into cabinets by exception when those cabinets are in unsecure locations and the cabinet door can be locked.

Third parties are encouraged to use Te Whatu Ora UPS.

900mm workspace around racks.

A minimum workspace of 900mm **shall** be designed into the rooms to the front, at least one side and at the rear of the racks.

This space is between any wall mounted cabinets or floor mounted equipment and the allocated rack space.

Fire Extinguishers

These **shall not** be installed in the rooms.

They **shall** be available just outside the rooms or in the hallway outside the rooms and within 10m of the room.

The staff are expected to leave the rooms in the event of an emergency and request assistance before returning to the room if safe to do so.

Fibre patch panels to be designed with eye safety in mind.

The Single mode fibre cabling system used means that there is a possibility of eye damage if the laser from the transmitter hits someone's retina.

The LC connectors in the panel **shall** be angled to the side and the panel **shall** have a front panel blocking any trajectory of the laser beam.

Doors shall open inwards.

Doors **shall** open into the room, so they do not cause an obstruction to an evacuation path.

If the room is large (5 or more racks) then provide the room with double doors.

No Building electrical DB cabinets in the room

The only DB in the room will be what is required to feed the bypass panel and rack power circuits.

There **shall** be no other Building electrical distribution boards in the room.

Network equipment **must not** share rooms/cupboards/cabinets with building electrical power systems.

5.13. Lighting

The ER and TR **shall** have a minimum of two impact resistant luminaire. The luminaire **shall** be located so that they are separated from ICT cabling to comply with AS/NZS14763.2

The ER and TR average lightning level measured one metre AFF between cabinets **shall** be 500 lux in the horizontal plane and 200 lux in the vertical plane. Light fittings **shall** be mounted at least 2.4 metres AFF, unless otherwise specified. The light placement **shall** be coordinated with cabinets to provide the best lighting exposure while maintaining adequate clearance from telecommunication cable and cross-connects locations. The lighting control/s **shall** be located at the entrance door/s to the room, which may require 2-way and intermediate switching arrangements.

The ER and TR **shall** be provided with essential lighting, with at least fifty per cent of lights connected to the essential supply. The room lighting should not be supplied from an electrical distribution board located within the room.

5.14. Power

The ER and TR electrical distribution board installation **shall** comply with AS/NZS3000 for the electrical earthing of cabinets and frames, within the room. Power design and install **must** be carried out by electrical engineers/contractors. The ICT designer is responsible for advising the electrical team of the loads and requirements.

a) Advise the electrical design engineer of the projected day-1 load of the equipment to be installed in the ER and TR, and the projected day-n load requirements over the lifetime of the installation which **shall** be a minimum of 50% greater than the calculated day-1 load.
b) The room **shall** be fed with both Essential (generator backed) and Mains power sources.
c) Centralised UPS systems **shall** be used, and separate room UPS systems **must** be requested by exception.
d) The room **shall** have a UPS on an essential power feed that will keep all the systems in the racks powered up for a minimum of 20 minutes.
e) The UPS s**hall** contain both temperature and humidity sensors.
f) Each of the overhead racks in the room **shall** be fed by a minimum of two 15A IP56CV315 switched power sockets. The designer is to confirm loads and advise if a larger supply of 20A sockets is required.

g) The incoming power **must** feed into a bypass panel.

5.14.1. GPO power

For non-telecommunication equipment the ER or TR **shall** have at least two suitably rated, double power outlets available for use with power tools or testing equipment. These outlets **shall not** be used to supply telecommunications equipment and do not require an UPS.

The outlets **shall** be placed at 1.8 metre intervals along the walls in the room. These outlets **shall** be coloured consistently with other outlets in the building. These power outlets **shall** be fed by a common circuit connected to the non-essential supply.

5.14.2. Additional requirements for ER power

A separate supply circuit serving the room **shall** be provided and terminated in its own electrical distribution board ("the board") located in the ER with surge protection at the board. The board **shall** be designated accordingly and labelled to clearly identify its function. The board **shall** be used exclusively for supplying power to electronics equipment in the equipment room.

Sizing of the board and the electrical power supply is dependent upon the equipment types and equipment load and **shall** be calculated by the Electrical Engineer on a case-by-case basis, including sufficient spare capacity of a minimum 50% for future growth and redundancy. The ER power circuits **shall** originate from the board, dedicated to serving the ER.

The board **shall not** be used to supply power to sources of electromagnetic interference such as large electric motors, medical imaging, or transformer equipment. The board **shall** be linked to the standby generator power supply.

The distribution board within the TR/ER room **shall not** be used to power devices external to the racks within the room.

N+1 redundancy design criteria **shall** be incorporated into all new or refurbished ER designs for Electrical (including UPS) plant systems.

5.15. Cooling

HVAC systems design and installation **must** be carried out by mechanical engineers/contractors. The ICT designer is responsible for advising the mechanical team of the loads and requirements.

a) Advise the mechanical design engineer of the projected day-1 load of the equipment to be installed in the ER and TR, and the projected day-n load requirements over the lifetime of the installation which **shall** be a minimum of 50% greater than the calculated day-1 load.
b) The ER and TR cooling and ventilation **shall** be provided by a continuous (24 hours a day, 365 days a year) air conditioner (using a refrigeration cycle).
c) Refrigeration cycle air conditioners **shall** be designed and installed such that any leakage of liquids does not occur within the room.
d) They **shall** provide the required number of air changes to dissipate all heat generated from all active equipment within the room (both existing and planned future), and as a minimum, a complete change of air in the room each hour.
e) The operational sound level **shall** be less than 60dB, measured outside but adjacent to the room with the doors closed.
f) The ICT designer **shall** ensure the ER and TR cabinet design provides reliable heat removal with the capability to lower the cabinet temperature. By exhausting hot air from the cabinet to room, it allows conditioned air (entering through Air Intake Grills) to cool the load. Enclosed cabinets containing active equipment **shall** have blank panels fitted in unused RU spaces.

g) The room **shall not** use Building Air-con systems as these can be powered down during times when the building is not being used. If Building Air-Con systems are used, they **must** be fit for purpose and not inadvertently shut down.
h) Temperature – **shall** maintain between 19 – 25 Degrees Celsius with the set temperature to be 22 Degrees Celsius. (Note: No building radiators or other building heating systems **shall** be in the room).
i) HA rooms require N+1 cooling units. One of the air-con units **shall** be set to maintain a temperature of 22 degrees Celsius with the second air-con unit set to start if the room temperature exceeds 25 degrees Celsius.
j) Humidity – **shall** maintain between 40 – 60%.
k) A/C Type – **shall** be wall or ceiling mount split unit.
l) A/C Drip tray – **shall** be installed.
m) Water sensor – High Availability room – **must**, Standard room and below – **should**.
n) The air-con units **shall** be capable of being monitored via the building management system.
o) Cooling systems shall be configured to automatically restart and continue pre-set operation after a mains power interruption.
p) Standard availability rooms should have one air-con unit.
q) Exceptions **shall** be requested for smaller buildings feeding non-critical services, portacomms, contractor temporary buildings, etc, that only support minimal services do not need an air-con unit or can use the building air conditioning or a wall/door mounted fan with dust filter for incoming air flow.
r) The building air-con system **shall** be kept on for that area 24/7. Note: These options are dependent on the communications room size and location.
s) Cabinets in office spaces may use the office air-conditioning if this is sufficient and works 24/7.

5.15.1. Additional requirements for ER cooling

Electrical power provisions **shall** be made to allow the HVAC system to operate on essential supply power when commercial power is disrupted.

Where the anticipated humidity levels exceed the limits specified for the equipment being installed in the ER, provide dehumidification equipment.

Temperature monitoring **shall** be provided via the BMS.

N+1 redundancy design criteria **shall** be incorporated into all new or refurbished ER designs for Mechanical (Air-Conditioning) plant systems.

In-Row cooling units and thermal containment should be considered for ER's with more than 35kw of cooling requirement.

5.16. Entrance Facility (EF)

An entrance point to a building or facility for both public and private network service cables, and the space made for cable transition from external to internal grade cable.

a) The cable entry **shall** be constructed to ensure that water ingress and damage will not occur. Provision **shall** be made for the sealing of cable pathways systems entering the building to prevent ingress of water. Re-enterable seals such as T-Dux or similar products are preferred.
b) The EF may also share a space with an ER or TR.
c) When an EF contains public network services and share the same space as an ER or TR, requirements specified by the Telecommunications Service Provider (TSP) **shall** be considered.

d) External contractors and facilities personnel are likely to need access to the EF therefore should an EF share a space with an ER or TR, appropriate separation and physical security between public and private services **shall** be maintained and considered.
e) **Shall** be attached to the main ER and designed for the following:
    - Hosting frames to terminate cabling,
    - Wall space and frame space for incoming carrier services fibre,
    - Electrical distribution boards,
    - ELV systems e.g., security controllers, BMS controllers,
    - Space to haul/pull incoming cabling,
    - Entrance Facility location and cabling, when more than one EF is provided, the minimum separation between any two EF **shall** be 20m.
f) **Shall** allow for an additional conduit into the Room and exiting the room for quick cable replacements if needed.
g) Cabling **shall** be routed directly to the Entrance Facility.
h) Entrance Facility incoming services: Carrier Service Provider fibre to be terminated on a wall mount ITP (Internal Termination Point) and extend to a client supplied and installed cabinet within the Entrance Facility.

6. Cabinets and Racks

Data Cabinet selection depends on the type of room in which it is located and the size of the facility it services. Sizing the rack space requirement relies on information about the anticipated Data outlet count serviced by a TR and the equipment hosted in an ER.

The preferred cabinet and enclosure options are:

a) ER and data centre – Cabinets for ICT network data centre, server, and distribution backbone networks, 4-post open frame racks or enclosed cabinets for third party services.
b) TR – Open Frame Racks are recommended. Cabinets may also be used in multi-tenant situations or where additional security is required.
c) Supplementary spaces – Wall-mounted cabinets.

6.1. Floor distributor cabinet sizing

When a cabinet or open frame is installed in a TR the following recommendations are made for the maximum outlet quantity per rack. If the recommendations are likely to be exceeded the designer **shall** confirm acceptability with the Te Whatu Ora Data & Digital team:

Cabinet / frame size	Maximum load
12RU	30kg
24RU	60kg
45RU	485kg
47RU	550kg

Table 6 - Cabinet maximum load guidelines

6.2. Enclosed cabinets

Enclosed cabinets should be aligned in rows. The typical orientation for doors **shall** be installed so that they can be pushed closed during an emergency exit, i.e. The doors to close in the direction of the emergency exit.

6.2.1. Floor mounted enclosures

The cabinets **shall** have the following as minimum requirements:

a) Minimum eight hundred (800) mm wide, to provide space for vertical cable management and up to one thousand (1000) mm deep to allow for potential future mounting of nine hundred (900) mm deep servers or UPS's.
b) Cabinets **shall** be at least 150mm deeper than the deepest equipment expected to be mounted within the cabinet for safe access to power cables etc.
c) A minimum depth of 800mm when used as a floor distribution cabinet, recommended depth for all other locations is 1000mm as per above.
d) Front rails located minimum one hundred and fifty (150) mm from the front of the frame.
e) Baying kit.
f) Perforated doors.
g) RU labelling – front and rear.
h) A facility for levelling adjustment.
i) Lockable front and rear bi-folding perforated doors.
j) Lockable removable side panels.

k) Two internal vertical cable trays i.e., one on each side of the frame at minimum 300mm wide.
l) Welded earth bonding studs and earth connecting leads to achieve the earthing/bonding of all frame parts i.e., doors, panels etc.
m) Factory manufactured cabling access components allowing entry of cabling from the top, rear and sides of the cabinet.
n) Should cable entry be required through floor penetrations, racks **shall** be installed on a factory manufactured plinth to facilitate cable entry from below.
o) To avoid thermal cross-contamination between multiple floor mounted enclosed cabinets bayed together, the internal cabinet panels **shall** be left fitted with bushed cable entry holes provided top, middle, and bottom to permit ease of cable reticulation between cabinets.

6.2.2. Bayed Cabinets

Cabinets can be bayed for the following reasons:

a) To provide rack space for high density floor distributors.
b) To provide a dedicated cabinet for third party tenancies to house active equipment that can be patched into the building's common structured cabling system.
c) To provide for Equipment Room rows.

When baying cabinets, the following standards apply:

d) Bayed cabinets **shall** be identical make, model, and size.
e) Bayed cabinets should have the side panels between them removed to facilitate patching.
f) Vertical cable management facilities **shall** be installed between the cabinets.
g) Bayed cabinets **shall** have individual cabinet designations.
h) When two Bayed cabinets are configured, they **shall** have opposing door hinge orientation, with both doors hinged on the outside walls of the cabinets. When three bayed cabinets are configured, at least two should have opposing doors. This may only be done when sufficient aisle clearance means that emergency egress will not be impeded by open doors that cannot be pushed closed.
i) Where three cabinets are bayed, the switch field **shall** be in the centre cabinet. Where multiple switches are provided, distribute evenly.

6.3.Open frame racks

Open frames **shall** be provided by the contactor and designer adhering to the following minimum specifications:

a) Open frame racks **shall** be free-standing. The use of 4 post or 2 post versions **shall** be agreed by design with the Te Whatu Ora Design Team.
b) The racks **shall** be 47RU in height unless the height space conditions within the room require smaller racks. Open frame racks **shall** only be used in areas where access is restricted by a locked door on the Electronic Access Control System.
c) Where using 2-post racks, design in sufficient space behind the rack to allow for the rear posts to be added if required at a later date.
d) The racks should be aligned so that their front faces the door, where possible.
e) The racks **shall** be joined by 1 x 300mm wide vertical cable management bar with the end racks having an additional 300mm wide vertical cable management bar on their outer sides.
f) The patch panels for data cabling may be the angled or flat type.
g) 24-port or 48-port patch panels **must** be used.

h) Analogue Voice panels should not be used. Where they **must** be used, they **shall** remain as the flat type of panel.
i) Patch cabling to the panels **shall** be done from the vertical cable management bar that services the closest side of the RJ45 patch panel.
j) Design the layout of the racks to reduce the need for cross patching.
k) There **shall** be 1 x horizontal cable management bar located in the top of the rack to provide cross patching of fibre cables to other racks.
l) There **shall** be 2 x horizontal cable management bars in suitable locations in the rack to accommodate the few cables that do need to be cross patched.
m) 19" rack mounting rails should be used for servers, fibre patch panels and equipment that comes with these rails.
n) Factory manufactured vertical cable management compartments mounted at the front of the frame on both the left and the right of the 19" mounting rails. These **shall** run for the full height of the frame.
o) Factory manufactured horizontal pass-through ducts, fitted with cage nut fixings, providing ease of access for patching cables between the left and right sides of the frame.
p) Two internal vertical cable trays i.e., one on each side of the frame at minimum 300mm wide.
q) Front rails located one hundred and fifty (150) mm from the front of the frame.
r) Factory manufactured cabling access components allowing entry of cabling from the top, rear and sides of the frame.
s) Should cable entry be required through floor penetrations, frames **shall** be installed on a factory manufactured plinth to facilitate cable entry from beneath.
t) 1x (minimum) 450mm deep, cantilevered heavy-duty shelf for equipment unable to be racked-mounted should be used, where appropriate.

6.4. Wall mounted cabinets

For floor distributor in a small satellite building that has up to 48 data outlets and 2RU of active equipment a 12RU cabinet may be used. Where space does not allow, switches may be mounted vertically within narrow, vertical, wall mounted cabinets.

Wall mounted enclosures **shall** be located to avoid injury and follow relevant Standards and OSH requirements. Top of the enclosure **shall** be no higher than 2000mm AFFL and the bottom of the enclosure a minimum of 500mm AFFL. If this requirement is unable to be met, then written approval from Te Whatu Ora for an alternative installation **shall** be obtained prior to installation.

The 12 RU cabinet **shall** have the following minimum requirements:

a) Six hundred (600) millimetres wide and six hundred (600) millimetres deep including the swing frame.
b) The swing frame **shall** be a minimum of one hundred (100) millimetres deep and rear mounted to the cabinet.
c) Be installed on a minimum of twelve (12) millimetre AC grade plywood backboard, with the smooth side out. It **shall** be secured to at least two wall studs, fixed at top and bottom to each stud (typically eight hundred (800) millimetres x eight hundred (800) millimetres) for mounting of the cabinet swing frame, suitably affixed to ensure the cabinet will not separate from backboard or wall.
d) Vented top and bottom panels to allow airflow.
e) Perforated door to allow airflow.
f) Fully lockable, including side panels.
g) Top of cabinet cabling access and accessories.

h) Fan (two (2) fan unit) installed in top of cabinet with built in thermostat set to operate at 26C.
i) One (1) vented cantilever shelf if required.
j) One (1) rear mounted horizontal power rail complete with six (6) AS/NZS socket outlets and 10-amp plug.
k) Have a dual 10A power outlet on a dedicated circuit installed external to the cabinet. Note: Power outlets **shall not** be installed inside the cabinet. If there is a power short within the cabinet, it **must** be possible to isolate power to the cabinet from the outside of the cabinet.
l) Front rails **shall** be set back one hundred (100) millimetres from open door.
m) Be installed at a height that is accessible without the need for a ladder or elevated work platform.
n) Appropriate fixings **shall** be used suited to the wall material and **shall** be of a sufficient load rating to support the weight of the cabinet.
o) All cabinets and frames fixed to masonry walls **shall** be mounted on a 18mm MDF backing board painted to match the décor, this backing board **shall** be supplied and installed by the contractor.
p) Be installed on a minimum of twelve (12) millimetre AC grade plywood backboard, with the smooth side out. It **shall** be secured to at least two wall studs, fixed at top and bottom to each stud (typically eight hundred (800) millimetres x eight hundred (800) millimetres) for mounting of the cabinet swing frame, suitably affixed to ensure the cabinet will not separate from backboard or wall.
q) The fixing wall **shall** be a load bearing wall of sufficient strength to support the weight of the cabinet and expected equipment.
r) The contractor **shall** communicate additional bracing or beams required for the fixing of wall mount cabinets as early as possible to the main building contractor and architect.
s) Where space does not allow, switches may be mounted vertically within narrow mounted cabinets.

6.5. Cabinet Cable Entry

Cabling entering from the floor or ceiling space to enclosures **shall** be supported by a vertical cable support system.

The vertical cable support system **shall** extend from the backbone/horizontal cable pathway to the enclosure. In the case of raised floors, the vertical cable support system **shall** extend below the raised floor level. In the case of overhead ceiling pathways, the vertical cable system **shall** extend above the ceiling level.

6.6. Cabling Within Enclosures

All cables **shall** terminate at the patch panels in the communications enclosures with an excess length of not less than 0.5m neatly loomed in a properly supported loopback on the cable tray. Cables **shall** be loomed in groups of a maximum of 24. Cabling **must not** encroach on spaces reserved for active equipment.

6.7. Seismic Restraint

Seismic restraint to required specifications (NZS4219) is completed for all new cabinets, cable trays, and MEP equipment in the room.

The racks **shall** be bolted to the floor as a minimum and suitably braced.

6.8. Equipment within frames and enclosures

Frames and enclosures should be no more that 50% populated at initial installation allowing space for future growth and expansion.

Enclosed cabinets used in data centre and equipment rooms that contain active equipment **shall** be fitted with blank pates in unused RU spaces to support mechanical cooling.

6.9. Rack elevations

The ICT designer is responsible for providing rack elevation drawings with the construction issue set of drawings. The ICT designer **shall** provide the Te Whatu Ora Data & Digital team with the proposed rack elevation drawings for approval before issue to the contractor.

6.9.1. Recommended mounting locations

FOBOTs (Fibre Optic Break Out Tray) **shall** be installed at the top of the frame or rack.

Multi-pair copper cabling (Cat.3 or voice ties) for voice/analogue support should be installed below the FOBOT at 42RU or below.

Avoid installing heavy equipment at the top of the frame or rack. Chassis switches should be installed mid-way in the frame or rack, other heavy pieces of equipment such as Nurse Call controllers **shall** also be installed low to mid position. All chassis mount UPS or BBU (Battery Backup Units) units are to be installed in the lowest RU of the frame or cabinet.

6.10. Power

Racks and cabinets hosting active equipment in ER's & TR's **must** each have two power rails per rack in an A & B circuit arrangement.

Cabinets in ER rooms which host servers **shall** have monitored vertical power rails.

Racks in ER/TR rooms will have horizontal PDUs installed at the bottom of the racks.

Each floor mounted cabinet/rack will have two suitably rated, captive power outlets for the connection of each cabinet power rail, with circuits on the same phase to avoid 400V potential, (only relevant for three phase power).

Each PDU should be connected to a captive 15A power socket on the overhead power tray as a minimum. The designer **shall** confirm the load and advise if larger supply of 20A is required.

Two horizontal PDUs to be installed either at the front or rear of the rack.

If the cabinet/rack is mounted against a wall the power outlets **shall** be wall mounted external to the cabinet/rack, positioned 300mm AFL. The outlet **shall** be similar to a Clipsal 56C3XX and the power cord of each cabinet PDU **shall** be fitted with a captive plug, the plug **shall** be similar to a Clipsal 56P3XX.

Each rack will have 2 x 1RU PDUs (Power Distribution Units) located at the lowest two RU in the rack.

The PDUs in a rack will only feed the equipment within the rack they service.

No equipment **shall** be installed at the 5RU location or lower except for PDUs.

The PDU is and its cable at the power socket end are to be labelled to identify which PDU is fed by which power socket.

The power cable from the PDU to the overhead power socket **shall not** take the same data cabling management path as the data cabling in the rack. The power cables are to be secured to the frame of the rack leading up to the overhead power sockets.

Each power outlet **shall** be fed by a dedicated circuit on the building's essential supply (UPS protected).

A room UPS should be used when building essential power cannot be supplied to the room.

A cabinet/rack mountable UPS with external bypass and rated to supply all equipment within the cabinets and can be installed where building essential supply is unavailable.

6.10.1. Wall mounted cabinet power

Each wall mounted cabinet **shall** have one suitably rated double power outlet mounted on the wall outside of the cabinet and fed by a dedicated circuit.

i. Rack Space and Cable Basket/Power Tray Layouts

The racks can be either 2-post or 4-post.

The space allocated for a rack should be the same whether a 2 or 4-post is installed. Note: dimensions may be different depending on manufacturer. Ensure to double check dimensions!

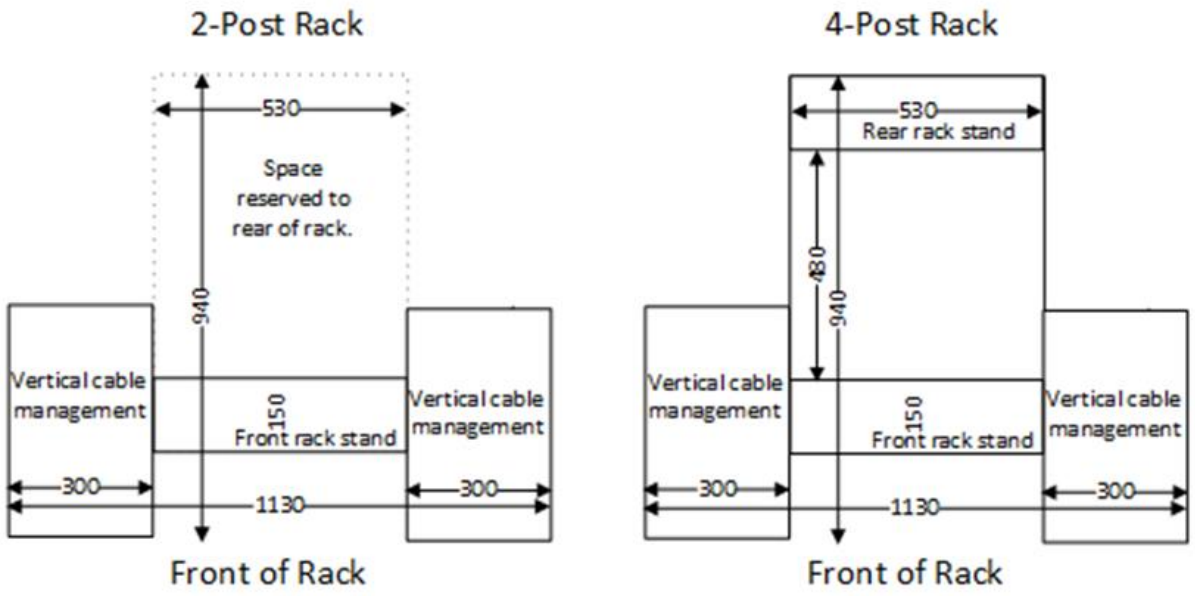


Figure 7 - Rack dimensions example 1

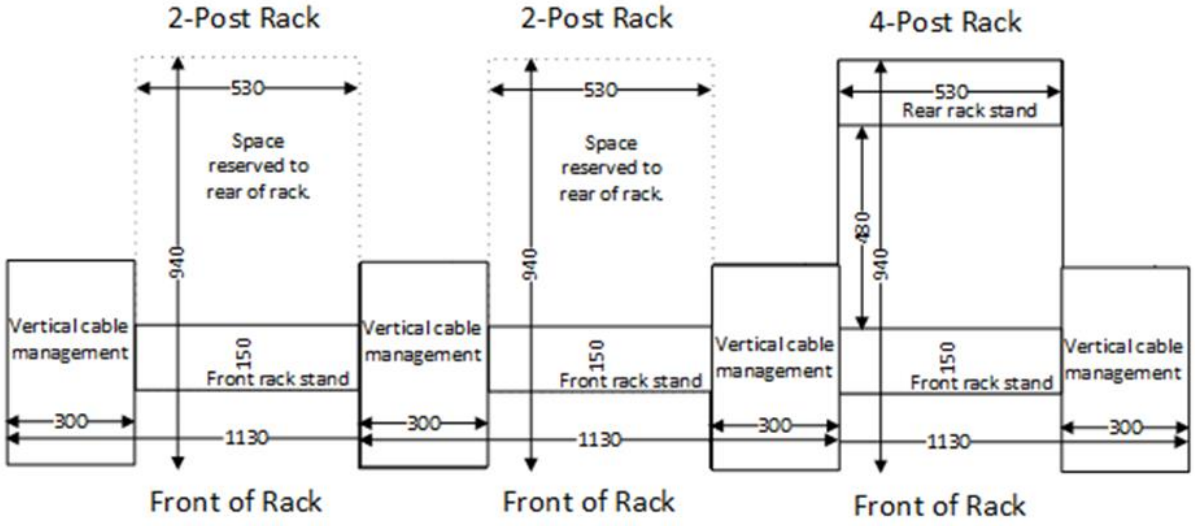


Figure 8 - Rack dimensions example 2

When baying the racks together only one 300mm wide cable management is required between them.

Space Assigned to racks and cabinets.

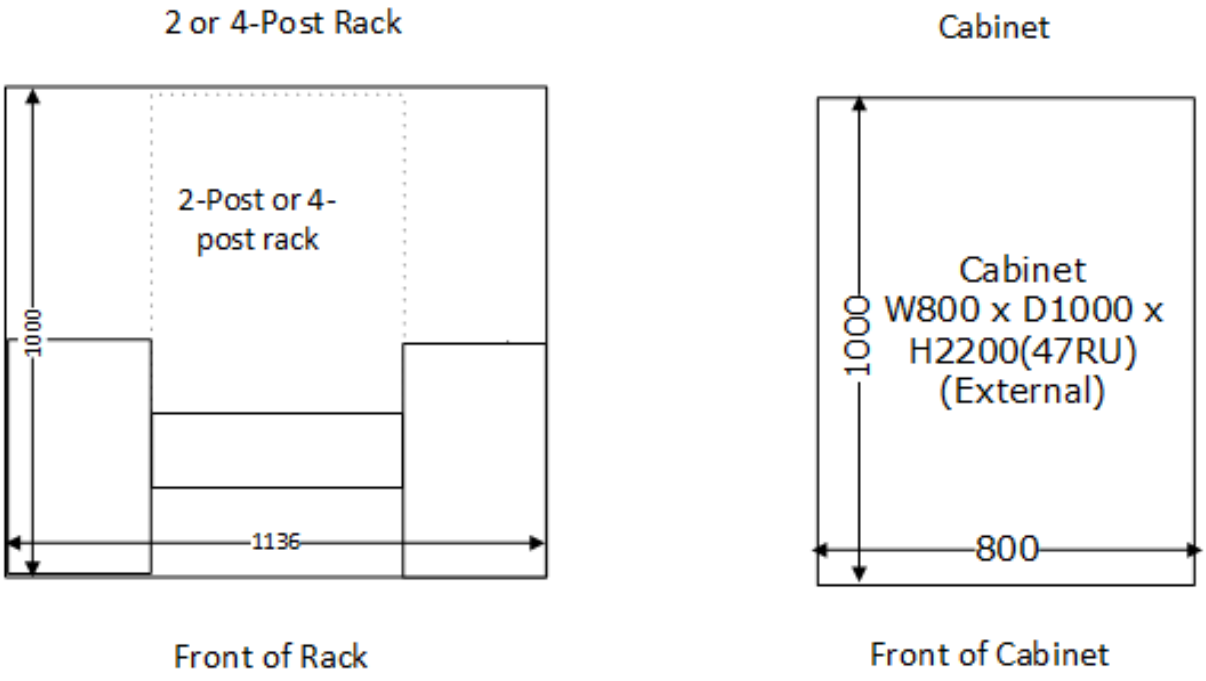
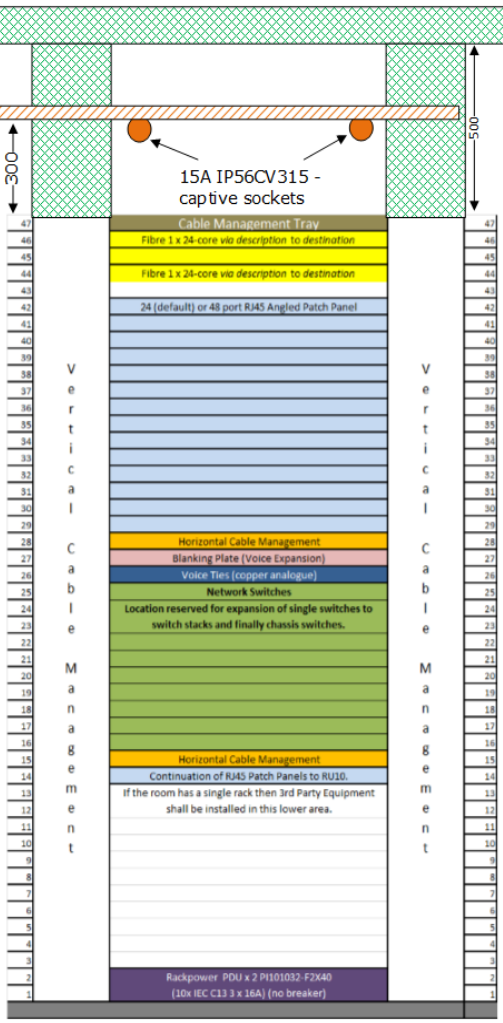


Figure 9 - Rack Dimensions example 3

When laying out racks or cabinets in a comms room ensure to allocate space as per the above diagram.

Rack, cable basket and power tray layout.



There shall be waterfall tray/support feeding of the distribution cabling into the **REAR** vertical Cable Management bar.
Distribution cabling shall not be fed into the front cable management section reserved for patch cabling.

Fibre Panels – shall have eye protection.

The Power Tray shall be installed 300mm above the top of the rack.
This allows space for the 15A Power socket to be attached and the power cable to be fed to the back of the rack.

The Cable Basket shall be installed 500mm above the rack.
This allows space to access the power tray for future changes.
The cable basket is to have waterfall tray to support the distribution data cable from the basket to the rear vertical cable management section.
This waterfall support prevents the crimping of cables coming out of the overhead basket. The crimping effect is increased with the weight of additional cables.

15A IP56CV315 -captive sockets.
The power sockets shall be of the captive type and attached to underside of power tray with on/off switch to the front of the rack.
Power cable to feed behind rack following the rack stands.

Rackpower PDU - 2 X P1051062-A2X40-56P315
(5x IEC C13 6 x C1916A) (no breaker) with 4m IEC19-PDL 56 15Amps Series Captive Leads. (2per rack). Installed bottom of rack and cabled to overhead IP56CV315 captive power sockets.

Figure 10 - Rack, Cable Basket, and Power Tray Layout example

Note: the above is an example of good practice. Each facility has discretion to follow their own design layout.

7. Grounding and bonding

The preferred earthing method for all Te Whatu Ora cabling systems is the Communications Earth System (CES).

The CES is a dual-purpose earthing system used for both functional and protective purposes. All CES grounding and bonding cabling **shall** have yellow/green insulation, grounding cables **shall** be sized as detailed in S009.

Refer to AS/CA S009 for a complete description of the CES.

7.1.Telecommunications Rooms

7.1.1. Coordination with the electrical engineer

Electrical requirements for ER's and TR's are to be provided to the electrical engineer. Service coordination is to be undertaken to ensure separation requirements are followed.

Earthing and bonding of cable containment systems and data cabinets is to be specified by the electrical engineer.

7.1.2. Communications Earth Terminal (CET)

The CET is an earth bar to be installed on the wall near or adjacent to the cabinets. The CET **shall** be a minimum 6-stud earth bar and **must** be clearly labelled "For Data Use Only".

- The CET size is to be defined by the ICT designer.
- The CET and the earth cable connection to the electrical switchboard is to be installed by the electrical contractor and **must** be included in both the electrical engineering design and included for reference in the ICT system design.
- Earth cabling from the CET to the cabinet and within the cabinet is to be specified by the ICT designer and installed by the ISCS contractor.

CET works below **shall** be carried out and tested by the SCS contractor. Refer to the SCS Scope of Works document for detail on which cabinets, racks, frames, and patch panels etc are to be bonded via the CET.

a) A minimum 6.0 mm^2 earth conductor (green/yellow stripe) **shall** be installed from the CET to a minimum 4 stud earth busbar mounted within the communications cabinet, rack, or frame.
b) The busbar within the communications cabinet, rack of frame **shall** be bolted directly to the cabinet body ensuring a reliable mechanical and electrical connection i.e. any cabinet powder coating is removed where to busbar contacts the body.
c) All interconnecting earth leads **shall** be fitted for cabinet accessories i.e. panels and doors etc.
d) Connections to powder coated cabinet, rack of frame surfaces **shall** be via a suitably sized terminal lug, and serrated star washer, ensuring that any paint is scraped back to bare metal. Spade lugs **shall not** be used for earth connections.
e) All metallic patch panels within the cabinet, rack of frame **shall** be connected to the earth busbar located within the communications cabinet using minimum 6.0 mm^2 earth conductor.
f) No more than three earth conductors **shall** connect at any one connection point.
g) The SCS contractor is to conduct a continuity test from each patch panel/IDC frame to the CET. This resistance **shall** be no greater than 0.5 Ω.

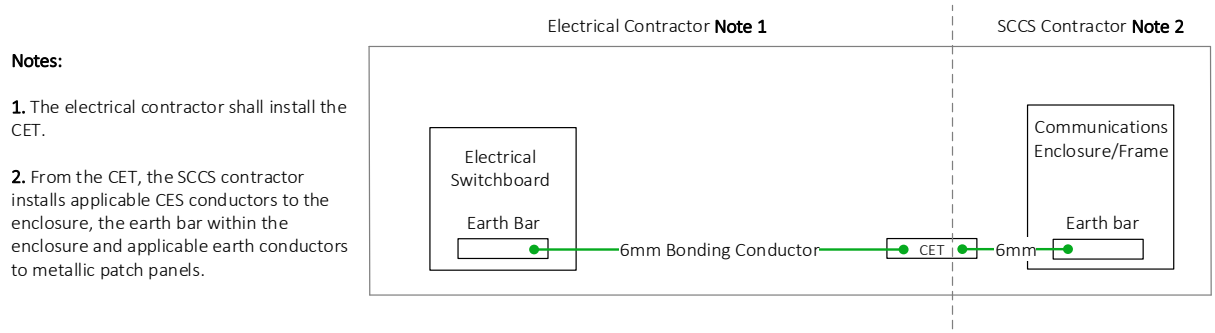


Figure 11- Communications Earth Terminal responsibility

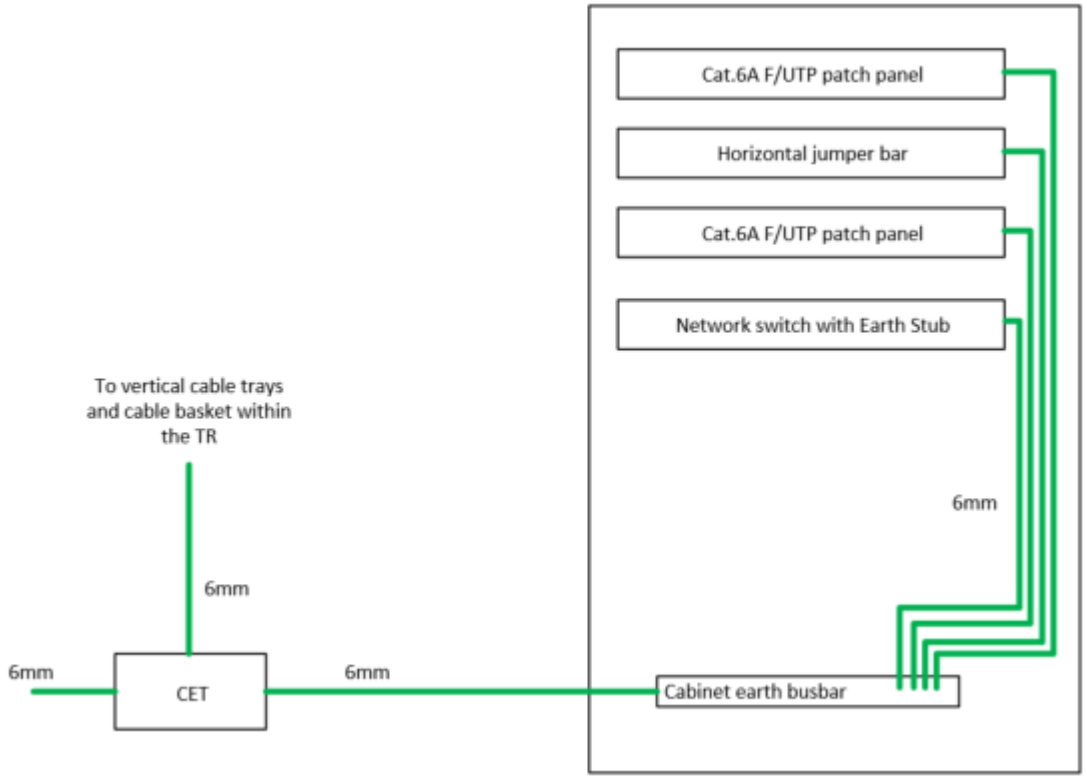


Figure 12 - Communications Earth Terminal structure

7.2.Shielded cable earthing

Shielded category 6_A (F/UTP) data backbone ties, and distribution cables **shall** be installed as follows:

a) Foil shields and drain wires of respective category 6A (F/UTP) data backbone ties **shall** be grounded at one end only, the end grounded **shall** be the upstream end, i.e. the closest to end to the CD.

b) Foil shields and drain wires of respective category 6A (F/UTP) data backbone ties **shall not** be connected at the downstream end of each respective backbone tie and a non-shielded i.e. standard category 6A (U/UTP) RJ45 jacks **shall** be used for all category 6A (F/UTP) data backbone ties at the downstream end of the permanent link which is not grounded.

7.3.Cardiac protected areas

Refer to “AS/NZS 3003 Electrical Installations – Patient Areas for detail on the earthing requirements of all metallic elements including data cabling within cardiac protected areas. The following is provided as additional information only.

Electrical wiring in Cardiac Protected areas has special requirements over and above those of standard Body Protected Areas. One of these is the EPJ, the Equipotential Junction (EPJ) which is defined in AS/NZS 3003 Electrical Installations – Patient Areas.

This is a mandatory standard and responsibility for provision of the EPJ lies with the Electrical Designer and Electrical Contractor. Other contractors **must** ensure they connect any of their components to this EPJ. Its purpose is to ensure that no more than 50mV potential difference exists between any metallic items within the cardiac patient area can be applied to the patient heart through wired connection or conductive fluids as voltage shocks at this level can interfere with heart rhythm. This standard provides full description of the design and testing of EPJ’s and potential difference however in the context of the ICT systems the key elements are:

Part 4.4.1 (ii) conductive parts of permanently connected electrical appliances that are accessible within the patient environment.

a) Part (ii) covers metallic data outlets, AV outlets and so on and this is generally achieved by bonding the MSP (Medical Services Panel) in which they reside to the EPJ. The ICT/AV contractor must coordinate connection of the ICT system outlets to the MSP and therefore the EPJ with the Electrical Contractor and ensure it is compliant with the prescribed bonding resistance limits.
b) Data outlets without exposed metal work are recommended for cardiac areas. This may be achieved by use of a non-metallic retaining clip on the MSP.
c) Data outlets with exposed metalwork must be bonded to the EPJ either directly or through the MSP, the electrical engineer must confirm the resistance requirements of the standard are met.

Part 4.4.1.(iii) conductive parts of permanently installed building services and fittings that are accessible within the patient environment.

d) Part (iii) is a reminder that it is not just electrical and communications metallic elements, but would also include taps, metal window frames, pendant frames, curtain rails and so on. Despite any work done by the ICT/AV contractor as above, it remains the responsibility of the Electrical Contractor to ensure compliance and provided the Certificate of Compliance.

7.4.Communications Earthing System (CES)

The preferred earthing method for Te Whatu Ora facilities is a Communications Earthing System (CES). This is a dual-purpose earthing system used for both functional and protective purposes and **shall** use green/yellow insulated earthing conductors.

The main earthing conductor **shall** be a yellow/green building wire (minimum size 16.0mm) terminated and clearly identified at the CET and earth bar of the electrical distribution board or main switch board on the same floor and building of the ICT cabling horizontal sub- system.

The Main Earthing Conductor **shall** connect to a Communications Earth Terminal (CET) located:

a) In a convenient and readily accessible location close to the racks, at 1200mm above floor level; and/or
b) Adjacent to the switchboard to which it is connected; and
c) Shall not be installed on or within an electrical switchboard or distribution board.

The cabinets, frames, and cable basket within the ER/TR **shall** be earthed using a green /yellow building wire (minimum size 6.0mm) to allow for the use of surge suppression devices.

All communications cabinets, catenary cables, cable tray, metallic IDC frames **shall** be electrically earthed as per AS/NZS3000.

Green /yellow building wire (minimum size 6mm) **shall** be used for earthing metal structures (communications cabinets, catenary, cable tray, frames).

Connections to cable tray or metal structures **shall** be via a suitably sized closed hole terminal lug, and serrated washer, ensuring that any paint is scraped back to bare metal.

No more than one (1) earth wire **shall** connect onto any one (1) earth bar connection point.

7.5.Communications Overvoltage /Surge Protection

Users and equipment **shall** be protected from communication system overvoltage that may exist between the operational environment and the communication facilities in that environment. Examples of overvoltage conditions may include:

a) Contact with AC (Alternating Current) mains power through customer equipment failure or cabling faults.
b) Surge currents and induced voltages through power system faults or lightning.
c) Power feeding.

In situations where the overvoltage condition is due to remote power feeding by carriers and where users are required to be in the vicinity to these feeds the necessary precautions **shall** be taken to ensure their safety and that of others.

7.6.Surge Suppression Devices (Carrier or Voice Grade Services)

Over voltage (lightning) protection modules **shall** be fitted to all IDC 10 pair modules and frames directly connected to the lead-in cable, on customer's side of the network boundary, or other external copper cabling (for example, inter building tie cabling connections) that have, or **shall** have, carrier or telephony present.

Over voltage protection **shall**:

a) Be modular protecting each pair individually.
b) Automatically restore service once fault is corrected.
c) Be maintenance free.

All over voltage protection modules **shall** be electrically connected to back mount or frame. The back mount or frame **shall** be earthed.

Surge protection **shall** be provided where voice grade twisted pair cabling is provided to, or between, buildings or structures, either owned or leased by Te Whatu Ora.

In the case of inter-building ties, the surge protection **shall** be installed on each pair of the cable/s at both ends of the run (each building). The preference is to use fibre between buildings.

The decision to install surge protection on the cabling at or before the network boundary is the responsibility of the carrier.

7.7.Surge Suppression Devices (Non-Carrier or Non-Voice Grade Services)

A Lightning Protection System **shall** be either, installed or existing, prior to any installation of Non-Carrier or Non-Voice Grade Services cabling between buildings. The suitability of the Lightning Protection System **shall** be determined by an electrical engineer.

Prior to the installation of any cables, a risk analysis **shall** be performed using calculation procedure outlined in Lightning Protection (LP) AS/NZS 1768:2007. The risk analysis needs to be applied separately to each building under consideration. Where the two buildings are co-located and the main (feeder) building is fitted with LP, some level of protection may be offered to the second building. In this situation AS/NZS 1768:2007 provides guidelines as to how to calculate the level of protection offered and this **shall** vary on a site-by-site basis.

Where a Twisted Pair link is run via a metal-framed structure, such as, a metal walkway between two co-located buildings and it has been determined that LP is a requirement, as detailed in a) above, and the walkway frame is bonded to the building LP earth at both ends, and a bond conductor has been run between the two (2) LP earths, to create an equipotential connection. If these requirements are met and:

a) If the buildings are < twenty (20) metres apart, no additional protection for the Twisted Pair link circuits is required.
b) If the buildings are > twenty (20) meters apart, Optical Fibre shall be used.

Where a Twisted Pair link is run via a non-metal-framed structure, such as, a timber walkway between two co-located buildings, the cables **shall** be run in a suitable metal enclosure and the same grounding and bonding arrangements, as detailed in b) above, **shall** be applied to the enclosure and on all pairs at both ends of the link.

Where any of these requirements cannot be met, in totality, optical fibre cable **shall** be run to, or between, buildings or structures in accordance with standards.

7.8. Earthing of Surge Protection devices

Surge suppression devices for connection between communications line conductors and earth and installed in customer cabling **shall** be connected to the earthing system of the electrical installation or CES (Communications Earth System) using a minimum 6.0mm2 green/yellow conductor, and additional requirements as per AS/NZS 3000.

8. Backbone cabling system

8.1. Backbone topology

The backbone topology design of each Te Whatu Ora site **must** support the deployment of a converged network architecture. Sites with a High Availability (HA) requirement **must** provide for a redundant network architecture with physically diverse dual backbone circuits.

A backbone distribution system is the part of a premises distribution system that provides connection between data spaces.

A backbone distribution system typically provides:

- Campus connections in multi-building environments.
- Building connections between floors in multi-story buildings.

Passive Optical Networks are not to be installed as LAN components of any Te Whatu Ora network, (e.g. using passive optical splitters to enable a single fibre cable to serve multiple premises).

Each TR is to have a fibre backbone circuit connecting to each ER. This can be achieved by running cables directly or via one passive cross connect. Tube Management boxes provide a junction method for running fibre cores directly from ER to TR. To maintain physical path diversity all cables and interconnecting equipment **must** maintain a minimum distance separation of 5 metres.

Each Primary ER **must** have two diverse fibre backbone circuits connecting to a Secondary ER on site if present.

Cabling additions or repairs require the backbone topology design of each site to be maintained.

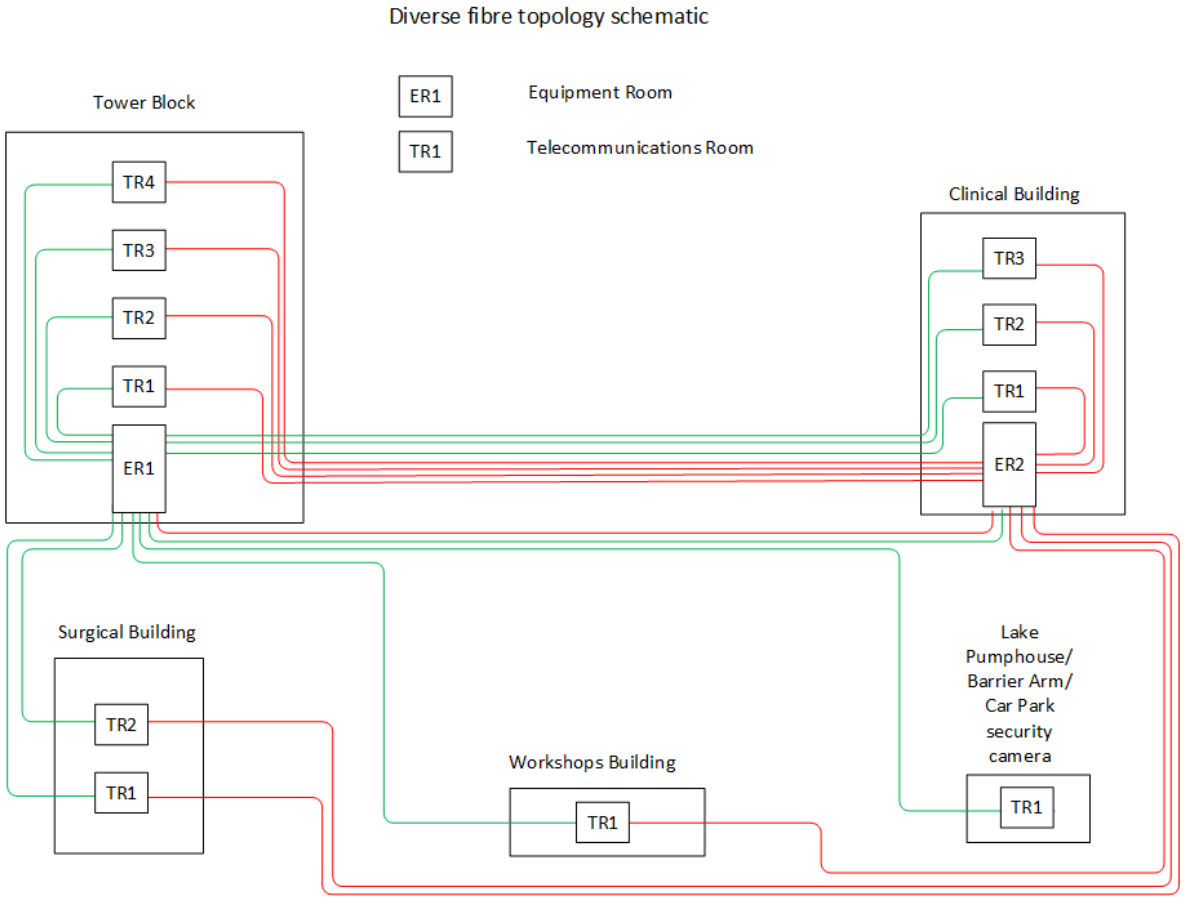


Figure 13 - Backbone topology #1, green (primary) and red (secondary paths.

8.2.Sizing & Capacity

For each circuit:

Each TR **must** have a minimum of 4 blow tubes terminating at the Floor Distributor. A minimum of 24 OS2 fibre cores **must** occupy a single blow tube. All 24 cores **must** be terminated on 6 eye-safe duplex LC-UPC connectors, blue in colour.

If blown fibre is not used, then each TR is to have a minimum of a 24-core fibre back to each ER core room. All fibres to be terminated in LC connectors.

8.3.General Requirements

All Te Whatu Ora backbone links **shall** be built with single-mode OS2 fibre optic cable. Optical fibre cabling **shall** meet or exceed the performance requirement of AS/NZS 11801.1 for the relevant performance class.

Multimode fibre may be used between equipment, (e.g. rack to rack or rack to equipment).

Optical fibre cables **shall** terminate at fibre patch panels located at distributors. Each cable **shall** be continuous from one patch panel to the destination patch panel without intermediate joins or connections. This includes permanent repairs. The cable strength member **shall** be electrically non-conducting and securely fastened at the termination enclosure (not applicable to air blown fibre).

All cores **shall** be terminated, tested, and presented.

Once cables have been installed, products like the Rayflate- duct sealing system (TDUX) or similar **shall** be used at the building entry point.

The direct burial of cables is not acceptable on Te Whatu Ora managed sites.

Fibre Trays **shall** have:

a) A sliding splice-tray.
b) Eye protective front panel or shuttered connectors.
c) The provision to secure the backbone cables at their point of entry fitted with the appropriate cable glands.
d) Lugs or posts for mechanically securing cable strength members.
e) Splice management cassettes capable of containing 12 splice protection sleeves.
f) Dust-caps supplied for all terminations and fitted on all unused terminations.
g) Laser warning safety label to be affixed to front of each fibre tray.
h) Adequate labelling space to identify all ports, fibre type and fibre destination as part of the fibre tray.
i) Capacity to terminate up to 48 fibre cores presenting as 24 duplex LC connectors.

All backbone fibre optic cables should be presented (terminated) in a suitable patch panel at the top of the cabinet or rack within the designated communications room.

If the work is “design and build” then the installer should request the location from the Data & Digital Project Manager or representative.

All backbone designs **must** be signed off by the appropriate Data & Digital team.

8.4.Optical Fibre Cable

Optical fibre cables for outdoor cabling **shall** be rated for outdoor use and entirely suitable for drawing into underground conduits. The appropriate rated cable **must** be used for the outdoor application such that it will be warranted by the manufacturer for a period of not less than 20 years.

Cables **shall** be capable of long-term water immersion without degradation of performance.

Te Whatu Ora Data & Digital recognises three fibre cable construction solutions:

a) Loose-tube gel filled cable (outside plant – transition required).
b) Loosetube LSZH reduced-gel – suitable for both indoor & outdoor installations, does not require a transition point for building entry.
c) Tight-buffer cable (internal).
d) Air-Blown fibre, (both internal and external).

The designer **shall** choose the cable construction most appropriate to the design requirements.

8.5.Loose-tube, (external fibre cable)

Te Whatu Ora external backbone circuits may be built with external (gel-filled) Loose-Tube fibre OS2 cables.

Loose-tube outdoor fibre cables **shall** include provision of restoration coils to facilitate temporary repairs. Restoration coils **shall** be strategically located in any large pit that the cable passes through, as close to the middle of the span as possible. Restoration coils **must** be neatly coiled but unfastened to provide strain relief should the cable be pulled. Air-blown fibre micro-duct cables are not to be coiled.

Fibre cables **must** be suitable for extended immersion in water as conduit paths will flood.

Individual tubes **shall** be numbered with Critchley (or similar) labels within the Tube Management box. All cables **shall** be labelled where they enter Tube Management boxes.

8.6.Tight-buffer, (internal fibre cable)

Tight-buffer (internal fibre cable) may be used for internal fibre backbone fibre paths. Tight buffer cable **shall** comprise a LSZH sheath and be a minimum of 24-core OS1a (Singlemode).

8.7.Air Blown Fibre

Air Blown Fibre may be used for both Intra and Inter building fibre cabling distribution between ER and TRs. Ducts may also be used.

8.7.1. Tube Management

Te Whatu Ora backbone circuits, both internally and outdoors may be built with Air Blown fibre cables.

Air blown fibre installations **shall** utilize 4, 7, 12 and 19 tube micro-ducts throughout a site. Tubes **must** be 5mm diameter.

Tube Management Boxes (TMB's) **must** be sized appropriately for the installation. The minimum acceptable size of a TMB is 600mm wide by 800mm high and 120mm deep. All Te Whatu Ora TMB's **must** be keyed alike.

Tube management boxes should be installed within communications rooms and service risers, or other safely accessible areas. Tube management units should be accessible from floor level. Tube

Management boxes **shall not** be located outside of buildings or within communications pits. All cable junctions **shall** be located within buildings.

Individual tubes **shall** be numbered with Critchley (or similar) labels within the Tube Management box. All cables **shall** be labelled where they enter Tube Management boxes.

Where cables enter the Tube Management boxes, compression glands **shall** be used to secure them. Use of heat shrink glands is not acceptable.

Tube Management boxes should be of a type that allows for future expansion.

8.8. Micro Ducts

Micro-duct bundles **must** be DI (Direct Install) type for installation within inter-building ducts and LFH (Low Fire Hazard) type for internal building installation. Cables installed in garages and plant rooms **shall** be DI type.

All unused micro-ducts **must** be fitted with end caps to prevent contamination.

8.8.1. ABF Microducts

External microduct assemblies **must**:

a) be bundled in HDPE sheath,
b) be thick walled, direct bury duct assemblies, or suitable for installation within buried conduits,
c) Building (fibre only) connections: have an outer/inner diameter of 7/3.5mm,
d) Powered Fibre solutions to have additional tubes with an outer/inner diameter of 14/10mm,
e) be able to allow any grade of fibre to be blown through,
f) incorporate a trace wire,
g) be capable of blowing fibre at least 500m,
h) be capable of providing individual tube breakout.

Internal microduct assemblies **must**:

i) be made of halogen free, flame-retardant materials,
j) rated for internal installation,
k) have an outer/inner diameter of 5/3.5mm,
l) be able to allow any grade of fibre to be blown through,
m) be capable of blowing fibre at least 800m,
n) be capable of providing individual tube breakout.

8.8.2. Tube management boxes

Tube management boxes **must** be labelled with the designation recorded in the Air Blown Fibre register. The Labels **shall** be 50mmx50mm, self-adhesive multi-layered laminate engraved with 15mm upper case lettering.

8.9. Optical Fibre Cable Installation

Optical fibre cable between locations **shall** be one continuous length with no splices or joins except for pigtails used to terminate single mode optical fibre cores.

The maximum length of optical fibre cable **shall** be calculated on a per cable basis. The cable will be checked for light loss to ensure that the combination of specified optics and cable components across the entire channel meet the performance requirement.

Optical fibre bending radius **shall not** be less than 10 times the cable diameter (not less than 30mm) or as specified by the cabling manufacturer whichever is greater under no load conditions and 20 times the cable diameter or as specified by the cabling manufacturer whichever is greater under load, i.e. when being pulled through conduits and the like.

15m of fibre optic cable should be coiled and fixed in each pit where the fibre route changes direction, crosses a road, or enters a building. This will be achieved, where possible, using a cable storage wheel or "J" brackets.

Fibre cables **shall** be labelled with appropriate labels:

a) at entrance and exit of every pit,
b) Approx. 300mm from the rear of a fibre patch panel,
c) Upon entry and exit of a fibre support wheel,
d) 300mm-600mm either side of a pathway change or firewall,
e) At every building entry, external cabinet and fibre panel or splice locations.

Fibre cables **shall** only be installed onto suitable containment (Cable tray or basket). Hook and loop fasteners are the preferred method of securing the cable to the pathway.

When a fibre cable has to transition a vertical riser and the cable cannot be secured to a tray or basket due to inaccessibility, then the installer **shall** use an adequately secured "chain system" to ensure that the cable is supported.

A chain system is also required, if the cable **must** run vertically through a conduit system for more than 3 meters.

8.10. Optical fibre crossovers

Fibre cables terminated within a FOBOT **shall** utilise simplex PC connectors to allow crossovers to be implemented within the FOBOT. When fibre cables require a crossover, the crossover **shall** be implemented within the FOBOT at the downstream end of the permanent link, i.e., the end furthest from the ER or BD.

8.11. Fibre backbone warranty

The cable contractor **shall** provide all licenses and warranties pertaining to the hardware supplied.

The Contractor **shall** facilitate a manufacturer's Performance and Application Warranty for a period of not less than 20 years for the completed installation. The warranty **shall** be issued by the manufacturer directly to the owner of the cabling system and **shall** provide warranty against defects in workmanship, components, and performance of the installed cabling system to the performance specifications of the nominated standards and to the manufacturer's specifications.

The warranty **shall** cover the components and labour associated with the repair or replacement of the failing link within the warranty period.

The warranty does not start until all submission documentation has been accepted by the Data & Digital Project Manager or representative.

8.12. Fibre decommissioning

If replacing or updating external cable infrastructure that has been written off as faulty or deemed not fit for purpose, it **must** be decommissioned.

That is, completely removed from the “pit and pipe” or tube system.

This would include all peripheral equipment related to this cable, wiring frames, joints, etc.

9. Distribution cabling system (Horizontal cabling)

9.1.General

Balanced cabling **shall** meet or exceed the performance requirement of AS 11801.1 Category 6A, Class E_A F/UTP (shielded) 23AWG cable.

For new or refurbished installations, cable of the same manufacturer type **shall** be employed throughout the entire installation.

For MAC's and alterations to existing cabling systems the same cabling system vendor should be used, and existing 25yr performance warranties extended to include the new or refurbished works.

Certification **must** be provided by the manufacturer that the balanced cabling system meets the specified performance levels on practical completion.

All ICT cabling **shall**:

a) Make use of ceiling, wall space, or floor voids.
b) Utilise cable tray, catenary cable, and other authorised supports wherever possible.
c) Be segregated from power.
d) Have a gooseneck (instead of a coil) of one (1) metre at any entry point to a vertical channel (for example, service column, plaster board wall).
e) Have, wherever possible, three hundred (300) millimetres of slack at the data outlets to allow for re-termination. It is appreciated that this may not be possible in some types of workstation / skirting duct.
f) Be kept away from extremes of temperature (for example, adjacent to a tin roof) since this affects performance and minimises maximum allowable cable length.

All ICT cabling **shall not** be:

g) Anchored to the false ceiling supports (the calculated maximum loading of these supports does not consider the additional weight of cabling).
h) Creased / kinked at any point (even temporarily when being drawn from the manufacturer's container). The straightening of the cable after being creased / kinked will not remove the problem.
i) Visibly exposed or accessible to the public.
j) Pulled-in using motorised methods.

The Accredited Installer **shall**:

k) Inspect the cabling path prior to pulling the cable to ensure bending radii of the cable does not exceed the cable manufacturer's requirements and ensure the appropriate equipment used to draw-in the cable does not exceed the pulling tensile-loading limit specified by the cable manufacturer.
l) Use specialised external cable grips and stockings with swivel attachments fitted in conjunction with the cable's load bearing strength members when a mechanical advantage is required to pull-in the cable.
m) Use a suitable lubricant where a single person applying reasonable effort without mechanical advantage is unable to pull-in the cable without exceeding the manufacturer's tensile-loading specification for the cable.
n) Use cable lubricants that are polymer-based for copper cables and silicon-based for optical fibre cables. Oil, wax, and power based electrical cable lubricants **shall not** be used on low-density polyethylene insulated telecommunication cables.

o) Be responsible to ensure that all persons on site are aware of the delicate nature of ICT cabling. The accredited installer is responsible for protecting the cabling from any deliberate or accidental damage by any person during installation. If evidence of such damage is identified (for example, footprints on the cable) the cable is to be replaced at the accredited installer's expense.

9.2. Wiring pattern

Where the Region is predominantly Type A then Type A **shall** be used and where the Region is Type B then Type B **shall** be used to retain conformity.

In the event of cabling a new building or a full cabling refit of an existing building, then type A **shall** be used.

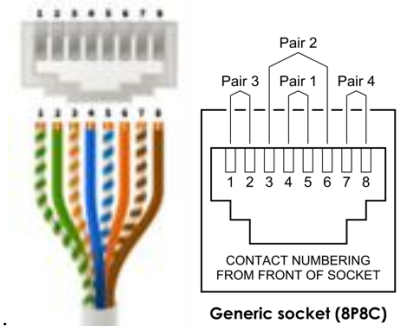


Figure 14 - T568A wiring pattern.

9.3. Distribution cabling pathway design

The ICT designer is responsible for the layout and design of all distribution cabling pathways.

Installation may be undertaken by the GCS contractor however more typically will be undertaken by the electrical contractor in conjunction with the installation of electrical cable pathways.

a. The ICT design set **shall** include drawings showing the cable pathways and note the installation responsibility is by the electrical contractor if applicable.

9.4. Distribution cabling pathway requirements

The designer and contractor **shall** apply the following to all horizontal cabling pathways:

a. All cables **shall** be concealed in walls or conduit except where run on cable trays in equipment rooms, basements, risers, and attics. An exception to this requirement is buildings where cable tray is exposed as an architectural feature. Cables **shall** be run in neat lines and perpendicular to the structure.
b. Aesthetics is important. All installations are to be unobtrusive and blend in with the existing surroundings. Aesthetic considerations and concealment devices **shall never** compromise product installation specifications. This is of particular importance in the case of cable bend radius specifications.
c. All fixed horizontal cabling **shall** be concealed from view within occupied workspaces.
d. All cabling **shall** be installed in conduits, on cable trays in under floor or above ceiling cavities. Velcro cable fasteners **shall** be used at intervals as specified in AS/NZS 3084.
e. All cabling **shall** be concealed by installation in ceiling, floor, or wall cavities. However, it may be necessary to surface mount cabling within trunking where no cavity exists or where concealment would prove to be inordinately expensive, disruptive, or impracticable. Two-compartment trunking **shall** be used to segregate power and communications cabling in these situations.

f. All trunking **shall** be run in an inconspicuous manner. Excess cabling **shall not** be stored in the trunking.
g. Where cable bundles of fewer than six horizontal cables are run in a false (suspended) ceiling they **shall** be suspended from fixed non-movable structural features. Fixed, non-movable features exclude water pipes, sprinkler systems and trunked electrical power.
h. All fibre cables and cable bundles of greater than six cables **shall** utilise installed cable trays or catenary wires.
i. Cables **shall not** be laid on ceilings or ceiling tiles or attached to any suspended ceiling support structures.
j. Plastic capping **shall not** generally be used in new or refurbished building and construction projects and low-profile ducting **shall** be considered where cable numbers are low. Any capping used **shall** be UV rated.
k. Perimeter trunking **shall** be considered for use in environments where frequent moves, adds and changes are made and where aesthetic considerations allow a highly conspicuous cable pathway feature. When using perimeter trunking preformed bends, tees and caps **shall** be used. The perimeter trunking pathway **shall** extend all the way to the main cable pathway at full capacity, rather than being fed from an in-wall pathway of a smaller conduit. The use of perimeter trunking in a new or refurbished build **shall** be specified in consultation with the architect and the electrical engineer.
l. If the transition point is not the building distribution frame, then this should be a fusion spliced through joint, not a patch panel.

9.5. Distribution cabling supports

Horizontal IT cabling infrastructure **shall** be supported by an approved method and **shall** be installed in accordance with the following:

a) Where exiting cable tray, catenary wire or other continuous pathways, cabling **shall** be installed such that there is a maximum spacing of 1 meter between supports or fastenings:
b) Cables installed on cable trays **shall** be loosely laid and secured not more than every 1.5m using Velcro.
c) No more than 24 cables of any type **shall** be in a single bundle and tied to a catenary wire, (although multiple bundles may be used if the centenary wire is rated to support the volume).
d) Cables **shall** be tied to catenary wires at 300mm intervals using a Velcro (minimum of 12mm wide tape).
e) Catenary wire **shall** be supported at a minimum of every 3m using hooks or other appropriate fasteners.

9.6. External Telecommunication Outlets

On some occasions SCS outlets are required outside.

All normal installation practices are to be adhered to plus:

a) All cables that leave a building and are terminated outside **shall** be rated for the environment in which they are to be installed and protected accordingly.
b) Any cable entering an underground duct line **shall** be externally rated.
c) Cables **shall** be installed in a manner that protects them from risk of damage or vandalism and does not expose them to the elements.
d) The direct burial of cables is not acceptable on any Te Whatu Ora entity.

9.7. Patch panels

Patch panels within frames and enclosures **shall** be:

a) Open frames – angled patch panels.
b) Enclosures – flat patch panels.

10. Data Outlets

10.1. General

Data outlets should be mounted at the same height as existing outlets and/or power outlets. If there are none, in office and administration areas they should be mounted so the top of the outlet is as close as possible to one hundred (100) millimetres above desk or a minimum of three hundred (300mm) and up to five hundred (500) millimetres above floor level height, (unless there is a specific use case that warrants an exception).

a. In clinical and bed-side locations dual double outlets should be installed as per the guidance.
b. Data outlets supporting televisions and displays should be mounted behind the television.
c. Power outlets **shall** be mounted as close as possible to the height of data outlets, allowing for segregation.
d. Data outlets **shall** be installed in a readily accessible location.
e. Data outlets **shall** have their outlet designation labelled on the faceplate.
f. Dual outlets **shall** be installed at a minimum in all locations.
g. Data outlets **shall** be fitted to the same pattern of faceplates and mounted at the same height and orientation (vertically or horizontally) as existing outlets and services.
h. Ceiling mounted outlets **shall** be mounted perpendicular to the building axis.
i. Data Outlets for pendants **shall** be mounted on the wall or ceiling closest to the pendant and a patch cable run inside the pendant, (apart from mental health, where the installation design **must** be agreed with Facilities).

10.2. Ceiling droppers

Ceiling droppers may be used in open spaces and **shall** be use where wall outlet provision options are not feasible. The following **shall** apply when ceiling droppers are installed:

a. Terminal Equipment Outlet, Service Outlet (TEO or SO) **shall** be terminated on the ceiling or within the ceiling cavity directly above the area being serviced.
b. If TEOs or SO are installed in the ceiling cavity, then the ceiling grid **shall** be labelled with the outlet number to indicate the location and numbering of the outlet.
c. Appropriate length patch cords **shall** be extended from the ceiling-based outlets to the service area.
d. Patch cords **shall** be neatly bundled and supported by a chain, or a purpose-built cable spine. Under no circumstances **shall** patch cord lengths cause the distances set out in AS 11801 to be exceeded.
e. Installation of ceiling outlets for servicing droppers **shall** include the installation of leads to the work area.
f. Work area patch cords when used with ceiling droppers **shall** be labelled at both ends.

10.3. Floor boxes

Floor boxes should only be in areas that will not be walked over, i.e. in Auditorium speaker plinths.

New or refurbished floor boxes should be located with careful consideration of any fixed furniture layout plans. Exact location **must** be defined in conjunction with the main building stakeholders including the Architect, the Property Services Manager, and any department representative.

Floor boxes **shall** be constructed from durable material capable of withstanding a 150kg point load and have approximate dimensions: 245 mm square, with a minimum depth sufficient to fit a standard data outlets or GPO wall plate and to maintain the bend radius and performance requirements for a Category 6A cabling installation.

A floor box with a carpet insert **shall** be used to allow the floor box to blend into the surroundings.

To prevent debris or foreign objects from damaging the outlets or presenting a hazard to the user, the mounting of GPOs and data outlets **shall** be such that they are not facing directly upwards.

Each floor box **shall** be able to accommodate a minimum of four GPOs and maximum of four data outlets.

The entry and exit of power and communications cables to and from the floor box **shall** be provisioned via separate entry/exit points with sufficient capacity to allow four work area patch cords and four power cords, with sufficient protection to prevent damage.

The mounting of the floor box **shall** be such that it is flush with the floor and does not present a hazard to any user.

Any new or refurbished floor box **shall** be fed with a minimum of two 40 mm conduits when installed in a concrete slab. These **shall** be supplied directly to each floor box. For communications cabling circuits conduit looping or pass-through installations are not acceptable.

Earthing of floor boxes **shall** be carried out in accordance with the requirements of AS/NZS 3000. Floor boxes should be earthed with a 6mm earth cable. Looping off the earth on the power feed is not an acceptable earthing method.

10.4. Modular Plug Terminated Link (MPTL)

Distributed building services, including CCTV, BMS controllers, video intercoms, Nurse Call devices etc., **shall** be terminated as MPTL assemblies when the cabling cannot be terminated in a standard 8P8C modular jack.

Links including MPTL connections **shall** be a tested as per AS/NZS 14763.4, if no specific IEC standard testing is required by the manufacturer, to ensure the connectors allows for equivalent mechanical and environmental performance requirements, stated under the AS 11801.1.

Cable re-termination into a free MPTL is not allowed under schedule B.4 or B.6 of the AS 11801.1. Re-termination is only allowed for fixed MPTL units. The introduction of a MPTL **shall not** introduce more than 2.5 Ohms with the initial termination and more than 5 Ohms after the MPTL has been allowed to settle. The introduction of a MPTL unit **shall not** cause the overall generic cable channel to exceed 100m unless the applications allow for it i.e., BMS sensors.

MPTL assemblies **shall not** be implemented with ES3 applications.

Field terminated assemblies **shall** be allowed to ensure that the cabling channel and permanent link will be covered under cabling warranty.

Insulation Displacement Contact assemblies are permitted. Insulation piercing contact is NOT permitted.

Any MPTL connections deployed as a part of the overall cabling solution **shall** be tested and warrantied as per the requirements of this standard.

10.5. Telecommunication Outlets for Specific Applications

10.5.1. Data Outlets for Security Cameras

Data outlets and cabling for servicing security cameras **must** be installed in accordance with a building wide security plan.

Data outlets for security cameras **must** be installed in the ceiling above the camera and fixed to a permanent feature such as the slab or wall, or the cable tray.

Internal outlets should be mounted in an accessible space for servicing purposes. These outlets **shall** be labelled with the unique ID of the outlet.

For outdoor cameras mounted on a building, the outlet **must** be positioned within an accessible location within the building and utilize an outdoor rated lead extending to the camera.

10.5.2. Data Outlets for Infection Control

In areas where opening the ceiling tile or trap door to the ceiling void will require the Infection Control process to be followed. The data outlet should be installed on the wall near the ceiling. If there is a requirement to install in the ceiling, (e.g. mental health, theatres, etc), this **must** be agreed with the relevant Te Whatu Ora representatives.

10.5.3. Data Outlets for Wall Phones

Outlets for public wall phones **must** be positioned so the phone covers the flush box on which it is mounted. The flush box may contain a MPTL connector that allows presentation of the terminated cable in an RJ45 female plug.

10.5.4. Data Outlets for MEP (Mechanical, Electrical, Plumbing) Services Devices

Data outlets and cabling for servicing MEP service devices (also referred to as building management services devices and building management control systems), within a building are to comply with data cabling standards in every regard.

Data outlets utilized by mechanical control devices **must** form part of the building's standard structured cabling system. Data outlets for MEP devices **must not** utilize daisy chained non-certified links unless prior approval is obtained from the Te Whatu Ora Data & Digital team.

10.5.5. Data Outlets for AV (Audio Visual) Applications

Data outlets and cabling for servicing audio visual equipment are to comply with data cabling standards. Data outlets utilized by AV services **must** form part of the building's standard structured cabling system. Such outlets **must** terminate in the data cabinet.

Non-certified point to point links are not permitted.

10.5.6. Data Outlets for Wireless Access Points

Wireless Access Points (WAP's) can only be installed in accordance with a building wide wireless placement plan. Building occupancy changes and/or building layout changes require review/rework of the wireless placement plan.

Each planned Wireless Access Point **must** be installed with a dual data outlet to allow for flexibility.

WAP's **must** be installed within a 500mm radius of the location marked on the wireless placement plan, and fully within the room in which they are marked. Deviations greater than 500mm **must** referred to the Wireless Placement Plan author to be made in the wireless planning tool. Flyleads **must** be no longer than 5 meters.

Wireless Access Points **shall** be installed in accordance with the correct mounting orientation of the device. Wall mounting of WAP's intended for ceiling mounting **shall** utilise a small shelf or bracket to achieve the correct orientation. Brackets **shall** be powder-coated metal laser cut and folded in a uniform manner. These should be uniform across the site.

Ceiling mounted WAP's will be installed on the underside of removable ceiling panels with the data outlets located within the ceiling void. Where installation is on fixed ceilings the data outlets will be located alongside each AP with visible fly leads connecting them.

Wireless Access Points installed on a tiled suspended ceiling T-Rails are to be centred on a tile where it is practical to do so. Seismic issues need to be considered – a backing board above tile and a seismic restraint of it, may be required.

The Wireless Access Point **must** be labelled with its designated ID, (including connected data outlet ID, if it is not visible from the floor).

Access port MAC address and patching information **must** be recorded as part of the installation process.

If the AP utilises a custom manufactured mounting bracket or is installed at a height exceeding 5m it **must** have a safety tether.

10.5.7. Data Outlets for Nurse Call Applications

Data outlets and cabling for servicing Nurse Call equipment are to comply with data cabling standards. Data outlets utilized by Nurse Call services **must** form part of the building's standard structured cabling system even though the protocol running over them may not be IP. Such outlets **must** terminate in the data cabinet/rack.

Non-certified point to point links **shall not** be used.

10.6. Copper Patch Cords

Path cords **shall** be factory assembled using copper conductors. Patch leads utilising copper clad aluminium **shall not** be used. No connector apart from an RJ45 **shall** be plugged into RJ45 data outlets. This is applicable to telephone cords and device cords terminated in RJ11 (4-pin) or RJ12 (6-pin) connectors, which can damage the RJ45 data outlet and void the warranty.

11. Patch cords and fly leads

All patch cords **shall** be provided in the colours identified in the Colour Cabling Scheme section.

- **Racks and cabinets**

All patching within the communications enclosures and racks **shall** ensure that NO patch cord crosses the centre line of the patch field. For example, any patch cord that needs to patch from left to right (or reverse) **shall** make the transition across the face of the patch field via the horizontal cable management.

Patch cords installed by the contractor within communications cabinets **shall** utilise horizontal and vertical cable managers and **shall** be of a suitable length for the respective patching circuit. Excessive patch cord lengths **shall** be avoided.

- **Umbilical cable managers**

Where vertical umbilical cable managers are utilised to reticulate a work area, fly leads are to provide connectivity at workstations. These **shall** be labelled at both ends using computer generated, commercial grade, permanent self-laminating vinyl wraparound labels.

The labelling of patch cords **shall** reflect the nomenclature of the data outlets to which they are connected.

11.1. Fibre-optic patch cords

Fibre optic patch cords **shall** be provided as duplex LC to LC except when used to interface equipment using other formats of fibre connectors to optical patch panels.

Patch cords **shall** be matched to the AS 11801.1 optical fibre cable type of the cabling system in which they are used. Fibre patch cords may only be used that match the optical fibre cable type being used i.e., only OM3 patch cords **shall** be used on an OM3 cable, only OS1a patch cords **shall** be used on an OS1a internal fibre cable.

When fibre cross-over is required, the cross-over **shall** be installed at thee FOBOT in the downstream end of the permanent fibre link, i.e. the end furthest from the CD.

Patch cords **shall** be provided in standard pre-manufactured lengths (e.g., 1m, 2m, etc) sufficient to interconnect the optical fibre termination unit and switch/router hardware while minimising the need to manage excess cable. Where excessive patch cable slack cannot be avoided, vertical and horizontal cable management and patch cable slack drawers should be installed to manage the excess slack.

a) All fibre-optic patch cables shall be factory manufactured.
b) All fibre optic patch cords that are not plugged into an adapter/coupler or keep in storage shall have dust caps fitted.
c) The connectors on fibre optic cords shall be cleaned immediately prior to being patched or repatched to remove dust, dirt or fingerprints which can affect performance.
d) The mating pair within the FOBOT must also be cleaned using a Cletop or similar fibre pen cleaner.

11.2. Copper patch cables

Patch cords and terminal equipment cords (fly leads) **shall** be:

a) Constructed of an 8-wire stranded cable terminated with an 8P8C (RJ45) plug at both ends.
b) Factory assembled patch leads must be used.
c) Plugs shall be fitted with moulded strain-relief boots.

d) The wiring pattern shall be consistent with AS 11801 wiring pattern, patch cables and fly leads may have either the T568A or T568B colour code as this makes no significant difference to channel performance and channel wire-map is maintained regardless of the permanent link wiring pattern engaged.
e) Shall be of the same Category/Class or higher than the permanent link they are connected to.
f) Must be a minimum of 0.4mm (24awg) cross sectional area. Smaller patch cords (26awg, 28awg, and 30awg) are available but not supported by AS/NZS and ISO standards and are not recommended for PoE and remote power channels. These smaller cables shall not be used as any patch cable or channel may be required to support PoE in the future.
g) Devices shall be connected with the shortest practical patch cords and fly leads possible. The combined length of the patch cord and fly lead on a permanent link shall not exceed 10m.
h) Not made from copper-clad aluminium (CCA).

12. RF Systems

12.1. Wi-Fi

Wi-Fi is provided in Te Whatu Ora facilities for both staff, patient, and visitor use. The Wi-Fi network supports clinical systems including Nurse Call staff communication as well as providing internet connectivity for mobile devices including bio-medical equipment, workstation on wheels, laptops, duress alarms etc.

The Wi-Fi access point cabling should be considered as part of the SCS package and where required by the scope of works is required to be provided by the SCS Designer with installed by the SCS Contractor.

12.1.1. Wi-Fi design and installation

Wi-Fi design **must** be undertaken by the Designer using predictive mapping planning software to assist with the placement of WAPs within the facility. The Designer **shall**

a) Confirm with user density and projected traffic requirement parameters with the Te Whatu Ora Data & Digital team as inputs to the mapping software. When projected requirements are undetermined, an initial allowance of 1 WAP for 75sqm in clinical spaces and 1 WAP per 200sqm in plant spaces **shall** be assumed.
b) Provide a dual Cat.6A data outlet at each WAP location. The data outlet should be no more than 500mm from the predictively mapped installation location of the WAP. Note that some services such as Fire Protection may take positional preference.
c) WAPs **shall** be installed in accordance with the correct mounting orientation of the device. Wall mounting of WAPs intended for ceiling mounting **shall** utilise a small shelf or bracket to achieve the correct orientation.
d) Ceiling mounted WAPs **shall** be installed on the underside of removable ceiling panels with the service outlets located above within the ceiling void. Where installation is on fixed ceilings the service outlets **shall** be located alongside each AP with visible patch cords connecting them.
e) When a WAP is fitted on a ceiling tile, the data outlets **shall** be installed above the ceiling tile at a location that is readily accessed to allow the patch cord to be fitted. The ceiling grid **shall** be labelled with the data outlet numbers to indicate there are data outlets in the ceiling space above and make finding the SO and fault finding easier.
f) WAPs installed on a tiled suspended T-Rail ceiling **shall** be centred on a tile where it is practical to do so.
g) The designer/contractor **shall avoid** installing WAPs above a height of 5m. For auditoriums, large lecture halls and other large spaces the WAPs **shall** be wall mounted at 3.5m maximum to avoid the need for special height access equipment.
h) These wall mounted WAPs **shall** be installed on horizontal mounting brackets to provide the optimum antenna orientation. The placement and coverage **shall** be confirmed by the wireless planning tool.
i) Any WAP fitted on a ceiling tile at 5m or above **shall** have an additional seismic safety chain (or nylon coated multi stranded steel wire harness rated at 50kg minimum) fitted and attached independently to the ceiling grid or beam above the ceiling tile.
j) When WAPs are to be designed/installed in heritage buildings, approval for mounting the WAP in any location may be required. The design **shall** confirm with the architect and the Te Whatu Ora Data & Digital team before determining installation locations for WAPS.
k) Complete a scan post installation and provide the test results to Te Whatu Ora to confirm the coverage has met the design brief.

12.2. DAS – Distributed Antenna System

The design and installation of DAS systems is not included in this specification, these will be undertaken by contractors approved by the lead DAS carrier.

Where the building (cable tray/basket) and campus infrastructure (ducts/pits) are available, then they may be used for the installation of DAS cabling.

These facilities are owned and managed by the Te Whatu Ora Data and Digital Team so their permission and advice **must** be followed for the use of these systems.

There may be reasons that specific infrastructure should not or cannot be used.

a) When DAS is being installed in a construction or refurbishment project, the Designer **shall** liaise with the lead DAS carrier to ensure that appropriate space is clear in the TRs for the DAS installation.
b) a) DAS distribution systems may use the SCS cable pathways and ducts at the discretion of the Data and Digital team.
c) b) DAS distribution fibre backbone cabling systems may use the SCS ABF tubes or Microducts at the discretion of the Data and Digital team.

DAS cables **must** be clearly labelled as per the National Labelling Standard.

12.3. RF (Radio Frequency) systems

The design and installation of RF systems cabling is not included in this specification.

a) RF coaxial cable **shall not** share SCS cable pathways.

13. Testing and conformance

13.1. Facilitates system upgrades or reconfigurations

The contractor **shall** provide test records for all cabling links installed under the project using test equipment accepted and approved by the manufacturer as part of their performance warranty programme.

All testing **shall** be carried out by the contractor utilising a quality plan as per the standards.

The contractor test results may be confirmed by random tests made by the cabling system manufacturer or the Te Whatu Ora Data & Digital team, or their representatives.

a) All testing **shall** comply with IEC 61935.1 for copper cabling and AS/NZS IEC 14763-3 for optical fibre cabling in accordance with the values set out in AS 11801.
b) If test results for existing cable are not available and the cable is to be re-terminated, it **shall** be tested along with all new or refurbished cabling.
c) Permanent link copper testing **shall** be performed in all acceptance testing. Channel testing **shall** be utilised for fault location only. Testing **shall** only be performed using calibrated test and simulation equipment following the test guidelines set forth by the tester manufacturer and the structured cabling manufacturer.
d) Test equipment approved by the cabling manufacturer should be used for all testing.
e) Optical fibres **shall** by tested by light source and power meter in accordance with AS/NZS IEC 14763-3.
f) The test results, for all cables, connectors and outlets **shall** be fully documented and tabulated, identifying each cable and each outlet or interface port by its label. Testing **shall not** proceed until all labelling and documentation is complete so that the test results accurately reflect the actual cables and connectors. All test results **shall** be included in the as-built documentation.
g) Any modifications to an already warranted SCS **shall** be retested, and warranties revalidated by the manufacturer.
h) The tester **shall** be:
i) Factory calibrated within the previous twelve months.
j) Firmware **shall** have been updated within a week of commencement of GCS cable system testing.
k) The tester **shall** be in good working order. This includes all test heads, leads, and adaptors.
l) Replacement of test adaptors tips **shall** be every 5000 tests. Any test results submitted for a GCS project that are made on adaptor tips that have been used for more than 5000 will not be accepted.
m) Test results **shall** be supplied electronically in the native format of the tester (e.g. in. lkw. olts, .trc, format) with a copy of the tester manufacturers software to read the file (if required).
n) Marginal Pass results (*PASS) and Marginal Fail results (*FAIL) are not acceptable and **shall** be rectified to ensure a clear Pass result.
o) All tests will be time and date stamped.

13.2. Power over generic cabling testing

All generic cabling (SCS) is to be designed, installed, and tested to be PoE ready and **must** be tested with the extended DC Resistive Imbalance tests enabled on the tester.

Each conductor in a cable assembly responsible for remote power delivery **shall** have the capacity to allow a continuous carrying capacity of 0.75A operating in temperatures up to 60 degrees Celsius.

DC resistive imbalance testing is required as per AS 11801.1 and is to be carried out in Accordance with IEC 61935.1.

13.3. Copper cables

All links **shall** be tested using a Level-III (up to Class-E) and Level-IV (Class-E_A) cable test device as per the Quality Plans. The tests **shall** include the full set of tests required to confirm performance to IEC 61935.1 and AS 11801.1 Permanent Link specification.

Test results **shall**:

a) Be downloaded to a database using the utility provided by the cable tester manufacturer.
b) Be supplied in the native format of the tester (e.g., .flw format) and are to be with a copy of the tester manufacturers software to read the file.
c) Frequency sweep test results and plot data **shall** be provided.

Text files or PDF files of test results are not acceptable.

13.4. Modular Plug Terminated Link (MPTL) testing, End-to End, and Direct-Attach premises cabling testing

Testing IP cameras, WAPs, IP Intercom stations and IP speakers:

a) All installed circuits using MPTL interconnects **shall** be performance verified to AS/NZS14763.4. Test results **shall** be automatically evaluated by the equipment and the result shown as PASS/FAIL.
b) Any defect in the cabling system installation or the point of termination to modular RJ45 connectors **shall** be repaired or replaced to ensure 100% useable conductors in all cables.
c) All testing **shall** be conducted with all components of the cabling system in their final positions (e.g., cables loomed to catenary wires, patch panels terminated etc.
d) The test measurement **shall** be set to "Cat 6 Mod 1-Conn Perm Link (+ALL).

All cabling using E2E or DA configuration (typically in building management systems), **shall** be tested to the parameters included in AS/NZS 14763.4.

13.5. Fibre testing

All terminated links **shall** be tested using a Power Source/Light Meter that can provide stored test results in the original tester format. An optical time-domain reflectometer (OTDR) may only be used as an additional test.

Fibre testing **shall** be fit for purpose and in accordance with ISO/IEC 14763-3. Include one cord test method as per ISO/IEC 14763-3.

The tests **shall** include the full set of tests required to confirm performance to ISO/IEC 14763-3 and AS 11801.1 specification.

In addition:

a) The tester **shall** have a certification of calibration current to within the tester manufacturer's specification and **shall** be validated at a maximum of 12 monthly.
b) Multimode fibre **shall** be testing using the 1 test cord reference method using Encircled Flux (EF) launch controllers. Testing **shall** be undertaken in both directions at 850nm and 1300nm.
c) Single-mode fibre **shall** be tested using the 1 test cord reference method. Testing **shall** be undertaken in both directions at 1310nm and 1500nm.
d) Cable length can be verified either by using an OTDR or it may be directly determined from the cable metre marking.

e) The test report **shall** have the correct parameters applied including:
   - Testing standard,
   - Meters,
   - Number of connectors and splices.

f) All core test results should encompass the cable number and core.

g) **Shall** include the full name of the technician performing the test as well as state the room that was used to conduct the tests.

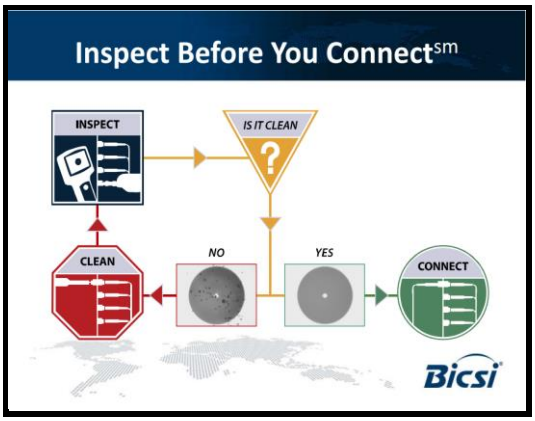


Figure 15 - Inspect Before You Connect

13.5.1. Optical Time Domain Reflectometer (OTDR) testing

An OTDR is used to characterise power reflected along optical fibres with a graphical signature on a display screen.

The OTDR has the capability to measure the length of the optical fibre, characterise power loss at events and measure attenuation between any two points along the cable.

An OTDR trace is required for all installed fibre cores, this requires fully compliant reference launch and receive leads. (recommend minimum of 150m's per launch and receive leads).

Testing parameters:

- Connector loss - 0.5dB
- Splice loss - 0.3dB

OTDR tests are not required for pre-terminated cables, due to them being factory manufactured to a specific length under laboratory conditions.

The tester **shall** have a current certificate of calibration to within the tester manufacturer's specification.

The OTDR trace enables the evaluation of elements along an installed optical fibre link, including the optical fibre segment length, attenuation uniformity and attenuation rate, connector location and loss, splice location and loss and other power loss events (e.g., sharp bends). Essentially, it is used to evaluate the installation quality of the cable.

13.5.2. Power and Light Meter testing

Fibre cores **shall** be tested using the 1-jumper method. Testing **shall** be undertaken in both directions at 1310nm and 1550nm.

Test reference cords should be factory-assembled, factory-polished, and be the same optical fibre core size as the cabling system (e.g., 50/125nm leads for a 50/125nm system).

The power meter and the light source **must** be set to the same wavelength.

The light source **must** operate within the range of 1310 ± 10 nm or 1550 ± 20 nm for single mode testing.

The tester **shall** have a current certificate of calibration to within the tester manufacturer's specification.

14. Documentation

14.1. Planning & Design Documentation

ICT Build plans are required under the following circumstances:

a) Addition of >12 Data Outlets.
b) Addition of any fibre backbone cables.
c) Addition/Alteration of any TR or ER.
d) Addition/Alteration of any Data Cabinet or Rack.
e) Construction of any new or refurbished building.
f) Alteration to any existing building that impacts on ICT cable pathways or spaces.

14.2. CAD/BIM Elements

Where a project utilises a BIM model, ICT elements that are to be attached to the building **must** be included in the model. These elements include:

a) Data Cabinets,
b) Cable Trays/Basket/Ladder/Containment systems,
c) Penetrations of walls, floors, and structural elements,
d) Perimeter Trunking,
e) Data Outlets,
f) Wireless Access Points.

The specifications detailed in the project's BIM execution plan **must** be followed.

14.3. Schematics

The following schematics **must** also be produced:

a) Backbone cabling schematic,
b) Rack Layout Diagrams.

14.4. Specifications

A detailed specification **must** be prepared to accompany plans and schematics. The specification **must** reference this document and any other relevant standards to be followed.

14.5. CIC Guidelines

On build projects where NZ Construction Industry Council (CIC) Guidelines are used the ICT designer **must** set out their deliverables per design phase using the CIC guideline templates. These **must** be submitted to the Project Manager.

14.6. As-Built Documentation submission and storage

For all work undertaken on Te Whatu Ora sites, the following **shall** be sent to the Data & Digital team, prior to payment:

a) The test results in native format.

b) An as-built floor and/or ceiling plan in electronic, AutoCAD DWG drawing format.
c) A warranty certificate from the manufacturer covering all ICT cabling for a minimum of twenty (20) years.
d) Re-certification of any fire-rated penetrations.

14.7. Test Results

Test results **shall** be provided as detailed in the section 15 Testing and Conformance of this standard.

Test results for all outlets **shall** be provided. Outlets that originally failed a test before being fixed and retested successfully **shall** be documented and provided.

a) The test results provided by the tester **shall** be in the test equipment manufacturer's native format only and be able to be viewed using the test equipment manufacturer's software package.
b) The test results **shall** be able to be statistically analysed by using the test equipment manufacturer's software.

Test equipment **shall** be capable of testing to the class and standard specified, have a current calibration certificate, and have the latest cabling manufacturer approved hardware interfaces, software and firmware installed prior to performing the certification test.

14.8. As-built Floor Plan

Floor and/or ceiling plans **shall** be provided by the Data & Digital Team for mark up by the service providers accredited installer.

The accredited installer **shall** mark up the drawings to reflect the as-built locations, numbering and contain all required information as detailed in this document.

The service provider **shall** provide the As-built floor plans in an agreed electronic, (e.g., AutoCAD, DWG, Visio, PDF etc) drawing format.

14.9. Warranty Certification

The accredited installer is responsible for ensuring:

a) The manufacturer provides a warranty covering all system components, system performance and labour for a period of not less than twenty (20) years.
b) The original certificate confirming warranty and an electronic copy is to be forwarded to the Te Whatu Ora Data & Digital team, the electronic copy **shall** be included in the O&M manual.

Appendix A: Contractor Quality Plan Obligations

14.10. Quality Plan - Contractor Obligations

In accordance with AS/NZS 11801.1 the installation contractor should have a quality plan in place to ensure they are following various local and international standards as well as the customer's specific requirements.

By signing the certificate of compliance (below) the individual is accepting that this document is in line with their own company's quality plan, and they accept all its conditions and obligations.

The quality plan is based around the standards of installation, the specification of cabling components, testing parameters for the installed cables and what is or is not acceptable, plus the customers required submissions.

If there are any issues or conflicts, then they **must** be highlighted prior to project/work commencement. If not highlighted it is assumed the contractor has accepted these terms.

14.10.1. Certificate of Compliance

I _____(NAME)

Have read the National Digital Communication Systems and Structured Cabling Standard, understand its contents, and agree to work in accordance with its requirements.

ON THE _____(SITE)

ON THE _____DAY OF _____20___

SIGNED _____

Company: _____

Foreman / Manager: _____

Data & Digital Project Manager or Representative: _____

NB: The individual is not eligible to work on the Te Whatu Ora site until the Data & Digital Project Manager or representative has signed this form.

Appendix B: Colouring and Labelling

14.11. Copper cables

14.11.1. Category-X grade for ES1 and ES2 cabling and systems

Te Whatu Ora considers that all SCS permanent links of class ES1 and ES2 capable of delivering PoE up to 90W may be used for any service application and the application it supports may change throughout its operational life.

Te Whatu Ora - Health does not distinguish distribution cabling for various systems by colour, all SCS cabling is considered to form a converged network. There are no restrictions on the colour of permanent link copper cable for class ES1 and ES2 permanent links. Red **must not** be used as red is reserved for fire alarm systems.

14.11.2. Cable colour labelling of ES3 cabling and systems

ES3 generic cabling **shall** have "Homebush Gold" sheath colour. and **shall** be clearly labelled at the Distribution Frame, Structured Consolidation Points and Data Outlet locations in "Homebush Red" font and white label as ES3 Homebush Gold (X26) as per standard: AS 27001(10).

14.12. Patch cables

14.12.1. Fibre patch cables

Fibre patch cords **shall** employ the following colour scheme:

a) Orange for OM1 and OM2 - 62.5/125um (deprecated - expansion or upgrades only),
b) Aqua for OM3 - 50/125um,
c) Aqua/Violet for OM4 - 50/125um,
d) Lime Green for OM5 - 50/125um,
e) Yellow for OS1a or OS2 (single mode),
f) Blue fibre connectors for UPC (flat) connection, green fibre connectors for APC (angled) connectors.

14.12.2. Fibre cable colours

If replacing or updating external

- Tight buffered cable (internal cables)

g) Orange for OM1 - 62.5/125um (deprecated - expansion or upgrades only),
h) Orange for OM2 - 62.5/125um (deprecated - expansion or upgrades only),
i) Aqua for OM3 - 50/125um,
j) Aqua/Violet for OM4 - 50/125um,
k) Lime Green for OM5 - 50/125um,
l) Yellow for OS1a or OS2 (single mode),
m) UPC (universal polish connector) fitted with a blue connector,
n) APC (angle polish connector) fitted with a green connector.

- Loose tube cable (external gel-filled cable)

o) As available in common supplier stock profile, may include blue plastic/nylon cover.

- ABF tubes

p) As available in common supplier stock profile.

14.13. Copper patch cables

Category-X grade patch cables (installed in the Comms Room) **must** be colour-coded to their respective function, (e.g. Nurse Call).

Fly-leads (installed at the device) may be colour-coded for their respective function (e.g. data).

- Fly leads exposed in open and public spaces should be coloured to match the environment.
- Fly leads in non-public spaces may be coloured.

The following colour convention should be applied:

Function	Patch cable colour	Fly lead colour
Data, Voice and analogue	Grey	Neutral (to décor)
Critial equipment, (e.g.critical building services, biomed etc)	Yellow (mandatory)	Yellow (mandatory)
Fire and life safety services	Red (mandatory)	Red (mandatory)
Cable colours for the below functions are at individual sites discretion:		
Nurse-Call		Neutral (to décor)
Security / CCTV		Neutral (to décor)
Building services (critical)		Neutral (to décor)
Audio-Visual		Neutral (to décor)
Wireless LAN		Neutral (to décor)

Table 7 - Copper patch cable colour code