21.00 Communication & Data Services

All the requirements of this Section are Mandatory.

21.01 System Generally

All GU campuses are serviced by a structured cabling system comprising a flexible cabling infrastructure that can support computer, telephone, and audio visual systems independent of their manufacturer.

In this structured cabling system, each information outlet (IO) is wired to a central point using a star topology, facilitating system interconnection and administration.

The requirements for a structured cabling system as described in this document has been prepared by the Information Technology Infrastructure (ITI) section within INS, and shall apply to all new cabling installations on all GU campuses, including the refurbishment of existing installations.

Consultants and Contractors shall not depart from these requirements unless it is stated otherwise in the Technical Brief, or they are advised in writing by the Superintendent on the advice and approval of ITI.

21.02 Subsystems

The structured cabling system shall consist of any or all of the following subsystems;

Work Area subsystem – The connection between the IO and the equipment in the work area is provided by the work area subsystem. It consists of fly leads, adapters and other transmission electronics.

Horizontal subsystem – The horizontal subsystem connects the telecommunications equipment room to the work areas. It consists of the transmission media, the associated hardware terminating this media and the IOs.

Building Backbone subsystem – The main cable route between floors within a building and between Telecommunications Equipment Rooms (TER) within a building is called the building backbone subsystem. It consists of the transmission media and the associated terminating hardware. Access to the building backbone subsystem is via telecommunications risers on each floor. The building backbone subsystem is only used for the through passage of cables. No cables shall be terminated in telecommunications risers.

Administration subsystem – The administration subsystem joins all of the subsystems together. It consists of labelled hardware for circuit identification and patch leads or jumper wire for creating circuit connections.

Equipment subsystem – The equipment subsystem consists of electronic communications and audio visual equipment in the telecommunications equipment room and the transmission media required terminating this equipment on distribution hardware. This equipment shall not be installed in telecommunications closets.

Campus subsystem – The campus subsystem provides the circuits between buildings and must include two paths to each building in order to provide redundancy. This subsystem includes the entrance facilities into the building, transmission media, associated terminating hardware, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or power surges.

The different subsystems are illustrated in GU Standard Detail Drawing No. GSD-700.

21.03 General Requirements All Systems

21.03.01 Types of Use

As a minimum, the structured cabling system shall be capable of supporting future services that require up to 250 Mhz signalling as amended by ISO/IEC 11801 Class E using Category 6 Cabling for (but not limited to) the following protocols;

Data Communications

- IEEE 802.3
- IEEE-802.3ab(1000BaseT)
- IEEE-802.3af (Power over Ethernet)
- IEEE-802.3at (Power over Ethernet Plus)
- IEEE 802.11 (Wireless LAN)

Voice Communications

- IP Telephony
- Analogue telephone
- Digital telephone
- Facsimile and Modems
- EFTPOS
- Modems

Video

- IP Telephony with video and audio
- Analogue video
- Digital video
- Composite baseband video and audio
- Broadband Video
- RGB baseband video
- 3D Imaging

21.03.02 Standards Conformance

General - All cabling work shall be implemented and completed in strict compliance with Griffith University Design Guidelines and the latest regulations and standards issued or endorsed by the Standards Association of Australia and Australian Communications Authority. International standards shall be used where there are no applicable Australian standards.

The requirements outlined in this document, where different to the standards, Griffith University Design Guidelines will take precedence.

Where differences occur between Australian standards and international standards, the Australian standards will take precedence.

Quality Standard - The contractor shall have a quality system in place that conforms to the requirements of AS/NZS 9000 series of quality related standards, or shall provide details of progression towards accreditation to the relevant standard.

ITI approved contractors shall install, terminate and test cabling at GU unless otherwise approved in writing by ITI.

Communications Standards - The cabling materials and practices shall result in a structured cabling system that meets or exceeds the latest edition at the time of all relevant communications standards including but not limited to:

IEEE 802.3	CSMA/CD Access Method Physical Layer Specifications for 10 Mbps Ethernet
IEEE 802.3	Supp 1 Twisted Pair Media Attachment unit (MAU) and Baseband Medium Type 10 Base T (Section 14 of IEEE 802.3)

IEEE 802.3u	CSMA/CD Access Method Physical Layer Specifications for 100 Mbps Ethernet
IEEE 802.3ab	CSMA/CD Access Method Physical Layer Specifications for 1000 Mbps Ethernet

Australian Standards - The cabling materials and practices shall comply with the latest edition at the time of all relevant Australian Cabling Standards including but not limited to the following;

AS 3000	SAA Wiring Rules
AS 3080	Integrated communications cabling systems for commercial premises
AS 3084	Telecommunications installations – Telecommunications pathways and space for commercial buildings
AS 3123	Approval and Test Specification – Plugs, socket outlets and couplers for general industrial application
AS 3260	Approval and Test Specification – Safety of information technology equipment including electrical business equipment
AS 3548	Electrical Interference – Limits and methods of measurements of radio disturbance characteristics of information technology equipment
AS/ACIF S008	Requirements for authorised cabling products
AS/ACIF S009	Installation requirements for customer cabling (Wiring Rules)

Other Standards - The cabling materials and practices shall comply with the latest edition at the time of all other relevant standards including but not limited to:

IEC 801 PT 3 & 4	Immunity to radiated electromagnetic fields and electrical transients
ISO/IEC 11801	For Cabling Standards

21.03.03 Other Requirements

Workplace Health & Safety Compliance - All work shall comply with the GU WH&S procedures for Contractors.

Sealing of Openings – The Contractor shall carry out the following sealing of openings associated with cabling installation;

- Effectively seal all openings, made or provided, in or through building walls, floors, ceilings, and other fixtures after cable reticulation to ensure that the integrity of the barrier penetrated is maintained.
- Effectively seal all cable duct openings above ground level, and all cable entries into trenches or buildings to prevent the ingress of moisture and the entry of rodents and fire where applicable.
- Ensure that all spare conduit and cable entries into TERs are effectively plugged and sealed to prevent the ingress of moisture, entry of rodents or fire penetration.
- Ensure that all openings through roofs and external walls are made weatherproof. Where necessary, this will include the installation of flashing and/or rain hoods to prevent the entry of driving rain, seepage, etc.
- Ensure all fire rated sealing shall be done in accordance with the requirements of the BCA and AS3000. Particular attention shall be given to penetrations through fire rated barriers such as walls, floors, ceilings and doors. The barriers must have their fire-stopping capabilities restored after the cabling, conduit or cable tray penetrations have been made. 'Hilti Firestop' foam, blocks, logs, plugs and mastic, or tested equal, are the preferred materials for the sealing of penetrations through fire rated floors and walls, installed strictly in accordance with the manufacturers printed instructions.

Material Colours - All exposed materials shall be of a colour, which is consistent with the surrounding decor and shall be approved by the Superintendent.

The colour of telecommunications cable trays, conduits etc. shall conform to the requirements listed in Clause 20.10.03 of **Section 20.00 Electrical Services.**

Painting and Corrosion - The Contractor shall be responsible for corrosion protection and the painting of all brackets, supports, cable ladders weather shields, etc. being supplied and/or installed. The Contractor shall also be responsible for the restoration of any damaged paintwork on equipment and accessories to the supplier's finish, or to a matching finish approved in writing by the Superintendent.

Testing Documentation - The contractor shall provide a printed and electronic copy of the test summary results for all cabling with detailed test results provided in PDF file format on Compact Disk as outlined later herein.

Fibre optic cabling test results shall be based on using power meter and a light source providing the optical loss of fibre using 850 and 1300nm in both directions for multimode fibres and 1310 and 1550nm in both directions for single mode fibres. In addition to this, all fibres shall be tested using OTDR and a printed copy of the waveform parameters shall be submitted for each fibre of the cable tested. Short runs of optical fibre shall be tested by the Contractor as required by ITI.

Identification Labelling - Identify (label) all cables and equipment as outlined in this document for each specific subsystem.

Record Books - Ensure that distribution frame record books pertaining to new installations and changes are updated and accurate for each subsystem. Record entries shall be neat, tidy and completed in pencil.

Redundant Cabling - The Contractor shall be responsible for the following when replacing existing cables;

- The end to end removal of all redundant cabling as a result of a building or room refurbishment. This includes any cabling disconnected and not required, any old cabling left in walls, access poles, work station partitions, on cable trays, or in (wall and floor) ducting.
- The removal of any underground cable made redundant by the running of a new replacement underground cable.
- The removal of the cabling is to be from either the patch panel to outlet, from 'Krone' frame to outlet or in the case of underground cable termination point to termination point at both ends.
- In all cases records are to be rewritten to reflect the changes.
- A list of outlets made redundant by during a refurbishment is to be created and provided to NCS as part of the 'as built' information by the Contractor to ensure accurate updating of ITI records.
- Existing labelling of redundant outlets shall be blanked out on the patch panel end to show that the previous cabling is no longer existent

Cabling in Partition or Wall Cavities - The requirements of **Section 20 Electrical Services** Clause 20.10.06 shall apply equally to the installation of communication and data cabling. Also, cables shall not be installed diagonally and the use of wall frames is not permitted as a cable tray path.

21.03.04 Performance Warranties & Guarantees

Installation testing – 100% of all cabling shall be tested prior to commissioning. All tests shall be from end-to-end (patch panel to IO inclusive) and shall include the connectors and terminating equipment fixed in their final position at both ends at the time of the testing. These test results shall use IO identification as reference.

All as installed cable lengths shall be recorded and submitted with the test results, to the Superintendent.

Electrical acceptance tests shall be carried out on all UTP Cables following the termination and labelling of the cabling in compliance with AS/NZS 3087 and AS 3080. The tester used shall have a current calibration certificate from the manufacturer's accredited certification facility.

Post Installation test of all fibre optic cables shall be carried out with the following minimum criteria;

- Optical Loss end to end including connectors
- Physical condition by the use of an OTDR

Warranty - The installation Contractor shall provide a minimum fifteen-year channel warranty backed by the cabling manufacturer and a copy of any additional Contractor warranties.
All warranties will commence from the date of certification, and shall be submitted to the Superintendent within four weeks of the commissioning of the installed cable.
All components of the structured cable system shall be matched, tested and guaranteed as a channel system. Substitution of nominally equivalent components in lieu of vendor matched components will not be allowed unless specifically authorised in writing by the Superintendent.

Multi-pair telephone lead-in cables are to be continuity tested and the results recorded and provided to NCS.

21.04 Work Area Subsystem

21.04.01 Materials

All fly leads shall be factory-terminated, 4-pair, category 6 UTP with RJ45 connectors, and shall not exceed 5m. Length, colour and quantity to be provided within the contract shall be nominated by ITI.

21.04.02 Installation Practices

Where cable management facilities with adequate minimum bending radius for Category 6 cabling are provided in modular furniture or partitions, the cable slack from patch leads shall be housed inside these facilities.

Where inadequate or no cable management facilities exist, leads shall be laid against a wall and behind semi-permanent furniture such as desks, filing cabinets and bookshelves. Leads must never be laid next to chairs and other furniture, which is moved on a regular basis.

No cable slack shall protrude into the work area where it can be damaged by mobile furniture or people. If necessary, cable slack shall be taped to the back of semi-permanent furniture.

Leads shall not be run along any part of the floor where they pose a safety hazard to people or equipment.

No labelling of fly leads is required.

21.05 Horizontal Subsystem

21.05.01 Materials

All horizontal cables shall be of the Category of cables as determined by the latest AS/NZS 3080 Cabling standards. These cables are Category 6, 4-pair Unshielded Twisted Pair (UTP) cables and shall not exceed 90 metres from end to end. The physical length of the cable shall not exceed 80 metres because of the twist rate.

All UTP information outlets shall be electrically and mechanically matched to the Category of UTP cables to which it connects.

All horizontal UTP cables shall be terminated in the Telecommunication equipment Room on 24Port, RJ 45 patch panels mounted in a 19" rack of the Cabinet. All patch panels shall be electrically and mechanically matched to the category of the four pair UTP cable to which they connect.

Horizontal fibre optic cable shall only be installed when specified in writing by ITI and shall be a minimum of 2 core fibre to each workstation area.

All fibre optic cable shall only be installed using LC Duplex connectors on 19" AFC rack mounted optical fibre termination panels with appropriate labelling ID strips, or as otherwise instructed in writing by an ITI representative. Part Numbers required are as follows;

OM3
Part No. RC-2GL-D2X-2FF
Description: 1RU Static Sliding 24F LCD OM3 Loaded Encl
+
Part No. FRE-1RU-CTRAY
Description: 1RU Front Mount Cable Tray with ID Strips

OS1
Part No. RC-2EB-D2X-2GG
Description: 1RU Static Sliding 24F LCD OS1 Loaded Encl
+
Part No. FRE-1RU-CTRAY
Description: 1RU Front Mount Cable Tray with ID Strips

21.05.02 Mechanical Protection of Cables

The Contractor shall supply and install approved mechanical protection on all horizontal cables.

In work areas and public places, horizontal cables must be fully enclosed within cable ducts.

In ceilings, telecommunications equipment rooms, telecommunications risers, and other non-public areas, mechanical protection shall consist of cable ladders, cable trays, conduits, 'Unicons' and catenary wires.

Cables shall be supported clear of the ceiling structure by approved cabling support systems. Under no circumstances shall cables be laid on ceiling tiles, attached to a ceiling support, or other services.

Cable ties are to be removed from Category 6 runs and new velcro installed when adding new cabling to existing cable runs.

21.05.03 Cable Ducts

Cable ducts shall be installed in work areas and public places for the containment of telecommunications cables, where nominated. These ducts shall be;

- Identical to existing ducts in that location, if they exist
- Approved by OFM
- Located at a height consistent with existing ducts. Where no duct currently exists, the installer shall consult the Superintendent to determine the appropriate height for fixing
- A minimum of 50mm deep or be able to ensure bend radius requirements

21.05.04 Cable Supports

If ten or more cables run in ceiling space in parallel, a cable tray must be used unless otherwise specified by ITI representative in writing. The cable tray shall be installed no less than 150mm from the underside of any slab or cable tray carrying other services, and no less than 300mm from any roofing material unless varied in writing by an ITI representative.

On exiting the cable tray system, cables can be directed to their ultimate connection point through the use of catenary wires to the top of service columns or partition walls on which the workstation outlet is located. Ensure that the ends of catenary wires are not attached to the cable trays, but are anchored to strong and stable structural elements such as columns, walls or slab beams.

Where cables enter the Telecommunications Equipment Room (TER) above the racks, large bend radius cable ladders shall be used to facilitate the dropping off of cables into racks.

All cables shall be tied to rack mounted cable tray using velcro.

21.05.05 Cable Hangers

Cable hangers shall only be used in circumstances where it is not possible to install cable trays, ladders, or conduits. Written approval must be obtained from ITI prior to the installation and use of cable hangers.

If approved, cable hangers should only provide strain relief or ensure that the radius of any bend in the cable route conforms to the requirements AS/NZS 3084. Cable hangers must be a type which is approved by the cable manufacturer as suitable for the cable type, and must be installed to conform to the manufacturer's correct cable installation procedures including spacing and attachment requirements.

21.05.06 Conduits

Where cables traverse inaccessible ceiling areas, such as those behind lock-in type ceiling tiles, drywall and plaster, conduits with draw wires shall be used for the distribution and containment of cables. Provide n+1conduits, where n is the quantity required for known services at time of installation.

Inspection type tees, bends, etc. are permitted if approved by ITI.

Draw wires shall be provided in all conduits after installation for possible future cabling additions, and shall be replaced in existing conduits after the initial draw wire has been used for new cabling.

21.05.07 Separation

The minimum separation between the fixed telecommunications cabling and parallel runs greater than 3 metres of low voltage (240V) fixed electrical cabling shall be at least 300mm for performance and noise reduction reasons.

Separation from other electrically noisy environments such as power distribution mains, sub-mains, fluorescent light fittings and halogen down light transformers shall be 300mm.

21.05.08 Installation Practices

General - All horizontal cables shall be terminated in the TER.

A 1RU patch 5-ring patch cord minder TE Connectivity ADC Krone (64501 050-30) shall manage two RJ45 patch panels.

The cables shall be terminated onto the sockets in accordance with the T568A wiring code in AS/NZS 3084.

Within a rack, cabling to each patch panel shall be run in an alternating pattern on both ides to spread out cable congestion.

The typical layout of the equipment cabinets is illustrated in GU Standard Detail Drawing No. GSD-701. The project specific cabinet layout will be provided by ITI.

All fibre optic interconnection units (FOIC) shall be mounted at the top of a 19" cabinet in the TER unless instructed otherwise by ITI.

Cable entry into a power pole, riser column, duct or cavity wall shall be preceded by a 3m service loop of approximately 300mm in diameter and adequately supported to allow for minor moves/changes. If necessary cable trays should be installed that are wide enough to store this loop and maintain correct bend radius.

Where cables exit from skirting ducts and enter workstation furniture, flexible conduit shall be used to reticulate cables and to afford protection.

Sufficient excess cable (at least 1.5m) shall be included in the installation to enable each patch panel and fibre optic interconnection unit to be relocated at a later date to any position on the same equipment cabinet.

Cables shall not be installed in floor slabs unless approved by the Superintendent.

Cables within partitions or wall cavities shall be installed vertically from the ceiling space to the outlet or connection position. Cables shall not be installed diagonally or horizontally. The use of wall framing components shall not be permitted as a 'cable tray' pathway.

Where cables need to be installed in inaccessible locations such as behind wall linings, or horizontally within partitions, they shall be installed within conduits so that they can be withdrawn and so that there will be sufficient segregation provided for the installation of new cables across its path.

Outlets - All outlets shall be mounted on faceplates suitable for flush mounting in standard wall boxes, skirting trunking, ducts in modular partition systems and similar. Mounting shall be arranged to minimise the risk of damage during removal and replacement of skirting trunking covers or other associated hardware. Outlets shall be of the 'Clipsal C2000' type with I.D. covers unless otherwise nominated.

Outlets shall be firmly attached to the structure with Z-point (flat tipped) screws.

Outlets shall be mounted wherever possible with the key at the bottom and contacts at the top to reduce the risk of contamination of contacts with grit and dust. If this is not possible, outlets may be positioned on their side.

Faceplate colours shall be to the approval of the Superintendent.

Outlets shall be mounted at a height consistent with existing outlets in that area or where no outlets currently exist, at 850mm above f.f.l. (underside of cover plate) unless nominated otherwise.

All wall mounted telephone outlets in public areas shall be installed at 1250mm above f.f.l. Outlets for wall-mounted telephones shall be a 'Krone' wall mounted kit Part No. 6467 1 114-10 complete with Keystone km8 Cat 6 jack 6830 1 800-01.

A clear area of dimensions 300mm width and 300mm length shall exist to allow the installation of a wall telephone outlet.

Minimum distance between the bottom of an installed wall telephone and a horizontal surface shall be 300mm.

All other wall mounted telephone outlets shall be installed at 1250mm above f.f.l.

The number of data outlets in a standard office shall be two (2), one for data and one for phone in a dual face plate, unless directed otherwise in writing by an ITI representative.

21.05.09 Identification Requirements

Outlet Identification - Faceplates of the Clipsal C2000 type with an ID window shall be fitted with type printed labels. Where faceplates without an ID window are used, each faceplate shall be engraved with the outlet identification in accordance with AS 3084.

The identification shall clearly identify the room, outlet number, and the sockets. The outlets will number consecutively in a clockwise direction around the room starting from the door.

The socket at the top left of the faceplate shall be designated the 'A' socket with the next rightmost socket being the 'B' and continuing from left to right in normal reading style; for example, if there are two dual outlets in room 1.28, they shall be labelled as illustrated in GU Standard Detail Drawing No. GSD-702.

The standard labelling for **Wireless Access** data outlets shall be as follows;

[Room No.] + [/] + [W] + [Outlet No.] + [Port Letter]
Example: for Room 2.06A
2.06A/W1A – for the first wireless data port in the room
2.06A/W2A – for the second wireless data port in the room
2.06A/W1A & 2.06A/W1B – for the first dual wireless data port in the room

The standard labelling for **Ethernet Clock** data outlets is as follows;

[Room No.] + [/] + [CLK] + [Outlet No.] + [Port Letter]

Example: for Room 2.06A
2.06A/CLK – for the first clock data port in the room
2.06A/CLK2A – for the second clock data port in the room
2.06A/CLK1A & 2.06A/CLK1B – for the first dual clock data port in the room

The standard labelling for **Projector** data outlets shall be as follows;

[Room No.] + [/] + [P] + [Outlet No.] + [Port Letter]

Example: for Room 2.06A
2.06A/P1A – for the first projector data port in the room
2.06A/P2A – for the second projector data port in the room
2.06A/P1A & 2.06A/P1B – for the first dual projector data port in the room

The standard labelling for **IP Camera** data outlets shall be as follows;

[Room No.] + [/] + [CM] + [Outlet No.] + [Port Letter]

Example: for Room 2.06A
2.06A/CM1A – for the first camera data port in the room
2.06A/CM2A – for the second camera data port in the room
2.06A/CM1A & 2.06A/CM1B – for the first dual camera data port in the room

The standard labelling for **Digital Signage** data outlets shall be as follows;

[Room No.] + [/] + [DS] + [Outlet No.] + [Port Letter]

Example: for Room 2.06A
2.06A/DS1A – for the first sign data port in the room
2.06A/DS2A – for the second sign data port in the room
2.06A/DS1A & 2.06A/DS1B – for the first dual sign data port in the room

Printed labels at the wall outlet are either to be Times New Roman 10 point bold font if using Microsoft Office software or Times New Roman 4mm font size bold if using Clipsal ID Label Printing software. Wrapping the text to two lines when one line won't fit on a label is acceptable provided the entire label is visible.

Patch Panel Identification - Each patch panel shall be fitted with a type printed label in accordance with AS 3084. Printed labels shall be the same as for wall outlets provided there is no need to wrap around to a second line. If this necessary, reduce the font size to fit one line.

The identification label shall clearly identify the corresponding room and outlet number as illustrated in GU Standard Detail Drawing No. GSD-702.

Identification of Fibre Optic Interconnection Units - Each fibre cable termination shall be clearly numbered, commencing with number 1 at the top left, and continuing from left to right in natural reading order. The numbering shall recommence at 1 for each unique destination; for example, if there are two 12 core cables going to the campus telecommunications room, they shall be numbered 1-24. Another 12 core cable going to another destination shall be numbered 1-12. For all new installations LC Duplex Fibre enclosures shall be used unless specified by ITI representative in writing. Another example is illustrated in GU Standard Detail Drawing No. GSD-702.

Each group of fibres shall be clearly labelled to identify the destination (building and room) to which it connects.

A warning notice detailing the hazards associated with optical devices shall be affixed to each termination enclosure in a prominent position.

21.06 Riser Subsystem

The riser subsystem is the main cable route between floors within a building and between TERs within a building. The riser subsystem is only to be used for the through passage of cables. No cables shall be terminated in telecommunications risers.

The material requirements, mechanical protection of cables and Fibre, and installation practices are identical to those of the horizontal subsystem outlined in GU Standard Detail Drawing No. GSD-700.

The identification and documentation requirements are identical to the requirements of the previous Clause with the addition of the following;

- All fibre cables shall be identified with an indelible label in every telecommunications riser closet and TER through which they pass. (refer to GU Standard Detail Drawing No. GSD-705 Cable Identification Tag)

21.07 Administration Subsystem

21.07.01 Generally

The administration subsystem provides for the interconnection of two or more wiring subsystems. The logical arrangement of hardware in the TER is an important part of hardware administration.

All administration shall be performed in the TER.

21.07.02 Materials

All patch leads shall be factory terminated four pair UTP Cable with RJ 45 connectors or connectors to suit the manufacturer's modules.

Fibre optic patch leads shall be at least 3 metres in length with LC Duplex connectors at both ends. ST or SC connectors may be used where installed equipment exists.

Jumper wire shall only be used for interconnecting existing telephone wiring systems which are terminated on 'Krone' disconnect modules.

All UTP and fibre patch leads will be supplied by GU.

21.07.03 Mechanical protection

All patch leads shall be contained by cable management facilities on the equipment and/or equipment rack.

21.07.04 Method of Administration

Patch leads shall be used for all circuit administration, except for fire, lift and security services.

In existing buildings, circuit administration for telephony circuits may be carried out by means of jumper wire.

21.07.05 Identification

Record books shall be updated as previously described. When building services include fire use telephone cable pairs for the respective services, it is the responsibility of each service installer or maintainer to update and maintain records.

21.08 Equipment Subsystem

21.08.01 Materials

Equipment Cabinets - Unless otherwise specified equipment cabinets shall be;

- A MFB Type A 650/19" Reduced Rack Cabinets 45RU and 855mm deep (Part No. MFBP4397), and provided with cage nuts and bolts
- Supplied with the following unless otherwise specified by an ITI representative –
  - For 32A socket installations: 1 x horizontal APC branded(AP7724) Rack ATS, 2U 230V, 32A, IEC309 32 2P+E, (16) C13, (2) C19 Out
  - For 20A socket installations: 2 x horizontal, 1U, 230V PDUs with 10 x 10A (IEC C13) and 2 x 16A (IEC C19) with matching and locking 20A IEC plug
- Supplied with 2RU Krone patch Cord Minder (Product no. 6450 2 017-00) installed at the top of each Rack
- Supplied with a Glass Lockable door, roof panel and two side panels, the same colour as the cabinet if **not** housed in a Data Room
- Complete with 19" Type 'C' profile mounting rails, front and rear
- Provided with a minimum 80mm clearance between the front face and the equipment
- Complete with 300mm wide vertical cable ladders on both sides 2RU from the back of the cabinet for securing power services (back right), and data services (back left). Cable ladders shall be the same colour as the cabinet
- In accordance with GU Standard Detail Drawing No. GSD-701
- An APC Netshelter SX Series 42RU rack shall be used for mounting a UPS where there is a requirement to install one in a TER.

Wall-mounted Cabinets - The use of wall-mounted data cabinets is discouraged. Where no suitable alternatives exist, wall-mounted cabinets may be used with the written authorisation of the ITI representative. These cabinets shall be;

- A MFB 650/19" wall mounting cabinet with swing frame, 12RU and a minimum 855mm deep.
- Fitted with steel sides, roof and lockable front glass doors.

21.08.02 Mechanical Protection

Equipment cabinets shall be housed inside a TER.

Wall-mounted cabinets shall be located in positions, which minimise the risk of physical obstruction and damage, and must not pose a health or safety risk to people using the area.

21.08.03 Installation Procedure

Equipment cabinets shall be located in the telecommunications equipment room as illustrated in GU Standard Detail Drawing No. GSD-703.

All cabinets in the rooms shall be serviced by a horizontal overhead cable ladder, which connects to the cable trays on the same floor, and to the cable ladders in the riser subsystem.

21.09 Campus Subsystem

21.09.01 Materials

Multi-pair copper cabling, greater than four pair, shall be used for telephone circuits only.

Fibre optic cable shall be used for inter-building data circuits. Composition of the fibre shall be determined by the ITI. All splices in fibre cables shall be fusion splices.
All fibre optic cable shall be terminated using LC Duplex connectors.

21.09.02 Mechanical Protection of Cables

All underground conduits and cableways shall be approved by The Superintendent.

All underground communications conduits shall not be less than 100mm in diameter.

21.09.03 Installation Procedures

Excavation - Prior to any excavation, the contractors shall obtain approval from the Superintendent's representative. All excavation, trenches and pits shall conform to the latest edition of the Griffith University Design Guidelines.

Telephone Cables - Inter building Telephone cables are to be terminated as follows;

- Site MDF on 'Krone' Disconnect modules
- All inter building copper cable shall be terminated on an earthed 'Krone 27 Way Jumperable Back Mount' frame (Krone part # 6455 2 034-01) and covered with a Metal Cover (Krone part # 6455 2 022-10) in the building TER
- Distribute cables from the back mount frame to the 'Krone' patch panels in equipment racks as directed by ITI.
- The Krone 27 way frame shall be mounted on the wall of the TER behind the data racks at a height of not less than 1800mm above f.f.l. to the top of the frame. Refer to HB29 cabling requirements 3.1.6 Distributor Mounting, and also to GU Standard Detail Drawing GSD-704. The final location of the frame shall be to the approval of ITI.
- Terminate the distribution cables back to back with the inter building cabling on the back mount frame so there is no need for jumpering i.e on the same krone blocks.
- *'Special Services'* will have exclusive access to the last 10 pairs (i.e. 91 to 100 or 191 to 200 ect.) of the lead in copper cable terminated on the Krone back mount frame.A 10 pair cable shall be run from this frame to a separate terminal block where these services can be directly terminated.
- *'Special Services'* include, but are not limited to the following;
  - Fire alarms
  - Door security
  - Lift Phones
  - Public Telephones and their earth
  - Any services that should not be connected via a patch panel
- Lightning/Electrical overstress protection (Krone Profil Arrestor Magazine Loaded 500v, (Part No. 6462 2 099-00) shall be installed on all inter-building copper cable at the MDF end of all cables less than 800 metres in length, and at both ends when the cable length exceeds 800 metres.
- 24 pairs of cable terminated, 25th pair left un-terminated and coiled as a spare on the patch panel
- 24 Port Patch Panels - Pairs 1 to 24 are to be terminated on the top patch panel, pairs 26 to 49 on the next patch panel down, pairs 51 to 74 on the next patch panel down, and pairs 76 to 99 on the next patch panel down
- In the case of more than 100pr the patch panels should continue on down the rack.
- A cable management panel shall be installed directly before the first patch panel, after every second patch panel and directly below the last patch panel

Excess Cable - Sufficient excess cable (at least 1.5m) shall be included in the installation to enable each patch panel and fibre optic interconnection unit to be relocated at a later date to any position on the same equipment rack.

Underground Cables - Refer to **Section 20.00 Electrical Services** for the installation and separation of underground cables.

All inter-building cables shall be run underground unless authorised in writing by ITI.

All pits and conduit installations shall meet the requirements of AS/NZS3084, in particular section ZB5. Also refer to Clause 20.15 of Section 20.00.

All new pit installations must have a 200mm wide X 200mm thick concrete collar around the top of the pit finished flush with the surrounding ground level and the pit cover.

Where conduits serving a new building connect into the existing network, the minimum pit size requirement is defined by the number of conduits, and must comply with AS 3084 tables ZB9 and ZB10.

A pit shall be installed at each cable entry point to the building.

All underground cables shall be Gel Filled and meet AS/ACIF S008 and AS/ACIF S009 requirements.

Ensure segregation between telecommunications and other types of cables comply with AS HB29 Cabling requirements, particularly electrical and control cabling.

All telecommunications conduits in ground will be white.

Underground cable joints are not acceptable.

Maximum distance between pits on underground cable runs shall be 60m.

All underground pits shall have their lids marked with a brass plate indicating the service installed and the route from the pit, and shall be positively drained without the use of pumps. Ensure pits do not receive water inflows through conduits.

Brass marker plates with lettering not less than 10mm high shall be installed at kerbs and road crossings and any changes in direction. In unpaved areas, the marker shall be set in a concrete pad not less than 300mm square x 200mm deep.

Fibre Optic Cable - All fibre Patch Panels shall be 'AFC' rack mounted optical fibre termination panels (see Clause 21.05.01). All fibres shall be terminated on to a type 'LC' connector. The fibre patch panel shall consist of angle adaptor plates/adaptor kits plus the patch cord minder to meet Class 2 Laser Product Standards.

Identification Practices - All inter-building cables shall be identified with a permanent and indelible label in every pit clearly indicating destination from/to (refer to GU Standard Detail Drawing No. GSD-705, Cable Identification Tag).

All inter-building cables shall be identified with an indelible label in every telecommunications riser closet and telecommunications equipment room through which they pass.

21.10 Design Criteria for New Buildings

21.10.01 Generally

The following requirements shall be incorporated into the design of new buildings and are in addition to the requirements of the relevant subsystems.

21.10.02 Telecommunications Equipment Rooms (TER)

The number of telecommunications equipment rooms (TERs) required in new buildings is directly related to the number of floors in the building and the building length.

The length of the building is the distance between the farthest extremes of the building along the path of the proposed cable trays on any single floor.

The following table indicates the minimum number of TERs.

Number of floors	Building length	Number and location of equipment rooms
1	<160m	1 room, centrally located on the ground floor
1	>160m and < 240m	2 rooms, located equidistant along the ground floor
1	> 240m and < 320m	2 rooms on the ground floor, each located 80m from opposite extremes of the building.
2	<140m	1 room, centrally located on the ground floor
2	>140m and < 210m	2 rooms, located equidistant along the ground floor
2	> 210m and < 280m	2 rooms on the ground floor, each located 70m from opposite extremes of the building.

3	<140m	1 room, centrally located on the second floor
3	>140m and < 210m	2 rooms, located equidistant along the second floor
3	> 210m and < 280m	2 rooms on the second floor, each located 70m from opposite extremes of the building.
4	<120m	1 room, centrally located on the second floor
4	>120m and < 180m	2 rooms, located equidistant along the second floor
4	> 180m and < 240m	2 rooms on the second floor, each located 60m from opposite extremes of the building.
5	<120m	1 room, centrally located on the third floor
5	>120m and < 180m	2 rooms, located equidistant along the third floor
5	> 180m and < 240m	2 rooms on the third floor, each located 60m from opposite extremes of the building.
6	<100m	1 room, centrally located on the third floor
6	>100m and < 150m	2 rooms, located equidistant along the third floor
6	> 150m and < 200m	2 rooms on the third floor, each located 50m from opposite extremes of the building.
7	<100m	1 room, centrally located on the third floor
7	>100m and < 150m	2 rooms, located equidistant along the third floor
7	>150m and < 200m	2 rooms on the third floor, each located 50m from opposite extremes of the building.
Other	Other	To be determined by the ITI representative.

The size of each TER and number of cabinets required are directly related to the number of outlets, which will be terminated in that room. Written approval must be obtained from ITI prior to the final acceptance of the TER size.

No. of Outlets Served	Size of Equipment Room (mm)	Number of Cabinets Required
<190	2600 x 2000	2
>190 and <380	2600 x 3250	3
>380 and <840	2600 x 4000	4
> 840	Consult ITI	Consult ITI

The TER will be for the exclusive use of telecommunications equipment and associated power distribution systems. *All other services are prohibited in this room.*

The door shall have a minimum clearance of 900mm wide x 2000mm high and shall be fitted with an electronic lock with free handle internally. Doors to TERs in external walls shall be properly sealed against the ingress of water, dust, leaves, debris and insects.

Where more than one TER is required, the rooms shall be connected to each other via easily accessible cable trays. Refer to Clause 21.10.05 Riser Subsystem.

The room shall be air-conditioned to maintain a temperature of no more than 22°C. Refer to **Section 18.00 Mechanical Services** for details of air-conditioning system. Each TER shall be fitted with an APC Model NBRK0201 Environmental Unit (EMU).

The walls and ceiling shall be paint sealed to reduce dust. Finishes shall be light in colour to enhance room lighting. Floors shall be covered in antistatic vinyl with paint finish below raised computer floors where installed. Vinyl flooring shall be coved at walls, and the room linings shall be sealed to painted floors around the perimeter against the ingress of moisture.

All electrical power requirements for the TER are outlined in **Section 20.00 Electrical Services.**

No hydraulics system whatsoever or air conditioning ductwork shall pass through a TER.

Incoming underground communications cabling to the building shall be via 100mm conduits terminating at floor level adjacent to the rear wall of the TER or communications riser to facilitate transfer of the cables to a wall mounted cable tray. Conduits shall not terminate in a pit within the body of the TER.

Appropriate portable fire extinguishers, in accordance with local fire regulations, shall be provided, and maintained within the equipment room. They shall be located as close as practicable to the entry/exit.

Security Access Control Equipment shall not be installed in the TER without consultation with ITI.

21.10.03 Telecommunication Risers

Telecommunications risers shall run the vertical height of the building and shall be used for routing all horizontal cables back to the telecommunications equipment room.

A telecommunications riser shall be located within 5 metres of each telecommunications equipment room.

The minimum size of the riser shall be 1000mm wide x 500mm deep.

The telecommunications riser shall be accessible on each floor by way of door 900mm wide x 2000mm high.

Cable ladders shall run the entire height of the riser and feed the horizontal cable trays in the telecommunications equipment room.

No communications or other electronic equipment is to be mounted or terminated in a telecommunications riser.

21.10.04 Campus Subsystem

Unless specified otherwise in writing by ITI, the following shall apply for each new building;

- It shall be connected to the campus TERs by two (2) physically diverse 100mm conduits for optical fibre cable.
- The optical fibre conduit(s) shall be installed to provide a diverse path in order to establish and maintain redundancy for the data network to the new building.
- It shall be connected to the campus TERs by two (2) 24-core Composite Fibre Optic cables. Final composition of the Fibre types shall be determined by ITI.
- It shall be connected to the Campus MDF by 100mm conduits for telephone copper cabling. (see next dot point). An additional 100mm conduit is to be provided for future expansion.
- TERs shall have a copper cable/s delivered to the room. The aggregate size of the cable will be such as to provide 30% extra capacity for future expansion.
- In buildings with no copper voice cabling the first TER shall be connected to the Campus Special Services Room by a 25 pair cable for the use of 'Special Services'. All 25 pairs are to be terminated on 'Krone' disconnect modules, wall mounted in the TER. ITI will identify the position where this frame is to be installed.

Voice Jumpering Colour Standards will be as follows;

White/Red	For analogue lines incorporating Phones, Faxes, Modems, some alarm lines
White/Blue	For digital lines incorporating D/Term phones
White/Green	For Fire Alarms, ADSL lines
White/Blue/Red/Black	For door access (Team Security-Cardax)

21.10.05 Riser Subsystem

Within each new building, the second, third, and subsequent TERs shall be star-wired to the main TER in that building by a fibre optic cable, the composition of which will be determined by ITI.

Where the distance between multiple TERs within a building is less than 90m, they shall also be star-wired to the main TER in that building using Category 6 UTP cables, quantity to be determined by ITI, and terminated on a separate patch panel and labelled.

21.11 Standard Documentation & Labelling Requirements

Block Diagrams - For new buildings and major refurbishment, the Contractor shall provide block diagrams showing all cable runs.

Room/Riser Titles - The TER shall be titled 'TELECOMMUNICATIONS EQUIPMENT ROOM'.

Telecommunications riser closets shall be titled 'TELECOMMUNICATIONS RISER'.

Record Books - Cable record books shall be supplied in each TER and completed for the initial installation and updated as work continues.

A separate Cable Record Book shall be completed for the initial installation of the special services cable and updated as work continues. A 'Special Services' record book shall be placed in a 10 Pair terminal block.

Voice Patch Panel Labelling - The standard for Voice Tie cables to Patch Panels is as follows;

The tie cable should be terminated one pair per port on each 24 port patch panel.
Example: a 100 pair coming from the PABX frame to the building terminates on vertical N, pairs 1 to 100.

- N1 to N24 would be terminated on the first patch panel. N25 would not be terminated but left at the back of the patch panel
- N26 to N49 would be terminated on the second patch panel. N50 would not be terminated but left at the back of the patch panel
- N51 to N74 would be terminated on the third patch panel. N75 would not be terminated but left at the back of the patch panel
- N76 to N99 would be terminated on the fourth patch panel. N100 would not be terminated but would be left at the back of the patch panel.

The patch panel would then be labelled to match the cable.
Example : the port that is wired to pair N24 should be labelled 'Vertical letter [N] + cable pair [24]'.

21.12 Building Control Systems

21.12.01 Generally

The following shall apply to the installation of Building control Systems;

- Building control systems shall be located in building plant rooms
- Services cabling will be Black in colour
- Patch Leads connecting building control systems to the Griffith Network shall be Black
- Installation of data cabling shall be by preferred data contractors as advised by OFM/ITI
- No building control system shall be installed in Data Rooms or Data Risers with the exception of legacy 'Cardax' installation in Residential Colleges
- Building control system Black cabling is to be run with services cables, not on data trays or with data cabling

21.12.02 Early Data Network Provisioning for BCS

The Project Construction Program shall take account of the following requirements to enable early provisioning of the data network to activate the BMS for commissioning of building services;

- Relevant data outlets shall be identified and both cabling and outlets shall be tested
- Outlets must be identified at the field end and at the TER patch panel end. NCS is to be provided with a schedule of the outlet numbers
- The TER room shall be secure, safe and with a stable electrical power supply, lighting and ventilation
- The Building/Campus fibre link must be installed and tested
- The MAC address of the BMS equipment to be activated must be provided by ITI
- The IP address for the BMS outlet is to be obtained from ITI, DHCP configuration should be used
- Reasonable notice (minimum 10 working days) is required to allow NCS/ITI activities to be completed before activating the BMS network in the building
- All test results for cables and outlets are to be provided to NCS

21.13 Wireless Networks

A single data outlet for each wireless access point (WAP) is to be provided where access to Wireless Networks is required as a standard feature in, but not limited to, the following rooms;

- All Libraries
- Lecture Theatres
- Learning Centres
- Collaboration Zones
- Seminar/Tutorial Rooms
- Meeting Rooms
- Board Rooms
- Teaching Laboratories
- RHD/PG Student Rooms
- Common Rooms (Staff & Student)

This is a requirement in all new building and refurbishments, but does not replace the need for fixed cable data connections to the network in other spaces. The location of all such data outlets must be approved by ITI.

Wherever possible, the WAP shall be installed above the ceiling at a height not exceeding 3 metres above finished floor level (f.f.l.) to enable easy access for maintenance using a standard platform ladder and to prevent unauthorised access by members of the general public. Generally the WAP shall be located over the entry door/s to the space it is covering. In spaces where the floor to ceiling height is greater than 3 metres, the WAP may be fixed below the ceiling but not at a height that is less than 3 metres above f.f.l.

Generally WAPs shall be wall mounted, but where this not practical, fixing to columns, cable trays or the slab soffit is acceptable as long as it does not require the removal of more than one ceiling tile to gain access. WAP brackets will be supplied by GU however the Contractor is responsible to fix them, but only in locations which have been approved by ITI.

WAP Equipment & Mounting Brackets – WAP equipment and mounting brackets are to be installed and securely fixed with the correct alignment close to the WAP data outlet. Ensure that there is adequate clearance between the WAP and the slab soffit, ductwork, cable trays and the like to allow for the wireless device to be easily slid in and out of the mounting bracket.

External Mounting – WAP devices installed externally of buildings in exposed locations shall be mounted in an IP55 watertight enclosure (equal to Code GR17016) with minimum internal dimensions of 310mm L x 240mm W x 100mm H. The mounting bracket and data outlet shall also be contained within the enclosure and positioned to ensure that the device can be easily installed and removed if required for maintenance.

Access to WAPs in Ceiling Spaces – Where the WAP device and bracket is located above a ceiling, it must be mounted within arm's length of a removable ceiling tile (T bar grid ceiling) or an access panel (flush ceiling). Access panels in flush ceilings shall not be less than 450 x 450mm square and shall open downward and be fitted with a simple Allen key locking mechanism.

21.14 Particular Telecommunications & Data Requirements – Teaching Spaces

The following communications and data requirements for Teaching Spaces are outlined in the following Clauses unless directed otherwise by CLF/NCS.

21.14.01 Lecture Theatres

Provide the following data outlets;

- One (1) triple outlet on the wall to the side of the FOH equipment rack below the lectern, *or* if it is an island console then install the outlet in a recessed floor box under the console position.
- One (1) double outlet in the ceiling adjacent to the Video/Data projector mounting bracket
- One (1) double outlet in the ceiling adjacent to the IP camera mounting
- One (1) single outlet in the ceiling for each Wireless Access point
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

Provide the following telephone outlets;

- One (1) single outlet on the wall adjacent to the lectern at 1250mm above f.f.l. *or* installed in the recessed floor box where and island console is utilised
- One (1) single outlet in the Projection Room (if any)
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

21.14.02 Seminar & Computer Teaching Rooms, Other Specialist Teaching Spaces

- One (1) triple outlet on the wall at the teaching position, below lectern level
- One (1) double outlet in the ceiling adjacent to the Video/Data projector mounting bracket
- One (1) single outlet per computer position (if computer related teaching room)
- One (1) single outlet in the ceiling for each wireless access point
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

Provide the following telephone outlets;

- One (1) single outlet (wall phone kit) adjacent to the lectern
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

21.14.03 Video Conferencing Rooms

Provide the following data outlets;

- Three (3) triple outlets to the equipment rack console, *or* if it is an island console then install the outlets in a recessed floor box under the console position.
- One (1) double outlet in the ceiling adjacent to the video/data projector mounting bracket
- One (1) single outlet in the ceiling for each wireless access point
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

Provide the following telephone outlets;

- One (1) single outlet (wall phone kit) adjacent to the control console at 1250mm above f.f.l. *or* installed in the recessed floor box where and island console is utilised
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

21.14.04 Learning Centres

Provide the following data outlets;

- One (1) single outlet to each workstation in the Open Computer Work Area and Computer Teaching Rooms
- One (1) double outlet on the wall adjacent to each printing station
- One (1) triple outlet to the Help Desk/Secure Area (if any)
- One double outlet per group Study Room/Booth

- One (1) double outlet on the ceiling adjacent to the Video/Data projector mounting bracket
- One (1) single outlet in the ceiling space for each Wireless Access point
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

Provide the following telephone outlets;

- One (1) single outlet (wall phone kit) adjacent to the control console at 1250mm above f.f.l.
- One (1) single outlet (wall phone kit) at the front of the Learning Centre at 1250mm above f.f.l.
- One (1) single outlet adjacent to the printers
- One (1) single outlet to the Help Desk (if any)
- One (1) single outlet for a Security Phone adjacent to the main entry
- Any other outlets required will be determined by CLF/ITI and noted in the SDF

21.15 Power over Ethernet Clocks

An Ethernet Clock system shall be installed in new buildings in spaces nominated on the SDFs and generally as required by **Clause 20.14.01** of **Section 20.00 Electrical Services**.

The clocks shall be Simplex PoE analogue or digital clocks as follows;

- Analogue clocks – Simplex Part No. ONTA12-BK of 343mm dia. with raised surround Part No. W643-481 (ensure that clock is ordered with MAC address label details on external packaging).
- Digital clocks – Simplex Part No. ONT4BK-S with a 102mm digit height (ensure that clock is ordered with MAC address label details on external packaging)

Each clock requires an Ethernet outlet located adjacent to the clock, connected via a fly lead to the clock's Ethernet socket. If the clock is dual faced e.g. in a corridor, a dual outlet is required.

Particular attention shall be given to mounting the Ethernet clocks to ensure that when the provided fly lead is attached to both the clock and the Ethernet outlet, that it is hidden by the mounted clock which should hang flush with the wall.

The Ethernet outlet shall be wired back to the patch panel in the TER using Category 6 cable. All outlets shall be identified and labelled as required by **Clause 21.05.09** of this **Section 21.00.**

21.16 Space Utilisation & Occupancy Monitoring

As part of the University's Space Management System, all teaching spaces shall be fitted with special devices to allow monitoring of the utilisation efficiency and occupancy of each lecture theatre, seminar room, laboratory etc. used for teaching purposes.

The monitoring devices shall be Brickstream 1100 Series or approved equal self contained people counters installed in the room on the ceiling above each entry point, and connected to and powered from the Ethernet network.

The number and installation of the monitoring devices shall be carried out in accordance with the GU Installation Guidelines for Space Utilisation & Occupancy Monitoring Devices contained in Section 34.00 of these Design Guidelines & Procedures.