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1.0 Introduction

1.1 Information Technology Infrastructure (ITI) is comprised of more than just voice and data. ITI embraces all wired and wireless means of conveying information within buildings and between sites.

1.2 Many Colleges, Schools and Support Services of the University of Edinburgh (UoE) will continue for some years to work in buildings that were designed and constructed long before the concept and application of Information Communications Technology (ICT). It is obvious that no thought was ever given to Structured Cabling. Therefore, it is the original construction of the building that dictates the degree of adaptation to meet the needs of the modern office. Cabling this type of building presents several challenges.

1.3 The importance of a Structured Cabling infrastructure is similar to that of other fundamental building utilities such as heating, water and electricity. As with other utilities, interruptions to service can have a serious impact. Because of this, and the additional fact that the useful life of a building may span several decades, it is essential that the planning, design and construction of a new or refurbished building be done with due care and attention given to Structured Cabling. Poor quality of service due to lack of planning can threaten the UoE’s effectiveness.

1.4 Structured Cabling is a vital component in today's information-based environment. The use of Structured Cabling, using high performance components, can offer long-term support for the delivery of the most demanding network solutions.

1.5 To meet the ever-changing ICT demands, the UoE has standardised on KRONE TrueNet TE Connectivity Enterprise Networks Structured Cabling Solution. This product set has been selected for its high degree of reliability, quality and performance. By standardising on the KRONE product set a standard warranty for voice and data has been set for all buildings within the UoE.

1.6 All installation work must be covered by a full TE Connectivity warranty. To ensure this happens, only KRONE TrueNet TE Connectivity Enterprise Networks Approved Contractor shall be used.

2.0 Scope

2.1 The aim of this document is to provide sufficient information for the successful delivery of a Structured Cabling Solution which has high reliability, is easy to maintain and can support the applications and services of today and the future.

2.2 It is hoped the following information will prove useful to architects, electrical/data/telecommunications consultants, main contractors, suppliers, installers, or anyone responsible for the design, specification, planning or installation of Structured Cabling infrastructure.

2.3 This information is an overview and is not intended to provide an in-depth consideration of cabling or working practices.
2.4 Whilst every care has been taken to ensure that the information is correct we submit the following as an advisory guide only. For clarification, the relevant standard, specification, manufacturer’s instructions or code of practice must be consulted at all times.

2.5 The UoE, Information Services, IT Infrastructure Division, Communications Infrastructure Section (C.I.S.) policy is one of continuous development and improvement. This information will be re-issued when the upgrading of products, specifications or installation techniques requires it. Please check that you have the most up-to-date version of this document.

2.6 This guideline does not include Data Centres. For further information on the design of Data Centres refer to ANSI/TIA-942-A and BS EN 50600 series (in preparation at time of writing).

2.7 This guideline does not include diverse building entrance points. For further information on the design of telecommunications facilities in a campus environment refer to ANSI/TIA-758-B.

3.0 Definitions and Abbreviations

For a definition of terms and abbreviations used in this document refer to the relevant British Standard, as indicated below.

4.0 Roles and Responsibility

4.1 In order to minimise any ambiguity, it is recommended the responsibilities of the design, specification, planning and installation of each ICT project be clearly defined. C.I.S. recommends the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design, specification, planning or installation of the Structured Cabling infrastructure use a template of the form shown in Table B.1., BS EN 50174-2.

4.2 C.I.S. will appoint a Project Manager who shall act as ICT advisor during the design, specification, planning, installation and commissioning phases.

4.3 Unless otherwise stated, C.I.S. shall supply all active network equipment.

4.4 The KRONE TrueNet TE Connectivity Enterprise Networks Approved Contractor shall supply and install all Structured Cabling components. For further information see Appendix 5.

4.5 The KRONE TrueNet TE Connectivity Enterprise Networks Approved Contractor shall install all Wireless Access Points (WAPs).

4.6 All matters relating to building fabric and cable routes shall be referred to UoE, Estates and Buildings (E&B).
5.0 Project Management

5.1 It is essential C.I.S input is requested at the feasibility stage of a project to assess current and future ICT requirements. At the very latest consultations should take place at Stage 2, RIBA Plan of Works 2013 (previously stage C).

5.2 Close liaison between C.I.S., E&B, architect, electrical/data/telecommunications consultant, main contractor, and installer is imperative for the successful completion of the project to the relevant British Standards.

5.3 On large projects, meetings between the electrical/data/telecommunications consultant and the C.I.S. Project Manager shall be held at least once a month to discuss planning and progress of the project. The electrical/data/telecommunications consultant is responsible for setting up such meetings.

6.0 British Standards

6.1. To ensure a high-spec installation, architects, electrical/data/telecommunications consultants, main contractors, sub-contractor, suppliers, installers, or anyone responsible for the design, specification, planning or installation of Structured Cabling infrastructure should have a thorough working knowledge of, and must adhere to, the three main British Standards associated with data/telecommunications cabling:

   - BS 6701: Telecommunications equipment and telecommunications cabling - Specification for installation, operation and maintenance.
   - BS EN 50173 series: Information Technology - Generic Cabling Systems.
   - BS EN 50174 series: Information Technology - Cabling installation.

6.1.1 Please Note: The latest edition of British Standards (including any amendments) applies.

6.1.2 For further information about other standards relevant to Structured Cabling infrastructure see Appendix 1; List of Relevant standards.

6.2 During the design phase of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure, should refer to; BS EN 50173 series and BS EN 50174 series, which specify the structure and configuration of generic cabling systems.

6.3 During the specification phase of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the specifying of the Structured Cabling infrastructure, should refer to; BS EN 50174 -1, which is concerned with specification, quality assurance, documentation and administration of information technology cabling to be installed. It sets out the responsibilities of cabling installers and premises owners or appointed representatives separately, and is intended to be referenced in relevant contracts.
6.4 During the **planning phase** of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the planning of the Structured Cabling infrastructure, should refer to; BS EN 50174-1, BS EN 50174-2 and BS EN 50174-3 and BS EN 30310, which are intended to be used by the personnel directly involved in the planning aspects (of the specification phase) and installation phase of cabling for both inside and outside buildings.

6.5 During the **installation phase** of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the installation of the Structured Cabling infrastructure, should refer to; BS EN 50174-1, BS EN 50174-2, BS EN 50174-3, BS EN 30310 and BS EN 50346, which are concerned with the planning, installation and testing of cabling.

6.6 Architects, electrical/data/telecommunications consultants, main contractors, sub-contractor, suppliers, installers, or anyone responsible for the design, specification, planning or installation of Structured Cabling infrastructure who design and carry out work to American Standards should have a thorough working knowledge of ANSI/TIA-569-C, ANSI/TIA-568-C, ANSI/TIA-942-A, ANSI/TIA-758-B and other standards associated with ITI. Please note; where there is a conflict between American and British standards, written clarification shall be sought from C.I.S. Project Manager.

7.0 **Structured Cabling System. Building Design - general**

7.1 Each item of a building’s Generic Cabling System can be broken down as follows: Campus Distribution (CD), Building Distribution (BD), Floor Distribution (FD) and Telecommunications Outlet (TO).

7.2 For further information consult the following:

Clause 4, BS EN 50173-1
Clause 4, BS EN 50173-2

7.3 The number and type of subsystems that are included in a Structured Cabling System depends upon the geography and size of the campus or building, and upon the strategy of the user. Usually there would be one CD per campus, one BD per building, and one or more FD(s) per floor.

7.4 An example of the basic construct of a typical building is shown below.

7.5 Campus Backbone Cabling Subsystem

The Campus Backbone is the cabling system that provides telecommunication services between buildings. It connects two or more BD(s) and will almost always be in the form of fibre optic cabling. Occasionally, for very remote sites, a suitable wireless technology may be required.

7.6 Building Backbone Cabling Subsystem

The Building Backbone is the cabling system that provides telecommunication services between floors or areas within a building. It connects the BD to the FD(s) and will usually consist of both fibre optic and copper links.

7.7 Horizontal Cabling Subsystem

The horizontal cabling is the cabling system that provides telecommunication services from the FD to the TO(s). It will almost always be in the form of copper cabling but occasionally fibre optic may be required.

7.8 During the ICT project the C.I.S. Project Manager shall issue a schematic drawing detailing Campus Backbone, Building Backbone and Horizontal Cabling.
Appendix 2 gives an example of a Typical Schematic.

8.0 Telecommunications Rooms and Equipment Rooms

8.1 CDs, BDs and FDs shall be located in Telecommunication Rooms or Equipment Rooms.

8.2 A Telecommunications Room is an enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling.

8.3 Experience shows, the design and location of Telecommunications Rooms is very often a last minute thought, resulting in telecommunications equipment being housed in inadequate, unventilated, overpopulated spaces, without allowing room for future expansion. To avoid this, the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the specifying of Telecommunications Rooms should seek advice from the C.I.S. Project Manager as early as possible.

8.4 Correct specification of Telecommunications Rooms is vital during the preliminary architectural design phase of a project and will ease the implementation and operation of both the cabling and the applications supported.

8.5 To ensure smooth transition from installation to operation, Telecommunications Rooms require detailed specification in terms of location, space and environmental aspects.

8.6 Telecommunications Rooms should provide all the facilities for passive components, active devices, and external network interfaces housed within it. Each Telecommunications Room should have direct access to the Backbone Cabling System.

8.7 An Equipment Room is an area within a building where telecommunications equipment is housed and may or may not contain distributors. If a Telecommunications Room houses more than one distributor (e.g. a BD and an FD) it should be considered an Equipment Room.

8.8 Equipment Rooms are treated differently from Telecommunications Rooms because of the nature or complexity of the equipment (e.g. PBXs, Servers, A/V services, CCTV, Door Entry Controllers, etc). They are likely to be larger than Telecommunication Rooms, requiring a more detailed specification, and are often referred to as Main Comms Rooms.

9.0 Telecommunications Rooms - general

9.1 There shall be a minimum of one Telecommunications Room per floor.

9.2 Telecommunications Rooms must be designed with expansion and maintenance as the foremost thought, taking into consideration:
Telecommunications outlet capacity of the building
Available cable routes
Permissible cable distances

9.3 Other considerations are:

- Power requirements
- Earthing
- Ventilation/Air Conditioning/Cooling
- Lighting
- Raised access floor

9.4 Telecommunications Rooms shall be located as close as practicable to the centre of
area being served.

9.5 Avoid locating Telecommunications Rooms in areas that are restricted by building
components that limit expansion, such as outside walls, lift shafts etc.

9.6 Telecommunications equipment may be endangered or adversely effected by other
services or conditions which may be obvious or hidden within the fabric of the
building. In particular, water/waste/steam pipes should never be installed directly
above or in the same room as telecommunications equipment, as per BS EN 50174-2
8.3.8.3.1.

9.7 Telecommunications Rooms should be located away from sources of
electromagnetic interference or designed to mitigate the effects of this interference.
Special attention shall be given to electrical power transformers, motors and
generators, X-ray equipment, and radio or radar transmitters.

9.8 Telecommunications Rooms shall be sized to meet the present and future
requirements, taking into account the function of the room, the number of TOs it will
serve and type and numbers of equipment required.

9.9 Telecommunications Rooms shall be a minimum of 3.2m and of sufficient length
to house the required number of Communication Cabinets.

9.10 The footprint of Telecommunications Rooms is dependent on the number of
Communication Cabinets being installed, which is largely dependent on the number
of TOs being installed. For number of Communications Cabinets likely to be used see
14.13.2.

9.11 Where the requirements are not known, the following guideline may be used;

- Provide 3 x TOs per person/work area and one person/work area per 10m².

The minimum footprint of Telecommunications Rooms shall be 3.2m x 2.4m,
which allows for one Communications Cabinet plus one spare with enough
required space to gain access to back of Communications Cabinet.

9.12 When planning the location, size and number of Telecommunications Rooms
required, the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design and planning of the Structured Cabling infrastructure should keep in mind the 90m rule for the Horizontal Cabling Subsystem. This is the distance from the FD to the TO. This distance must not be exceeded and all design and planning must adhere to this rule.

9.13 Minimum clearance height in Telecommunications Rooms shall be 2.5 metres without obstructions.

9.14.1 The door of Telecommunications Rooms shall be a minimum of 926mm wide and 2040mm high, and hinged to open outward. Alternatively, a double door arrangement, 826mm/413mm, may be used in some areas.

9.14.2 If the door must open inwards the size of Telecommunications Rooms (floor space) should be increased accordingly.

9.15 The walls, floors and ceilings shall be light in colour, and shall be treated such as to reduce dust. Floor shall have anti-static properties.

9.16 Telecommunications Rooms should not have exterior windows, as this may increase the heat load.

9.17 Lighting should not be lower than normal office level.

9.18 It is essential that a safe route be established to Telecommunications Rooms, with suitable access, to allow the passage of personnel together with necessary apparatus and equipment.

9.19 Please Note: All Telecommunications Rooms shall house only equipment directly related to the Structured Cabling infrastructure, associated electronics and its environmental support systems. Equipment and services not directly related to the support of Telecommunications Rooms or Structured Wiring System shall not be installed in, pass through, or enter Telecommunications Rooms. It is not permissible for other parties to store or install equipment within these rooms.

9.20 Telecommunications Rooms shall not be shared with electrical installations, other than those directly related to the support of the Structured Cabling infrastructure, associated electronics or its environmental support systems.

9.21 Should 'alien' equipment be required in Telecommunications Rooms then the location of such equipment must first be agreed with the C.I.S. Project Manager.

9.22 During the ICT project the C.I.S. Project Manager shall issue a Telecommunications Room layout.

9.23 Appendix 3 gives an example of a Typical Telecommunications Room Layout.

10.0 Communications Cabinets (aka Racks or Units)

10.1 Communications Cabinets are required to house the termination of the backbone
and horizontal subsystems, and associated electronics.

10.2 Communications Cabinets shall be housed in Telecommunications Rooms or Equipment Rooms and shall not be installed in:

- Direct sunlight
- Toilet facilities
- Boiler/plant/switch/machine rooms
- Emergency escape ways
- Ceiling or sub-floor spaces
- Areas subject to flooding
- Areas containing fire hose reels or other fire-extinguishing equipment

10.3 The location of the Communications Cabinets must provide physical and environmental protection for the telecommunications equipment. This protection may be achieved either by choice of appropriate location or by specific design and should address the following aspects:

- Temperature
- Humidity
- Vibration
- Exposure to ultraviolet radiation
- Ingress of dust, fluids or other contaminants
- Physical damage (accidental or malicious)
- Security
- Electromagnetic interference
- Presence of other hazards

10.4 Communications Cabinets shall allow adequate access and should be provided with illumination and temperature conditions suitable to allow installation and maintenance of a Structured Cabling System and associated electronics.

10.5 The following recommendations are made for all Communications Cabinets:

10.5.1 Communications Cabinets shall be located such that subsequent measurements, repair, expansion or extension of the installed cabling can be undertaken in safety.

10.5.2 The minimum clearance on all faces of the Communications Cabinets where access is required, i.e. front and back, shall be 1.2 metres, in accordance with BS EN 50174-1: 4.2.5.1

10.5.3 To allow access from front of the Communications Cabinet to the back, there shall be a minimum of 0.8m space to the side of the Communications Cabinet.

10.5.4 Communication Cabinets shall be equipped with adjustable vertical mounting rails, both front and back. The front vertical mounting rails shall be recessed at least 100mm to provide sufficient clearance for cable management.

10.5.5 Cable terminations and electronics shall be set at a safe working height to allow measurement, repair and reconfiguration, i.e. no higher than 2 metres and no
lower than 0.5 metre.

10.5.6 Within the Communications Cabinets, cables shall be supported to provide strain relief and prevent kinking, and in such a way that mechanical damage is avoided during later access to the patch panels or electronics.

10.5.7 Vertical cable management shall be installed between each pair of Communications Cabinets and at ends of every row of Communications Cabinets, taking into account maximum calculated fill, and should extend from the floor to the top of the Communications Cabinets.

10.5.8 Horizontal cable management shall be installed; one 1U management strip per 2U patch panels (48 TOs).

10.5.9 When installed side-by-side, Communications Cabinets shall be bayed together using the appropriate baying kits.

10.6 Please Note: The UoE use the term ‘Unit’ to refer to one or more Communications Cabinets.

10.7 During the ICT project the C.I.S. Project Manager shall issue a Cabinet layout - detailing Unit I.D., subsystem terminations, equipment locations, etc.

10.8 Please note; Wall mounted Communications Cabinets should not be used on UoE premises as they limit the type, size and weight of the electronic equipment, and restrict airflow. Should the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design and planning of the Structured Cabling infrastructure wish to install a wall mounted Communications Cabinet, they should first consult with and seek advice from the C.I.S. Project Manager.

10.9 Two 10 way vertical sequential start PDU strips shall be mounted to the rear of each active Communications Cabinet, one each side. Each 10 way PDU shall be connected into a separate commando socket.

10.10 Appendix 4 gives an example of a Typical Communications Cabinet Layout.

10.11 Appendix 5 provides a list of suitable Communications Cabinets to be used on premises belonging to the UoE.

10.12 Appendix 5 provides a list of suitable PDUs to be used on premises belonging to the UoE.

11.0 Telecommunications Rooms - detail

11.1 Depending on the type of equipment being housed in Telecommunications Rooms, a clean room environment, in accordance with BS EN ISO 14644 series, is recommended and should be seriously considered.
11.2 Power

11.2.1 A distribution board dedicated to, and housed in, Telecommunications Rooms is recommended and should be seriously considered. Where possible, this distributing board should be fed from the nearest essential services distributing board.

11.2.2 Power shall be provided to all Communications Cabinet that house active equipment. A minimum of two 16A CEEform “commando” sockets (refer; BS EN 60309) shall supply each active Communications Cabinet.

11.2.3 In certain circumstances, e.g. switches associated with iStars, a UPS shall be installed. The UPS can be free-standing or rack-mounted. If rack-mounted approximately 12U of rack space shall be allowed for within the Communications Cabinets. The UPS shall be equipped with an SNMP card, by-pass switch and 6 way PDU.

11.3 Earthing

11.3.1 A suitable Main Earthing Busbar shall be installed within Telecommunications Rooms.

11.3.2 A single direct earth connection shall be made from Main Earthing Busbar to each of the Communications Cabinets housed within Telecommunications Rooms. This connection shall be as short as possible and of low impedance and no less than 16mm in accordance with BS 6701: 5.2.2.4.

11.3.3 Equipotential Bonding should be maintained throughout the ICT installation and shall be carried out in accordance with BS EN 50310 and BS 7671.

11.4 Ventilation/Air Conditioning/Cooling/Humidity

11.4.1 It is essential the architect, consultant, main contractor or sub-contractor evaluate the current and future ventilation, air conditioning and cooling requirements. Experience has shown that heat dissipation continues to rise as processors become more powerful and, as more and more equipment is becoming IP based, this trend looks likely to increase.

11.4.2 The following should be used as a general guide. Potential heat dissipation per Communications Cabinet:

- Approx 1500 watts maximum
- Approx 5000 BTU/hour maximum

11.4.3 Telecommunication rooms shall be designed to control temperature and humidity according to ASHRAE Class A2 requirements.

11.4.4 In smaller telecommunication rooms, housing no more than three Communications Cabinets, ventilation/cooling may be provided by means of extract fan or vents in the door of Telecommunications Rooms.
11.4.5 Where a risk of electrostatic discharge exists, the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure, should refer to BS EN 50174-1: 4.5.3.

11.5 Lighting

11.5.1 The luminance shall be a minimum of 400 lux. Diffusers shall be used to ensure an even spread of light throughout Telecommunications Rooms.

11.5.2 For further information, Architects, electrical/data/telecommunications consultants, main contractors, suppliers, installers, or anyone responsible for the design of Telecommunications Rooms, should refer to; BS EN 12464-1.

11.5.3 Emergency Lighting to UoE specification shall be installed in Telecommunications Rooms.

11.6 Water Infiltration

Telecommunications Rooms shall not be located below water level unless preventative measures against water infiltration are employed. A floor drain with back flow preventer shall be provided within the room if risk of water ingress exists.

11.7 Raised Floor

11.7.1 A raised access floor is preferred in Telecommunications Rooms and shall provide a void of a minimum height of 200mm. The structure of the raised floor should allow unrestricted access to the void.

11.7.2 Consideration should be given to the installation of a water detection system in the floor void.

11.7.3 For further information, Architects, electrical/data/telecommunications consultants, main contractors, suppliers, installers, or anyone responsible for the design of Telecommunications Rooms, should refer to; BS EN 12825.

11.8 Fire protection

11.8.1 A fire in a Telecommunications Room can lead to extensive physical damage and serious disruption to operations and services. Measures must also be taken to safeguard the lives of C.I.S. personnel and provide a means of escape in the event of a fire.

11.8.2 Telecommunications Rooms shall have a smoke alarm fitted in a central ceiling location. This alarm shall be the same type and manufacture of the building fire detection system. The alarm must be linked into the existing building fire detection system.

11.8.3 For further information, Architects, electrical/data/telecommunications consultants, main contractors, suppliers, installers, or anyone responsible for the design of Telecommunications Rooms, should refer to; BS 6266.
11.8.4 Wet Pipe sprinklers should not be installed in Telecommunications Rooms. If however, due to the nature of the building, this is unavoidable then heads shall be provided with wire cages to prevent accidental operation, and drainage troughs shall be placed under the sprinkler pipes to prevent leakage on to the equipment within the room.

11.9 Lightning

It is beyond the scope of this guide to discuss in detail the effects of lightning discharges on ICT equipment. Architects, electrical/data/telecommunications consultants, main contractors, suppliers, installers, or anyone responsible for the design of Telecommunications Rooms should be aware that such effects exist and can cause serious damage or fire, and should refer to; BS EN 50468.

11.10 Security

11.10.1 Access to Telecommunications Rooms shall be restricted to authorised personnel only, as specified by the C.I.S. Project Manager, thus maintaining a degree of network security and minimising the risk of damage which could threaten the integrity of the network. Also, some active equipment is essential to teaching, and any downtime would have a detrimental effect.

11.10.2 The level of security required for any ICT installation and the physical measures needed to provide that security should be assessed at the planning stage. Guidance on the implementation of physical security is found in BS 7799 and BS 8220: Part 2.

11.10.3 All doors that have direct access to Telecommunications Rooms must be fitted with swipe card access or have security lock ASSA 9EA1734A 1-3 fitted. These locks are reserved for C.I.S. Telecommunications Rooms and are available from E&B.

11.10.4 All windows within Telecommunications Rooms must be fitted with opaque glass that is obscure to level 5. Security bars must be fitted to the inside of the windows.

11.11 Surface Finishes

Finishes should be smooth and resistant to dust collection. Surfaces beneath raised floors and above suspended ceilings should be sealed with resin or other suitable sealant to aid cleaning and reduce the amount of dust and flaking of building material.

12.0 Equipment Rooms (Main Comms Room) – detail

12.1.1 Due to recent developments, more and more equipment is becoming IP based, e.g. VoIP telephony, security equipment, CCTV, A/V kit, etc.

12.1.2 As pressure on building space increases, we should be looking at housing ALL network connected infrastructure devices in a shared location, i.e. an Equipment
Room.

12.1.3 Other equipment may also be housed in Equipment Rooms, e.g. Door Controllers, CCTV recording equipment, etc. The location and housing of such equipment must first be agreed with the C.I.S. Project Manager.

12.1.4 In addition to Telecommunications Rooms requirements, mentioned above (section 11), new building and refurbishment projects should take into account the following minimum requirements for Equipment Rooms:

12.2 Number of Communications Cabinets

Calculation of floor space and number of Communications Cabinets is dependant on many factors and will differ for each installation. Where the requirements are not known the following guideline may be used:

- 2 x 42U Communications Cabinets required for Network Services core equipment - PLUS any Communications Cabinets required for FDs. (see 14.12 and 14.13).
- 1 x 42U Communications Cabinet required for Telephones.
- 1 x 42U Communications Cabinet required for Security, CCTV etc.
- 1 x 42U Communications Cabinet required for future.

12.3 Please Note: Once a suitable location for the Equipment Room has been identified, the position of the Communications Cabinets should be carefully planned and agreed with the C.I.S. Project Manager.

12.4 Appendix 2 gives an example of the Number of Communications Cabinets required in an Equipment Room.

12.5 Power

12.5.1 A distributing board dedicated to, and housed in, the Equipment Room should be considered vital. This distributing board should be fed from the nearest essential services distributing board.

12.5.2 To protect equipment from disturbances associated with the mains power supply an Uninterruptible Power Supply (UPS) and/or back-up generator shall be installed.

12.5.3 Appendix 6 gives an example of Typical UPS requirements.

12.6 Ventilation/Air Conditioning/Cooling/Humidity

12.6.1 As new equipment is introduced, with increasingly more powerful processors, resulting in a rise in heat output, it is essential measures be taken to carefully control the temperature and relative humidity. At the early stages of a project an assessment of current and possible future ventilation, air condition and/or cooling requirements must be addressed by the architect, consultant, main contractor or sub-contractor.
12.6.2 The following should be used as a general guide.
Potential heat dissipation per Communications Cabinet:

- Approx 2500 watts maximum
- Approx 8500 BTU/hour maximum

12.6.3 The temperature and humidity of Equipment Rooms shall be controlled to provide continuous operating ranges of 18°C to 27°C, in accordance with ASHRAE Class A1 recommendation, and 20% to 80% relative humidity in accordance with ASHRAE Class A1 allowable range.

12.7 Lighting

Emergency lighting should be considered essential in Equipment Rooms.

12.8 Raised Floor

12.8.1 A raised access floor should be considered essential in Equipment Rooms and shall provide a void of a minimum height of 300mm.

12.8.2 The layout of floor tiles shall be planned to suit the positions of the Communications Cabinets, ensuring a full tile is below each cabinet. A 400mm x 400mm cut-out shall be provided in each floor tile below Communications Cabinets.

12.9 Security

12.9.1 The location of Communications Cabinets should be carefully planned and agreed with the C.I.S. Project Manager.

12.9.2 Doors to Equipment Rooms should be self-closing.

12.9.3 Swipe Card Access should be considered essential in Equipment Rooms.

12.10 Surface Finishes

Air-borne dust levels must be carefully controlled. A Clean room environment, in accordance with BS EN ISO 14644 series, is vital in Equipment Rooms.

12.11 Back up (analogue) Phones

Equipment Rooms shall have a double TO installed for back up (analogue) telephony. The TOs shall be positioned central to the Communications Cabinets on the wall facing the front of the patch panels and active equipment.

13.0 Backbone Cabling - Campus/Building Distribution

13.1 The Backbone Distribution is split into two areas, namely the Campus and the Building Distribution, which are interconnected to form a basic hierarchical topology, as described in Clause 4, BS EN 50173-1.

13.2 It is critical the Backbone Distribution is designed correctly, with consideration
given to:

- Current and foreseeable application requirements
- ICT media choice
- Cable routing
- Cable management
- Communications Cabinet layouts
- Raised floor
- Ceiling void

13.3 Backbone cables are routed using pathways. A variety of cable management systems can be used to support the cables within the pathways including ducts, conduits, tray and basket. Requirements for the pathways and the cable management systems within them are provided in the BS EN 50174 series of standards.

13.4 Where backbone cabling serves multiple buildings, the use of optical fibre cabling is essential to avoid transmission problems associated with earth potential differences between buildings, lightning strikes, power surges, etc. Unless otherwise stated by the C.I.S. Project Manager all fibre installations shall use Bloduct/Blolite products or KRONE TrueNet TE Connectivity equivalent.

13.5 Power and signal lines including fibre-optics in metallic protection may need protection against lightning-induced surges and rises in earth potential. Where this is the case, voltage limiting devices may need to be employed together with disconnection or protective devices such as barrier boxes. Where possible, overhead cables between buildings should be avoided. Separation of different types of cables entering the building will significantly reduce coupling effects. BS EN 62305 gives guidance on the protection of power and data/telecommunications cables.

13.6 Where the locations of CDs, BDs and FDs require backbone channel lengths less than 300m, the cabling shall comprise:

- 8 x OM3 multimode optical fibre.

13.7 Where the locations of CDs, BDs and FDs require backbone channel lengths more than 300m, the cabling shall comprise:

- 8 x OM3 multimode optical fibre, and
- 8 x OS1 singlemode optical fibre.

13.8 All fibre cores shall be terminated with LC duplex pigtails by fusion splicing. It is not acceptable to use mechanical splicing techniques.

13.9 In addition to the above, when the backbone cabling is in the same building, the following copper links shall be installed:

- 8 x CAT6A from BD to FD

13.10 See Appendix 2; Typical Schematic
14.0 Floor Distribution - general

14.1 The horizontal cabling subsystem extends from FD to the TO(s). The subsystem includes:
- Horizontal cables.
- TO(s).
- Mechanical termination of the horizontal cables at the FD and TO, together with associated equipment cords at the FD.

14.2 The horizontal cabling subsystem should be designed to support the broadest set of existing and emerging applications within the environmental conditions defined in Clause 5, BS EN 50173-2, and therefore provide the longest operational life. This will minimize disruption and the high cost of re-cabling in the work area.

14.3 The horizontal cabling subsystem shall be continuous from the FD to the TO and shall conform to the Interconnect - TO Model, as specified in fig. 11a, BS EN 50173-2.

14.4 The total length of the horizontal cabling subsystem must not exceed 90m and the total length of the patch cordage must not exceed 10m. The total combined end-to-end length must not exceed 100m and must contain no more than two connectors. C.I.S. forbids the use of Consolidation Points (CPs) or any form of joint.

14.5 Where a potential work area is not adjacent to a wall, facilities for under floor or above ceiling distribution (e.g. floor boxes or power poles) that provide cable protection shall be installed to enable TOs to be deployed at every potential work area.

14.6 All TOs must be easily accessible, and shall not be installed in inaccessible ceiling areas, such as lock-in type ceiling tiles or behind plasterboard.

14.7 The design should ensure that the lengths of equipment cords and work area cords are minimised:
- Equipment cords should not exceed 5m.
- Work area cords should not exceed 3m, although 5m can be used in exceptional circumstances.

14.8 Furniture with 'plumbed-in' data/telecommunications wiring or other types of m-f extension leads shall not be used. They are unreliable and prone to faults. C.I.S. will not support this.

14.9 FDs should be located such that the resulting cable lengths are consistent with the channel performance requirements of Clause 5, BS EN 50173-2.

14.10 Each TO require two power points.

14.11 Appendix 5 provides a list of suitable cable and components to be used on premises belonging to the UoE.
14.12 User Outlet Concentration

14.12.1 Please Note: Regardless of the TOs designation (VoIP, data AV, CCTV etc.), the architect, electrical/data/telecommunications consultant, main contractor, subcontractor, supplier, installer, or anyone responsible for the planning of the Structured Cabling infrastructure shall ensure ALL data/telecommunications requirements are shown on one layer of the drawing.

14.12.2 An important consideration is the number of potential work areas in a workplace requiring ICT facilities. This will have a direct effect on the number of Communications Cabinets required and, as a result, the size and design of Telecommunications Rooms. A high density of TOs, i.e. flood wiring, will enhance the ability of the College, School or Support Service to accommodate changes.

14.12.3 BS EN 50173-2 states; “The design of horizontal cabling subsystem should provide for a minimum of two TOs per work area”. However, on UoE premises each user type will demand different requirements from the Structured Cabling infrastructure. The main user types and number of TOs per person/desk have been defined below as the minimum requirements for outlet concentration.

<table>
<thead>
<tr>
<th>User Type</th>
<th>Minimum TOs per Person/Desk</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>Computing Officer</td>
<td>6</td>
</tr>
</tbody>
</table>

14.12.4 Other TO requirements include;

- Wireless Access Point: 2
- Lecture Theatre (WAP): 6
- Printer: 1
- Photocopier: 1
- FAX: 1
- Back-up Telephone: 2
- Door Controller (i-star): 2
- A/V Web Cam: 1
- A/V Information Screen: 1
- A/V Lectern: 6
- Study Space: 1
- SSP (smart service point): 1
- Till Point: 1
- CCTV: 2
- Metering: 2
- BEMS: 2

14.13 Communications Cabinets

14.13.1 In general, the Structured Cabling infrastructure and the active electronics are housed in separate Communications Cabinets. However, where there is a small concentration of TOs, the Structured Cabling infrastructure and the active electronics may be housed in the same Communications Cabinet. The number of Communications Cabinets required is largely dependant on the number of TOs being installed.
14.13.2 In the absence of detailed information the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure should allow the following;

- 001 to 100 TOs require one 42u Communications Cabinet.
- 101 to 300 TOs require two 42u Communications Cabinets.
- 301 to 600 TOs require four 42u Communications Cabinets.
- 601 to 900 TOs require six 42u Communications Cabinets.

14.13.3 During the design phase of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure, should allow 50% expansion when deciding on cabinet sizes.

14.13.4 Appendix 4 gives an example of a Typical Communications Cabinet Layout.

14.14 Wireless Access Points (WAPs)

14.14.1 Wireless networking shall be provided in addition to generic telecommunications cabling.

14.14.2 Please Note: Wireless networking is not functionally equivalent to hard-wired cabling, generally offering inferior reliability, security and data throughput. In situations where users regularly locate mobile equipment, e.g. a laptop, at a desk or meeting table, generic telecommunications cabling should be used.

14.14.3 Where the ICT facilities and services will be accessed only occasionally, e.g. café, using mobile terminal equipment, wireless networking may be used instead of generic telecommunications cabling.

14.14.4 During the design phase of a contract the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure, should perform a site/wireless survey (or use a planning tool) to determine the best location to site the Wireless Access Points, taking into account the users current and future requirements.

14.14.5 If a College, School or Support Service wants ‘complete’ wireless coverage then the data/telecommunications installer shall carry out a thorough wireless survey and report its findings back to the C.I.S. Project Manager for any knock-on effects or considerations.

14.14.6 Appendix 7 provides further information regarding Wireless Access Points.

14.14.7 It is possible DECT Wireless telephony may also be used. For further information contact C.I.S. Project Manager.

14.14.8 Where wireless is required C.I.S. recommend the installation of a dual TO.
14.14.9 The number of dual TOs required largely depends on the wireless coverage and bandwidth required, and the building fabric. As a rule of thumb, one Wireless Access Point can accommodate up to eighty users. This rule also applies to DECT Wireless Phones.

14.14.10 In the absence of detailed information or wireless survey the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure shall allow at least one dual TO for every 100m² of floor space.

14.14.11 The TOs and Wireless Access Points should be easily accessible, mounted vertically, on the wall, below ceilings and no higher than 2.4m from floor level, making sure the WAP bracket is mounted alongside the TO, and is the correct way up.

14.14.12 In some locations, e.g. Library, it is permissible to install the TO above the false ceiling and mount the Wireless Access Point horizontally below the false ceiling, no higher than 2.4m from floor level. Where this is the case the installer shall drill or cut a cable access hole in the ceiling tile large enough for the equipment cord to pass through. If the ceiling tile is metal a suitable grommet shall be used. The equipment cord shall pass through the access hole leaving approximately 30cm of cable at the Wireless Access Point. The equipment cord shall not exceed 3m.

14.15 Telephones Distribution

14.15.1 With a few exceptions, all new telephony shall be VoIP, and as such shall be carried over the Structured Cabling infrastructure.

14.15.2 Back-up phones shall also form part of the Structured Cabling infrastructure but shall not be IP based. Back-up phones shall patch to the analogue telephone distribution.

14.15.3 Emergency phones, e.g. lift phones, shall NOT form part of the Structured Cabling infrastructure but shall be wired in CW1308 cable from the local DP.

14.15.4 Each BD shall have a single 50 pair CW1308 fed from the Building DP.

14.15.5 Each FD shall have a single 20 pair CW1308 fed from the BD.

14.15.6 A dedicated Telephones Communications Cabinet shall house the analogue telephone distribution. This cabinet will usually be located in the Equipment Room.

14.15.7 The following links shall be installed from BD to Telephones Cabinet:

- 24 x CAT6A.
- 20 pair CW1308

14.15.8 See Appendix 2; Typical Schematic
14.15.9 For further information about telephones, please contact C.I.S. Project Manager.

14.16 Door Controllers

14.16.1 Many sites within the UoE require Access Controlled Doors. To this end Door Controllers (i-Stars) may be housed in Telecommunications Rooms or Equipment Rooms. The location of the Door Controllers (i-Star) must first be agreed with the C.I.S. Project Manager.

14.16.2 iStars may be either rack or wall mounted. The C.I.S. Project Manager shall advise.

14.16.3 If rack mounted, the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure shall ensure sufficient space is allocated within the Communications Cabinets to house the iStar and associated equipment. See also 11.2.3.

14.16.4 For further information about Access Controlled Doors, contact C.I.S. Project Manager.

14.17 Audio Visual Distribution

14.17.1 Audio Visual technology is increasingly becoming IP based. As such, much of the A/V equipment installed at UoE shall form part of the Structured Cabling infrastructure.

14.17.2 Teaching areas will require TOs for web cameras, information screens, lecterns etc. TOs will also be required at study spaces.

14.17.3 In the absence of detailed information the architect, electrical/data/telecommunications consultant, main contractor, sub-contractor, supplier, installer, or anyone responsible for the design of the Structured Cabling infrastructure should allow TOs as per above - see 14.12.

14.17.4 For further information and detailed requirements for the Audio Visual Distribution, contact Learning and Teaching Spaces Technology Section (LTSTS).

14.18 CCTV

14.18.1 CCTV is increasingly becoming IP based. As such, much of the CCTV equipment installed at UoE shall form part of the Structured Cabling infrastructure.

14.18.2 CCTV normally requires two TOs per location.

14.18.3 TOs shall be installed at locations specified by the Security Section of the Support Services Division within E&B.

14.18.4 A dedicated CCTV Communications Cabinet shall house the CCTV
recording and other security equipment. This cabinet may be located in Equipment Rooms, at a location agreed with the C.I.S. Project Manager.

14.18.5 In the absence of detailed information, the following links shall be installed from BD to CCTV Communications Cabinet:

- 24 x CAT6A.
- 8 x OM3 multimode optical fibre.
- 8 x OS1 singlemode optical fibre.

14.18.6 See Appendix 2; Typical Schematic.

14.18.7 For further information about CCTV, contact the Security Section of the Support Services Division within E&B.

14.19 Metering and Building Energy Management System

14.19.1 Both Metering and Building Energy Management System (BEMS) normally requires two TOs per location.

14.19.2 TOs shall be installed at locations specified by E&B.

14.19.3 For further information about Metering and BEMS contact E&B.

15.0 Horizontal Cabling – Installation Guidelines

15.1 The following information covers the implementation techniques required for a successful installation of a Structured Cabling System for UoE.

15.2 Cabling

Unless otherwise stated, the Cable used shall be KRONE TrueNet TE Connectivity CAT6A, 100 ohm, 4 pair unshielded twisted pair (UTP) cable.

15.3 Installation of Cable

15.3.1 The installation of system components has a tremendous effect on the final performance level of the network; therefore, it is essential to ensure that the performance of the entire network is not diminished through improper installation.

In particular:

15.3.2 Care must be taken not to stretch or abrade cables during installation; i.e. the pulling tension for cables must not be exceeded.

15.3.3 Cables that pass through the infrastructure of the building shall be suitably protected against damage. Through walls and floors this shall involve an appropriate type of sleeve; through any form of metalwork or stiff plastic then a rubber grommet shall be used.
15.3.4 To ensure cable management and also strain relief, cables shall be properly dressed using Velcro cable ties. However, cables ties should never be over tightened.

15.3.5 On vertical runs, the cables shall be dressed and tied from the bottom up, thus putting minimum strain on the cables.

15.3.6 Staple guns must never be used, as this damages the cable.

15.3.7 Cables shall not run behind radiators.

15.3.8 In order that the system may be easily re-routed, or damaged sections quickly replaced, free access to the cable, where possible, is recommended.

15.3.9 Draw cords shall be left in ducting, piping etc. for future use.

15.3.10 Because of the nature of modern offices, C.I.S. insist dust sheets be used at all times.

15.3.11 The Contractor shall be responsible for the removal, and reinstatement to the original condition, of any tiles and panels required to carry out the installation.

15.4 Special care shall be taken to avoid contact with dangerous materials e.g. asbestos. Should a contractor suspect the presence of, or have concerns regarding, asbestos they should report this to E&B who can advise accordingly.

15.5 Minimum Bending Radius

Sharp bends in the cable will damage the insulating material thus causing unacceptable losses in the transmission medium. Therefore, the internal radius of every bend in a cable shall be such as not to cause damage to the cable nor impair the characteristics of the cable, and shall be in accordance with manufacturers guidelines.

15.6 Cable Slack at TO Points and Patch Panels

Contractors shall install the system such that sufficient slack remains to enable re-termination of the outlets a minimum of twice and a limited scope for movement of the cabinets. Excess coils of cables underneath the cabinets are unacceptable.

15.7 Patch Panels and Cable Management

15.7.1 Where possible, patch panels shall be installed within the Communications Units from the top, continuing downwards. Should this not be possible, the contractor should seek advice from the C.I.S. Project Manager.

15.7.2 C.I.S. forbids the use of PCB Patch Panels.

15.7.3 Patch panels must be fully populated.

15.7.4 Contractor to supply and install cable management, both horizontal and vertical.
15.7.5 Cable management systems shall not be filled beyond their designed capacity.

15.9 Labelling

The cable shall be clearly labelled at both ends, as outlined in the documentation and/or drawings.

15.10 Electromagnetic Compatibility (EMC)

As a passive medium, Structured Cabling need not comply with the European EMC directive, EMC standards and UK legislation. The Contractor has no legal EMC responsibility. However, Contractors should be aware that cabling, when connected to transmission equipment, could radiate, receive and conduct electromagnetic disturbances.

15.11 Minimum Distance from EMI Sources

15.11.1 High power electrical plant may produce switching transients and radio frequency emissions that may induce interference on the UTP cable. Therefore, in addition to the rules imposed by the IEE Regulations, data/telecommunications cables shall not run parallel to power cables, especially where these cables may carry heavy switching loads. If, however, this is unavoidable it is advisable to keep cables as far apart as possible.

15.11.2 For 'standard' loads, the following separation distances shall be used as a guide;

<table>
<thead>
<tr>
<th></th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICC</td>
<td>2cm</td>
</tr>
<tr>
<td>Earthed Conduit</td>
<td>3cm</td>
</tr>
<tr>
<td>Earthed Trunking</td>
<td>3cm</td>
</tr>
<tr>
<td>Twin and Earth</td>
<td>7cm</td>
</tr>
<tr>
<td>Fluorescent Lighting</td>
<td>30cm</td>
</tr>
<tr>
<td>Electric Motors</td>
<td>100cm</td>
</tr>
<tr>
<td>Transformers</td>
<td>100cm</td>
</tr>
</tbody>
</table>

For further information consult the following;

Clause 6.2, BS EN 50174-2

15.11.3 When crossing mains cables this shall be done at right angles.

15.12 Cable Routes

15.12.1 Cable shall not be routed over pipes, conduits, other cabling, ceiling tiles, etc., but shall rest directly on the supporting surface so as to minimize the potential for sharp bends, kinks etc. Every cable used shall be supported in such a way that it is not exposed to undue mechanical strain and so there is no appreciable mechanical strain
on the terminations.

15.12.2 Inaccessible ceiling areas, such as lock-in type ceiling tiles or plasterboard, shall not be used as cable routes.

15.13 Cable Supports

For cables which are not continuously supported, the maximum distance between supports shall not exceed 50cm (horizontal or vertical).

15.14 Future Expansion

Unless otherwise stated, all newly installed containment must provide for at least 50% future expansion and be capable of supporting CAT6A cabling.

15.15 Wire Basket/Conduit

15.15.1 Where a multiple of cables are installed wire basket is preferred to other types of containment. When exiting the wire basket, cables shall be installed in 25mm conduit mated to the wire basket using appropriate gland plates.

15.15.2 Please Note: No more than 2 x CAT6A cables shall be installed in a 25mm conduit.

15.16 Conduit/Mini-duct/Dado Trunking

15.16.1 Where individual of cables are exposed, they shall be enclosed within plastic conduit, mini-duct or dado trunking.

15.16.2 The use of flexible metal conduit is not recommended.

15.16.3 No section of conduit shall contain more than two 90° bends, or equivalent, between pull points.

15.17 Trunking Lid

Trunking shall be installed such that the lid of the trunking does not form the lower surface.

15.18 Earth Bonding

Each section of metal trunking, tray work and wire basket shall be bonded to the adjoining sections using a suitable earth braid to meet the current edition of the I.E.E. Regulations.

16.0 Terminating

16.1 'LIVE' Units

Contractors shall not work in Communications Cabinets which already house active equipment. However, in certain circumstances where this cannot be avoided, the
C.I.S. Project Manager must first give permission, and arrange a suitable time for the work to be carried out. Prior to the work starting the contractor shall email C.I.S. Network Support (network-support@ed.ac.uk) with details, times etc.

### 16.2 Pin-outs

All terminations shall be made using an IDC punch tool fit for purpose. The incoming cables shall have all 4-Pairs terminated at both patch panel and TO on ADC Krone modular RJ45, 8 pin sockets, as follows (T568B):

<table>
<thead>
<tr>
<th>Pair</th>
<th>Colour</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WHITE/blue</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BLUE/white</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>WHITE/orange</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ORANGE/white</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>WHITE/green</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GREEN/white</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>WHITE/brown</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>BROWN/white</td>
<td>8</td>
</tr>
</tbody>
</table>

### 17.0 Labelling

Each RJ45 socket must be individually labelled. The label shall contain a unique identification, as outlined in the documentation and/or drawing, and must be indelible and placed behind a transparent cover. At the patch panels, each socket shall be labelled according to its corresponding TO.

### 18.0 Testing UTP Cables

#### 18.1 Notice of Testing

The Contractor shall give adequate (usually five days) notice to C.I.S. of the dates for testing the system so that, if necessary, the C.I.S. Project Manager may be present to witness the testing.

#### 18.2 Minimum Test

At present, C.I.S. requires only the Permanent Link be tested, i.e. from the patch panel to the TO. New installations, refurbishments, etc. shall meet the requirements of BS EN 50346 and BS EN 61935-1.

#### 18.3 Marginal Passes

C.I.S. forbids the use of CPs. Because of this, and the fact the C.I.S. use only high
quality components, marginal passes shall not be accepted, as per Clause 4.6.3c, BS EN 50346.

18.4 Saving the Test Results

The installer shall save the results under the labelling scheme as specified by the C.I.S. Project Manager.

18.5 Quality Assurance

To ensure confidence in the installed components, C.I.S. shall test 10% of the installation.

19.0 Documentation

19.1 Prior to commissioning by C.I.S., the contractor shall, on completion of the works and at least 15 working days before users occupy the site, submit copies of the following to the C.I.S. Project Manager:

19.1.1 Floor Plans, both hard copy (A1) and AutoCAD, suitably marked up to show location and I.D. of each and every TO, and detailing any deviation from the original plan. WAP TOs and other high level TOs shall be clearly identified.

19.1.2 Full Structured Cabling Test Results in .flw format, via email or compact disc.

19.1.3 Tester Calibration Certificate.

19.1.4 KRONE TrueNet TE Connectivity Enterprise Networks Warranty Certificate.

20.0 Commissioning

20.1 Prior to commissioning by C.I.S., the contractor shall supply the following KRONE TrueNet CAT6A equipment cords (grey), and leave them in the relevant Telecommunications or Equipment Room:

1 x 2 metres (approx.) equipment cord for every CAT6A cable terminated in the FDs, i.e. one equipment cord per TO.

20.2 In general, and unless otherwise stated, the contractor shall provide the following KRONE TrueNet CAT6A work area cords (grey), and leave them in the relevant Telecommunications or Equipment Room:

1 x work area cord for every TO; one-third of which shall be 1 metre (approx) in length; one-third shall be 3 metres (approx) in length; one-third shall be 5 metres (approx) in length.

20.3 The data/telecommunications contractor shall be responsible for providing specialist cleaners to provide a final deep clean of Telecommunications Rooms and Equipment Rooms, Communications Cabinets and other ICT equipment. This deep clean should also include beneath raised floor and above false ceilings.
20.4 Please Note: Telecommunications Rooms and Equipment Rooms need to be clean, well lit and lockable before commissioning can commence.

20.5 The C.I.S. Technical Services Team's job is to install the active network equipment required to make the network ‘live’ and to check that Structured Cabling Infrastructure performs to specification.

20.6 In order to avoid unnecessary delays and to ensure smooth transition from a passive to an active network, the C.I.S. Project Manager should receive adequate notice (i.e. 20 working days or more) of both handover and users’ entry dates.

20.7 The C.I.S. Project Manager shall notify the Technical Services Team of critical dates, who, in turn, shall schedule the work accordingly.

20.8 Any slippage on the contract will have a large knock-on effect. In these cases the Technical Services Team shall agree a target commissioning date with the C.I.S. Project Manager, subject to the contractor being complete, and will inform the user of that date.

20.9 Normally, the commissioning is completed within three weeks of the C.I.S. Project Manager receiving the relevant documentation. However, this can be delayed because of having to recall the contractor to correct things and also if network faults occur. If such delays occur, the Technical Services Team shall inform the user and the C.I.S. Project Manager of the revised schedule.
Appendix 1.
List of Relevant British Standards

Data/telecommunications installers should have a thorough working knowledge of the following Standards associated with data/telecommunications cabling:

- BS 6701: Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance.
- BS EN 50173-1: Information technology – Generic cabling – General requirements.
- BS EN 50173-4: Information technology – Generic cabling – Homes premises.
- BS EN 50174-1: Information technology – Cabling installations – Specification and quality assurance.
- BS EN 50174-2: Information technology – Cabling installations – Installation and planning and practices inside buildings.
- BS EN 50174-3: Information technology – Cabling installations – Installation and planning and practices outside buildings.
- BS EN 50310: Application of equipotential bonding and earthing in buildings
- BS EN 61935-1: Specification for the testing of balanced and coaxial information technology cabling. Installed balanced cabling as specified in the standards series EN 50173.
- PD CLC/TR 50173-99-1: Cabling guidelines in support of 10 GBASE-T.

Other standards relevant to data/telecommunications cabling installation may include:

- BS 6266: Code of practice for fire protection for electronic equipment installations.
- BS 6396: Electrical systems in office furniture and educational furniture-Specification.
- BS 7083: The accommodation and operating environment for Information Technology (IT) equipment.
- BS 7671: Requirements for electrical installations. IEE Wiring Regulations.
- BS 7799-1: Information technology - Security techniques - Code of practice for information security management. [aka BS ISO/IEC 27002]
- BS 7799-2: Information technology - Security techniques - Information security management systems - Requirements. [aka BS ISO/IEC 27001]
- BS 7799-3: Information security management systems - Part 3: Guidelines for information security risk management.
BS EN 12464-1: Light and lighting - Lighting of work places - Part 1: Indoor work places.
BS EN 12825: Raised Floor Access.
BS ISO/IEC 14763-2: Information technology - Implementation and operation of customer premises cabling - Planning and Installation.
BS EN 50098-1: Customer premises cabling for Information Technology - ISDN basic access.
BS EN 50098-2: Customer premises cabling for information technology - 2048 kbit/s ISDN primary access and leased line network interface.
BS EN 50288-1: Multi-element metallic cables used in analogue and digital communication and control. Generic specification.
BS EN 50288-6-1: Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for unscreened cables characterised up to 250 MHz. Horizontal and building backbone cables.
BS EN 50468: Resistibility requirements to overvoltages and overcurrents due to lightning for equipment having telecommunication ports
BS EN 60603-7 Series: Connectors for electronic equipment. Detail specification for 8-way, unshielded, free and fixed connectors.
BS IEC 61000-5-2: Electromagnetic Compatibility (EMC) - Installation and mitigation guidelines - Earthing and cabling.
BS EN 61000-6-3: Electromagnetic compatibility (EMC) - Generic standards - Emission standard for residential, commercial and light-industrial environments.
BS EN 61000-6-4: Electromagnetic compatibility (EMC) - Generic standards - Emission standard for industrial environments.
BS EN 61935-2: Testing of balanced communication cabling in accordance with series EN 50173. Patch cords and work area cords. Blank detail specification for class D applications
BS EN 62305-1: Protection against lightning — Part 1: General principles.
BS EN 62305-2: Protection against lightning — Part 2: Risk management.
BS EN 62305-3: Protection against lightning — Part 3: Physical damage to structures and life hazard.
BS EN 62305-4: Protection against lightning — Part 4: Electrical and electronic systems within structures.

American standards

American standards relevant to ITI include;

ANSI/TIA-568-C series:
ANSI/TIA-569-C series:
ANSI/TIA-942-A:
ANSI/TIA-758-B:
Schematic relationship between the BS EN 50173 series and other relevant standards
Appendix 2.
Typical Schematic

Telecommunications Room
- FD up to 100 TOs
- 1 x 42u

Telecommunications Room
- FD up to 300 TOs
- 2 x 42u

Telecommunications Room
- FD up to 600 TOs
- 4 x 42u

Equipment Room
- Telephones
  - 1 x 42u
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable

Network Services core equipment
- 2 x 42u
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable

Security, CCTV
- 1 x 42u
- 7 way blo-duct c/w
- 8 x MM, OM3, LC,
- 8 x SM, OS1, LC,
- 8 x CAT6a UTP
- 7 way blo-duct c/w
- 8 x MM, OM3, LC,
- 8 x SM, OS1, LC,
- 8 x CAT6a UTP
- 7 way blo-duct c/w
- 8 x MM, OM3, LC,
- 8 x SM, OS1, LC,
- 8 x CAT6a UTP

Telephones
- 1 x 42u
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable
- 20 Pair CW1308 telephone cable

FD up to 300 TOs
- 2 x 42u

FD up to 100 TOs
- 1 x 42u

To CD
- 7 way blo-duct c/w
- 8 x MM, OM3, LC,
- 8 x SM, OS1, LC,
- 8 x CAT6a UTP

To local DP
- 50 pair CW1308 telephone cable

50 pair CW1308 telephone cable
Appendix 3.
Typical Room Layout, showing minimum requirements for FD Telecommunications Room, housing up to approx 300 TOs
Appendix 4.
Typical FD Passive Cabinet Layout for 2 x 42u Communications Cabinet scenario, housing up to approx 300 TOs

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Appendix 5.  
List of Structured Cabling and Ancillary Components

The data/telecommunications contractor shall supply and install the following:

KRONE TrueNet TE Connectivity Enterprise Networks CAT6a Cable  
KRONE TrueNet TE Connectivity Enterprise Networks CAT6a Connectors  
Cable Management

Free standing racks - Cannon  
Wall mounted racks - Cooper B-Line

Olson 10 way vertical sequential start PDU strips  
See - http://www.olson.co.uk/seq_vert_13a.htm
Appendix 6.
Typical UPS Requirements for Essential Active Equipment

Riello Sentinel Dual 3kVA UPS c/w;
By-pass switch,
SNMP card,
6 way PDU.

PDFs for UPS, by-pass switch and SNMP card are available from C.I.S. Project Manager.
Appendix 7.
Wireless Information

C.I.S. has chosen the Cisco Aironet 2702i Series as its standard Wireless Access unit. This access point has been chosen for its simple deployment, high-performance and energy efficiency.
Appendix 8.
List of UoE KRONE TrueNet TE Connectivity Enterprise Networks Approved Contractors

The following is simply a shortlist of contractors local to Edinburgh. Other KRONE TrueNet TE Connectivity Enterprise Networks Approved Contractors may also be used. For further details contact TE Connectivity Enterprise Networks.

ACI Integrated Solution Ltd
Arthur McKay & Co. Ltd
Boston Networks Ltd
Capita – IT Services
Computer Links Ltd
Electrocom Networks Ltd
FES Ltd
Xtreme Business Solution Ltd