B-26 – COMMUNICATIONS INFRASTRUCTURE

About This Document

This document provides the University's guidelines for architects, engineers, and designers who are developing construction plans and specifications for new buildings and renovations for the University of North Carolina at Chapel Hill.

The document provides information about telecommunications services, standards, and practices for communications systems at the University. It covers topics such as copper and fiber optic cabling, duct banks, interior raceways and conduits, data communications, voice telephony systems, and cable television services.

The document describes guidelines that designers are required to follow when creating plans and specifications, with the intention that the applicable portions be applied and organized according to the Construction Standards Institute (CSI) MasterFormat specification.

Scope: CSI Divisions and Groups

This document describes only guidelines related to CSI Division 27 (Communications). Where references to other sections are important, those references are included in the section text.

- Procurement and Contracting Requirements *[Not Used]*
- Specifications
    - General Requirements *[Not Used]*
    - Facility Construction *[Not Used]*
    - Facility Services
        - Division 20 – Reserved *[Not Used]*
        - Division 21 – Fire Suppression *[Not Used]*
        - Division 22 – Plumbing *[Not Used]*
        - Division 23 – Heating, Ventilation, and Air Conditioning *[Not Used]*
        - Division 24 – Reserved *[Not Used]*
        - Division 25 – Integrated Automation *[Not Used]*
        - Division 26 – Electrical *[Not Used]*
        - Division 27 – Communications
        - Division 28 – Electronic Safety and Security *[Not Used]*
        - Division 29 – Reserved *[Not Used]*
    - Site and Infrastructure *[Not Used]*
    - Process Equipment *[Not Used]*

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References

1. Abbreviations

ADA	Americans with Disabilities Act
AFF	Above Finished Floor
ANSI	American National Standards Institute
ATS	Automatic Transfer Switch
AWG	American Wire Gauge
BBC	Backbone Bonding Conductor (ANSI/TIA-607-C, equivalent to GE)
BCT	Bonding Conductor for Telecommunications (ANSI/TIA-607-B and prior, equivalent to TBC)
BICSI	Building Industry Consulting Services International
CA	Construction Administration
CATV	Cable Access Television System (sometimes called Master Antenna Television System)
CD	Construction Documents
CIG	Communications Infrastructure Guidelines
CSI	Construction Specifications Institute
CommTech Engineering	The Communication Technologies Engineering group in the Information Technology Services Department at the University of North Carolina at Chapel Hill
DAS	Distributed Antenna System
DD	Design Development
EIDF	Extended Intermediate Distribution Frame
EF	Entrance Facility

ELFEXT	Equal Level Far End Crosstalk
EMT	Electrical Metallic Tubing
ETL	Electrical Testing Laboratories (Intertek)
GE	Grounding Equalizer (ANSI/TIA-607-B and prior, equivalent to BBC)
IDF	Intermediate Distribution Frame, floor/area distribution point, horizontal cross-connect
ITS	The Information Technology Services Department at the University of North Carolina at Chapel Hill
MDF	Main Distribution Frame, building distribution point, main cross-connect
MM	Multimode (fiber optic cable)
NEC	National Electrical Code
NEXT	Near End Cross Talk
NFPA	National Fire Protection Association
OCC	Optical Cable Corporation
OEM	Original Equipment Manufacturer
OSP	Outside Plant cabling or support structure
OTDR	Optical Time Domain Reflectometer
PBB	Primary Bonding Busbar (ANSI/TIA-607-C, equivalent to TMGB)
PDF	Portable Document Format from Adobe Corporation
PLAR	Private Line Automatic Ringdown
PSTN	Public Switched Telephone Network
RCDD	Registered Communications Distribution Designer (via BICSI)
RF	Radio Frequency

RFI	Request for Information
RG	Radio Guide
RGS	Rigid Galvanized Steel
SBB	Secondary Bonding Busbar (ANSI/TIA-607-C, equivalent to TGB)
SD	Schematic Design
SCO	State Construction Office
SEP	Service Entrance Passthrough
SER	Service Entrance Room
SM	Single Mode (fiber optic cable)
TBB	Telecommunications Bonding Backbone (ANSI/TIA-607-C and prior)
TBC	Telecommunications Bonding Conductor (ANSI/TIA-607-C, equivalent to BCT)
TDMM	Telecommunications Distribution Methods Manual
TGB	Telecommunications Grounding Busbar (ANSI/TIA-607-B and prior, equivalent to SBB)
TIA	Telecommunications Industry Association
TMGB	Telecommunications Main Grounding Busbar (ANSI/TIA-607-B and prior, equivalent to PBB)
TR	Telecommunications Room
UL	Underwriter's Laboratories
UNC-CH	University of North Carolina at Chapel Hill
VoIP	Voice over IP

2. Definitions

- **Bonding Conductor for Telecommunications (BCT):** A conductor that interconnects the telecommunications bonding system to the main electrical service (power) grounding system.
- **Division 27:** Three-part CSI-formatted section of project manual concerning communications
- **Duct Bank:** Underground conduit set serving building from outside
- **Entrance Facility:** Location of emergence of outside plant cabling in building
- **Extended Intermediate Distribution Frame (EIDF):** A space in a building that houses a small set of telecommunications equipment intended for a limited and specific purpose. EIDFs often consist of ceiling or wall-mounted enclosures.
- **Faceplate**: A communications outlet frame into which communication inserts, blanks, and jacks are secured in support of voice, data, and video services.
- **Floor Box**: Opening in floor intended to provide electrical and communications outlets for a conference table or workstation or other area, usually away from a wall.
- **Grounding Equalizer (GE):** A conductor that interconnects two of more TBBs within a multistory building.
- **Intermediate Distribution Frame (IDF):** A room in a building that houses telecommunications equipment for distribution of signals on a specific floor. In industry, this may be referred to as a satellite distribution room (SDR) or a floor distributor (FD).
- **Main Distribution Frame (MDF):** The primary room in a building in which active telecommunications equipment is located. Typically, this equipment provides service to IDFs located on other floors. In industry, this may be referred to as a primary distribution room (PDR) or a building distributor (BD).
- **Patch Panel**: Passive communications hardware utilized to terminate voice, data, security and signaling cable with the purpose of identification and patching. Most often used to patch passive cabling to active components, patch panels may be mounted in equipment racks or be wall-mounted.
- **Poke Through**: Conduit sleeve through a floor to the ceiling space of the floor below, providing a pathway for communications cabling, typically utilized to serve conference rooms or modular furniture.
- **Power Pole**: Vertical metallic raceway with a separate dedicated channels for electrical service and communications cabling, typically utilized to extend electrical and communications service from a ceiling to modular furniture situated in open floor areas not adjacent to a wall.
- **Ring-Down Emergency Phone**: A wall-mounted or free-standing tower analog emergency phone with central office generator backed up dial tone installed in parking decks and on

campus grounds. These emergency devices are equipped with a push button activation hook-switch that when activated automatically dials the UNC Department of Public Safety Emergency Operations Center.

- **SER-MDF**: A combined service entrance room (SER) and main distribution frame (MDF). i.e., a room that houses both the outside cable termination and the primary electronic distribution equipment.
- **Service Entrance Passthrough (SEP):** A room in a building in which a telecommunications cable transitions from outside to inside and thence passes to a separate service entrance room.
- **Service Entrance Room (SER):** The primary room in a building in which telecommunications cables terminate from their outside origin. In industry, this may be referred to as an Entrance Facility (EF).
- **Static Load**: In cable tray systems, the weight of the empty installed cable tray system together with the weight of the installed cables. For equipment racks, the weight of the empty installed rack together with the weight of the installed equipment.
- **Telecommunications Bonding Backbone (TBB):** A conductor that bonds a TGB (usually in an IDF) to the TMGB (usually in the MDF.)
- **Telecommunications Grounding Busbar (TGB):** The primary telecommunications grounding connection point in an IDF.
- **Telecommunications Main Grounding Busbar (TMGB):** The primary telecommunications grounding connection point in the MDF, connected to the main building service equipment ground and to each TGB.
- **Telecommunications Room (TR):** Any room whose primary function is to contain telecommunications equipment, e.g. an SER, MDF, or IDF (but not necessarily a SEP or EIDF).
- **Termination Block**: Passive communications hardware utilized to terminate voice, data, security and signaling cables with the purpose of identification and cross-connection. Typically wall mounted and most often used to cross-connect voice circuits.

3. Reference Documents

Designers shall utilize the following standards or the latest versions thereof when developing specifications for communication systems at the University of North Carolina at Chapel Hill.

- BICSI, Telecommunications Distribution Methods Manual, latest edition
- National Fire Protection Association, NFPA-70 (2020), National Electrical Code
- Telecommunications Industry Association, TIA-568-C.0 (February 2012), Generic Telecommunications Cabling for Customer Premises

- Telecommunications Industry Association, TIA-568-C.1 (February 2009), Commercial Building Telecommunications Cabling Standard
- Telecommunications Industry Association, TIA-568-C.2 (August 2009), Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- Telecommunications Industry Association, TIA-568.3-D.3 (October 2016), Optical Fiber Cabling and Components Standard
- Telecommunications Industry Association, TIA-568-C.4 (July 2011), Broadband Coaxial Cabling and Components Standard
- Telecommunications Industry Association, TIA-598-C (January 2005), Optical Fiber Cable Color Coding
- Telecommunications Industry Association, TIA-606-B (June 2012), Administration Standard for Telecommunications Infrastructure
- Telecommunications Industry Association, TIA-607-C (November 2015), Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- Telecommunications Industry Association, TSB-140 (February 2004), Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems

CIG-01 – Communications

1. Introduction

The telecommunications infrastructure of the University of North Carolina at Chapel Hill is a foundational element of the institution's academic, research, and service environments. The scale of this infrastructure is a reflection of the size of the campus, including over 720 acres and millions of square feet of buildings. In many respects, the University's telecommunications infrastructure is comparable to that of a small city, with similar requirements and challenges. Its complexity is a reflection of the long history and evolution of voice, data, and video technologies throughout the campus.

Communications infrastructure guidelines (including this document) are managed on behalf of the University by the Communication Technologies Engineering Group (CommTech Engineering) in the Information Technology Services (ITS) Division of the University. Of course, wiring standards are complex and evolve rapidly to keep pace with the technology requirements of the University. As a result, designers and contractors must consult with CommTech Engineering for clarification about current cable types and standards before completing telecom designs and specifications, purchasing materials, and commencing work.

This Communications Infrastructure Guidelines document is of a general nature and is intended to inform the development of a project's design documents and guide the construction process. Specifications may be modified by the University's Communication Technologies Office as necessary to accommodate design or functional requirements of specific projects.

For all new and renovated buildings and facilities, the scope of this guideline includes but is not limited to underground service entrance ducts and cables, telecommunications rooms, pathway and conduit riser systems, and building telecommunications wiring.

2. The Campus Communications Environment

The campus is provisioned with an extensive underground duct bank system and outside cable plant. The outside cable plant includes legacy copper trunk cables, legacy coaxial cables, and an extensive network of fiber optic cables. Going forward the outside cable plant will consist primarily of fiber optic cables except in rare instances. In some cases, locations remote from the campus are served by broadband RF microwave systems.

Each building is typically provisioned internally with fiber, copper, and coaxial cables. Outside plant cables terminate in a service entrance room, providing connectivity to a main distribution frame. Intermediate distribution frames on each floor provide horizontal connectivity.

Together, the outside and inside cable plants support multiple services including Ethernet for data and VoIP telephony, backhaul for mobile data services, security systems and cameras, CATV, energy management, and traditional POTS telephony.

3. Designer of Record Responsibilities

Each University project shall include a full telecommunications wiring infrastructure design, including horizontal and vertical cabling, telecommunications room racks and treatment, and linkages to outside cable plant as appropriate. Each design shall include reviewed and approved plans and specifications (construction documents) that are a part of each project's overall set of construction contract documents. Each design shall comply with the requirements of this guideline.

At the beginning of the design process, the Designer of Record shall review in detail the current Communications Infrastructure Guidelines and contact CommTech Engineering to determine if there are any unusual criteria that pertain to the project.

The Designer of Record shall harmonize the Communications Infrastructure Guidelines with the overall project contract requirements, along with national, state, and local codes and regulations.

All exceptions to these guidelines must be reviewed and approved by CommTech Engineering prior to implementation.

The Designer of Record shall be required to attend at least one face-to-face meeting between the Designer's telecommunications experts and CommTech Engineering, prior to commencing telecommunications infrastructure design activities on any project. This shall be coordinated through the UNC-CH Facilities Planning and Construction Management Office.

The Designer of Record shall ensure that all telecommunications infrastructure plans and specifications are provided to CommTech Engineering as required in the Submittals section of this document

The Designer of Record is responsible for ensuring that telecommunications infrastructure plans and specifications are appropriately communicated and enforced across relevant construction trades. In particular, electrical and telecommunications systems shall be closely coordinated, especially with regard to grounding and conduit systems.

A detailed list of the responsibilities of the Designer of Record can be found in Appendix 1. Note that in the case of outside plant duct bank all aspects of design shall be coordinated with the UNC Electrical Distribution Systems group as described later in the document at section "CIG-10 - Underground Ducts and Raceways for Communications Systems"

The full body and content of the University Design Guidelines are hereby incorporated by reference (https://facilities.unc.edu/resources/design-guidelines/

4. Contractor of Record Responsibilities

For the purposes of this guideline, the Contractor of Record (or "Contractor") shall be collectively defined as the Prime or General Contractor (and/or Construction Manager at Risk) and any subcontractor, sub-trade or installer thereunder.

The Contractor of Record will be required to purchase, install, test, and document all communications infrastructure systems and components as specified within the Designer of Record's telecommunications infrastructure plans and specifications. The Contractor of Record may

be required to provide communications manholes/duct bank within the scope of selected projects and associated construction contract documents.

The Contractor of Record shall be required to attend at least one face-to-face meeting between the Contractor's telecommunications experts and CommTech Engineering, prior to commencing procurement or other telecommunications infrastructure work on any project. This meeting shall be coordinated through the UNC-CH Facilities Planning and Construction Management Office.

The Contractor of Record shall submit all communications equipment and materials for review and approval by both the Designer of Record and CommTech Engineering prior to any procurement as described in the Submittals sections of this document. The Contractor of Record shall refer to the project bid document and the construction contract documents for all details of scope and responsibility.

Along with equipment and materials submittals, the Contractor of Record shall include the names and contact information for any telecommunications subcontractors or installers, which shall be subject to review and approval by both the Designer of Record and CommTech Engineering. During the project construction phase, the Contractor of Record shall not be permitted to change telecommunications subcontractors or installers without the express written permission of UNC-CH Facilities Planning and Construction Management Office, and CommTech Engineering. The Contractor of Record is responsible for all testing. See "Execution>Testing and Acceptance" of this section for full requirements.

The Contractor of Record is responsible for ensuring proper coordination across subcontract trades. In particular, coordination between electrical subcontractors and telecommunications subcontractors is critical. For example, in some cases bonding systems and conduit systems may be installed either by the electrical or telecommunications contractor. Both must be kept abreast of the specifications and contract requirements.

5. Design Scope: Network Electronics vs Infrastructure

While the Designer of Record is responsible for physical communications infrastructure (wiring, telecommunications rooms, pathway, ductbank, etc.) as detailed in this document, the Designer of Record is not responsible for network electronics, except for providing adequate rack space, power, cooling, etc. The University generally handles the selection and installation of network electronics (switches, routers, wireless access points, telephones, etc.) itself. As such, these devices are out of scope and should not be included in the design.

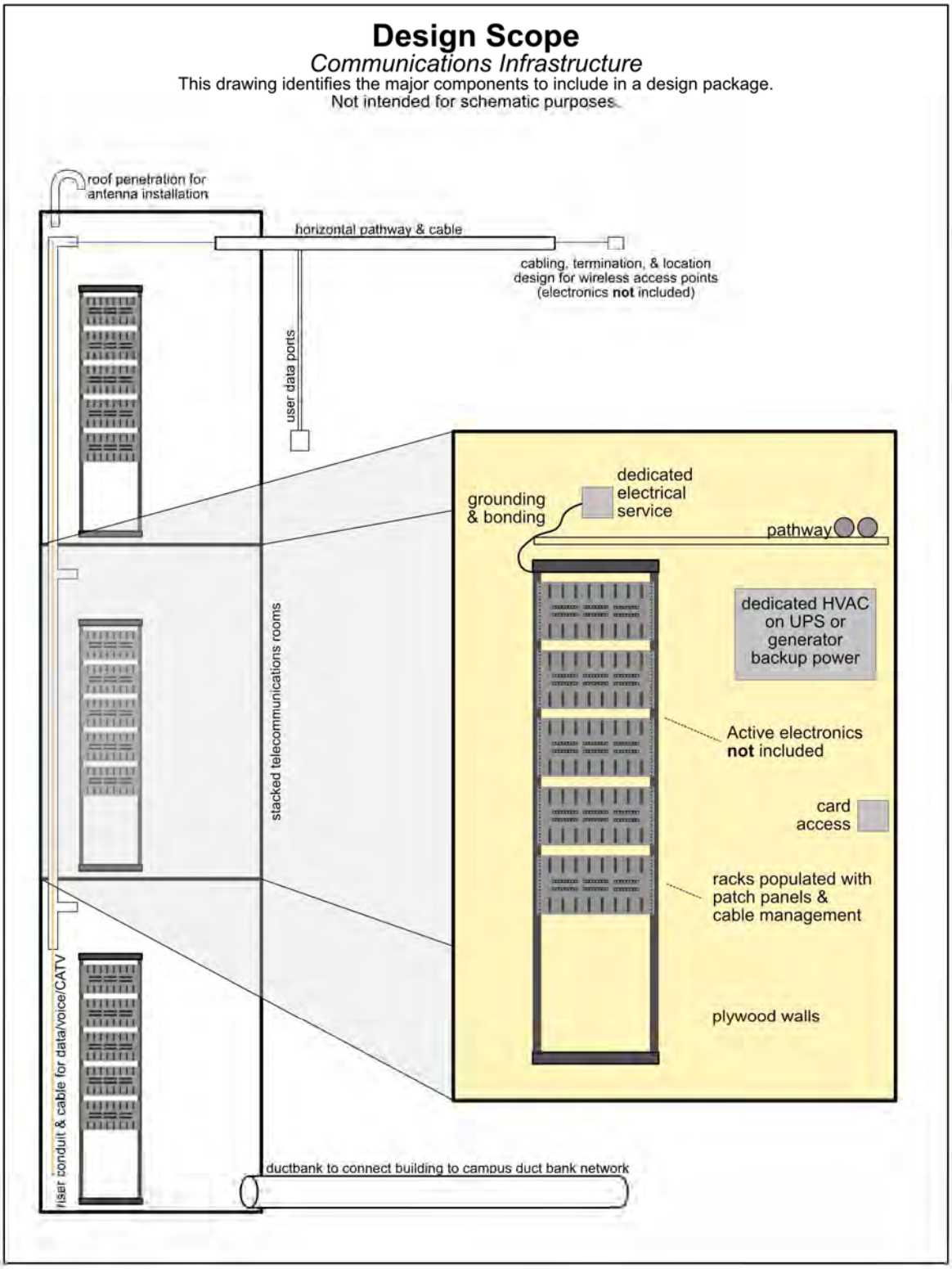
<u>Include in Design Package:</u>

- Ductbank and service entrance infrastructure (section CIG-10)
- Telecom rooms including racks, patch panels, cable management, access control, and treatments (sections CIG-03, CIG-16, CIG-17, CIG-18, CIG-19)
- Horizontal and riser cabling systems for data, voice, and CATV (sections CIG-20, CIG-21, CIG-22, CIG-23, CIG-24, CIG-25, CIG-26, CIG-27)
- Wi-Fi cabling design (section CIG-37)

- Conduit, raceway, and other pathway components (section CIG-04, CIG-05, CIG-06, CIG-07, CIG-08, CIG-09)
- Electrical service and grounding systems (sections CIG-03, CIG-19)
- Rooftop access (section CIG-11)
- HVAC (section CIG-19)
- Testing and documentation (section CIG-02, CIG-13, CIG-14)

Do Not Include:

- Switches, routers, wireless access points
- Telephones or VoIP instruments
- Patch cables


Design Scope
Communications Infrastructure
This drawing identifies the major components to include in a design package.
Not intended for schematic purposes
roof penetration for antenna installation
horizontal pathway & cable
cabling, termination, & location design for wireless access points (electronics not included)
user data ports
stacked telecommunications rooms
grounding & bonding
dedicated electrical service
pathway
dedicated HVAC on UPS or generator backup power
Active electronics not included
card access
racks populated with patch panels & cable management
plywood walls
riser conduit & cable for data/voice/CATV
ductbank to connect building to campus duct bank network

6. Qualifications

6.1. Designer of Record Qualifications

The Designer of Record must have at least five (5) years of experience in the successful development of specifications and designs for telecommunications infrastructure in projects of a similar scale and complexity as the proposed project.

UNC-CH requires that the Designer of Record maintain a currently certified RCDD on the project team that can be available for all project meetings and significant communications with CommTech Engineering.

See CIG-37 for qualifications required of the Wi-Fi system designer.

6.2. Telecommunications Contractor of Record Qualifications

The Telecommunications Contractor of Record shall be duly licensed in the State of North Carolina.

The Telecommunications Contractor of Record shall have at least 5 years of verifiable installation experience with projects utilizing unshielded twisted pair (UTP), Category 6, and Category 6A cabling in compliance with the latest edition of TIA-568 and related industry standards.

The Telecommunications Contractor of Record shall have a duly licensed RCDD on staff and be manufacturer-certified in one of the following programs, as applicable: Hubbell Mission Critical Warranty, for Hubbell cable and connectivity; nCompass Warranty, or 25-year warranty program, for Superior Essex cable with Legrand (Ortronics) connectivity; Leviton Networks Solutions Warranty for Berk-Tek cable with Leviton connectivity. Certificates verifying these credentials shall be submitted during submittal to be reviewed by CommTech Engineering.

The Telecommunications Contractor of Record's lead telecommunications technician shall be BICSI certified with such certification at least at the technician level. The same technician shall be the lead technician for the duration of the project or shall be replaced by a technician with the same or higher credentials and qualifications. Proof of BICSI Technician qualification shall be submitted with bid documents.

Grounding and bonding systems shall be installed by a contractor duly licensed in the State of North Carolina for the installation of electrical conductors.

Where the installation of any rooftop access assembly requires the penetration or compromise of a building roof, the Contractor of Record shall be certified to perform such work specific to the exact existing roofing system and type.

6.3. Manufacturer Qualifications

Unless otherwise approved by CommTech Engineering, all materials shall be provided by manufacturers regularly engaged in the manufacture of unshielded twisted pair, coaxial cables,

fiber optics, connectors, hardware, and related systems. Where applicable, manufacturers' products shall be listed by a recognized and appropriate third party, such as UL and ETL.

Manufacturers must have products in satisfactory use for a minimum of five years.

7. Execution

7.1. Telecommunications Designer Scope of Services

The designer shall provide a complete telecommunications design package. A full enumeration of all services and their associated construction phases can be found in Appendix 1.

7.2. Pre-installation Meeting

The Contractor shall attend a meeting with CommTech Engineering prior to commencing installation activities. This meeting will be held at UNC-CH at a location determined by CommTech Engineering and may include a site visit. The purpose of the meeting is to review project specifics and requirements. See Appendix 3 for details.

7.3. Installation Methods Governance

Installation of all systems and materials shall be accomplished in accordance with this document. Installations shall comply with all applicable national, state and local regulations, the NEC, and all other standards and guidelines noted herein.

7.4. Submittals

Submittals shall be prepared in a line-by-line format corresponding to the applicable section of the contract document specifications and shall indicate compliance with each requirement specified herein. Indicate deviations, if any, from the Communications Infrastructure Guidelines.

Drawings, specifications and product data sheets shall be enumerated and referenced for easy identification.

Complete and accurate submittal data for each individual section shall be submitted as a single package.

No installation work may begin until submittals are received, reviewed, and approved by CommTech Engineering and the Designer of Record.

A comprehensive table of submittal requirements is detailed in Appendix 2.

7.4.1. AutoCAD Drawings

All AutoCAD drawings shall be provided to CommTech Engineering as electronic files in version 2000 or later format.

All telecommunications elements shall be on a distinct layer of the drawing so that they can be easily isolated.

All plan view drawings shall be georeferenced with respect to the State Plane Coordinate System.

7.4.2. Product Data Sheets

Product data sheets are required for ALL components proposed for use. Product data sheets shall be submitted in PDF format.

The submittal of product data sheets is a key component of the design process. Any products for which we require data sheets must be approved by CommTech Engineering prior to installation.

Product data sheet submittals shall include manufacturer installation instructions.

7.5. Testing and Acceptance

The Designer of Record shall create a testing and acceptance plan for each communications infrastructure component as a part of the design phase. CommTech Engineering must approve the testing and acceptance plan before any installation work can commence. The test plan submittal shall include a sample of testing documentation and proposed test equipment.

The Contractor of Record shall conduct all testing and document results. The Contractor of record shall supply all personnel, materials, and equipment required to conduct testing.

Contractor of Record shall notify CommTech Engineering through UNC Facilities Planning and Construction a minimum of twenty-one (21) business days in advance of any testing to be performed with details about the specific location of the test and functions to be tested. CommTech Engineering reserves the right to be present for none, any, or all tests performed.

At the request of CommTech Engineering, the Contractor of Record shall re-test any component that CommTech Engineering deems not acceptable by virtue of the component in question failing the prescribed test or for which the testing methodology is in question. CommTech Engineering must be present for any re-testing that it requests. All personnel, materials, and equipment required for re-testing shall be provided by the Contractor of Record without additional cost to the University. CommTech Engineering reserves the right to independently perform its own testing of materials and systems.

Test procedures shall confirm that each specification statement has been met or exceeded. The Contractor of Record shall provide an actual demonstration of each system requirement. All tests are subject to validation by means of a re-test, by Contractor, in the presence of the Owner's Representative.

Owner reserves the right to reject any component, work, or system that does not comply with the specifications described herein.

These are general test criteria that apply to all testing and acceptance activities. Testing criteria for specific components are defined in their respective sections in this document. Note that

some wiring components are best tested as a system. Details on this type of testing can be found in CIG-02 – Testing and Acceptance of Cabling Systems.

8. Contacts

Designers, Contractors, and vendors are encouraged to communicate directly and proactively with the CommTech Engineering staff. Formal engagement with the UNC Facilities Planning and Design PM is recommended as the best practice to initiate this communication.

CIG-02 – Testing and Acceptance of Cabling Systems

1. General

This section defines end to end testing requirements for the subsystem components described in the following specifications:

- CIG-17 - Communications Termination Blocks and Patch Panels
- CIG-21 - Communications Copper Cable Splicing and Terminations
- CIG-22 - Communications Optical Fiber Backbone Cabling
- CIG-23 - Communications Optical Fiber Splicing and Terminations
- CIG-25 Communications Copper Horizontal Cabling

2. Execution

2.1. Testing

All testing shall be accomplished in accordance with CIG-01.

Prior to testing, the Telecommunications Contractor shall submit a Certification Test Plan, subject to approval by UNC ITS CommTech Engineering, that reflect the requirements of this section.

If the test results are unsatisfactory the contractor shall replace the entire cable and retest.

Testing shall consist of an end-to-end system test, encompassing the cable, patch panel termination, and faceplate termination, as appropriate.

The contractor shall test UTP cable in accordance with TIA-568-C series standards, including TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-568-C.4, and TSB-140. Each UTP cable shall be tested, and the results documented and delivered to the owner's representative for review/acceptance.

Copper cabling shall be fully tested for Cat 6 or Cat6A compliance, as appropriate, in the TIA specifications, including the following parameters:

- Wire Map
- Length
- Propagation Delay
- Delay Skew
- DC Loop Resistance
- Insertion Loss
- Near-End Crosstalk (NEXT)
- Power Sum Near-End Crosstalk (PS NEXT)
- Return Loss
- Attenuation to Crosstalk Ratio, Far-End (ACR-F)
- Power Sum Attenuation to Crosstalk Ratio, Far-End (PS ACR-F)

CIG-03 - Grounding and Bonding for Communications Systems

1. General

Grounding and bonding for communications systems are supplemental to the electrical power grounding system and devoted to the communications system infrastructure. Bonding and grounding of telecommunications systems is a requirement in each building on campus. Its purpose is to protect personnel and equipment from unwanted electrical currents associated with the communications infrastructure and equipment.

Grounding and bonding responsibilities are divided and shared between the electrical contractor and the communications contractor. The designer of record shall be responsible for coordinating the activities of these groups and ensuring that specifications are consistent across trades.

Grounding and Bonding applies to all communications systems elements, but especially to the following specifications:

- CIG-04 Pathways for Communications Systems
- CIG-06 Conduits and Backboxes for Communications Systems
- CIG-07 Cable Trays for Communications Systems
- CIG-16 Communications Cabinets, Racks, Frames and Enclosures
- CIG-18 Communications Cable Management and Ladder Rack

2. Execution

2.1. Bonding Conductor for Telecommunications (BCT)

The bonding conductor for communications shall bond the TMGB to the main electrical service (power) grounding system. The BCT originates in the MDF and terminates at the electrical service ground for the building. The BCT shall be a continuous copper conductor sized according to length. This conductor shall be installed in EMT, bonded to the conduit at each end and be sized, as a minimum, the same size as the largest TBB.

2.2. Telecommunications Bonding Backbone (TBB)

This conductor interconnects the TGB with the TMGB. The TBB shall be routed in a separate conduit alongside the telecommunications riser cables. The TBB shall be insulated and be a continuous conductor without splices that is connected to both the TGB and the TMGB via exothermic weld or irreversible compression connection. The TBB shall be a copper conductor sized per TIA-607 (based on 2kcmil/lf), with a minimum conductor size of 6 AWG.

2.3. Installation Compliance.

Provide grounding connections for cable systems as required by manufacturer's recommendations and in compliance with TIA-607-C and as required by the NEC.

2.4. Telecom Room Infrastructure Bonding

Bond all installed equipment racks, cable tray, and other metallic components to grounding bus bar in telecom room with a minimum 6 AWG copper conductor with green colored insulation.

2.5. TBB Sizing Requirements

The TBB should be sized per the table below with the TBB length calculated from the last TGB in the run to the TMGB.

TBB Length (LF)	TBB Size (AWG)	TBB Length (LF)	TBB Size (AWG)
< 13	6	85-105	4/0
14-20	4	106-125	250 MCM
21-26	3	126-150	300 MCM
27-33	2	151-175	350 MCM
34-41	1	176-250	500 MCM
42-52	1/0	251-300	600 MCM
53-66	2/0	> 300	750 MCM
67-84	3/0		

2.6. Telecommunications Main Grounding Busbar (TMGB)

The TMGB is located in the BDF and is bonded by means of a bonding conductor for telecommunications to the main building service equipment ground. It should be installed at 7’ 6” AFF onto the wall-mounted plywood. The bar should be electrically insulated from its mounting hardware. In addition to being bonded to the main electrical service ground, the TMGB should be bonded to building steel if available. This does not apply to buildings constructed of reinforced concrete.

2.7. Telecommunications Grounding Busbar (TGB)

The TGB is the interface to the building telecommunications grounding system located in each IDF and serves as the communications grounding system for that room. It shall be installed onto the wall-mounted plywood at 7’ 6”” AFF. The bar shall be electrically insulated from its mounting hardware. In addition to being bonded to the TMGB, the TGB shall be bonded to building steel if available. This does not apply to buildings constructed of reinforced concrete.

2.8. Grounding Equalizer (GE)

Whenever two of more TBBs are installed in a building the TBBs shall be bonded together with a GE. This conductor connects the TGBs in IDFs on the same floor in a building at the top floor and at a minimum of every third floor in between per TIA-607-C.

2.9. Cable Tray/Basket

A #6 AWG TBB conductor shall be installed for the TGB to the cable tray or basket with each section bonded together per manufacturer and NEC requirements.

2.10. Pathway Components

A #6 AWG TBB insulated grounding conductor shall be installed to each pathway component per manufacturer and NEC requirements.

2.11. Equipment Cabinets and Racks

A #6 AWG TBB insulated grounding conductor shall be installed between the TMGB or TGB and all equipment racks.

2.12. Interconnection with Building Ground

The grounding system for telecommunications is for telecommunications systems only. No other building or system grounds may be made to the TMGB, TGB, or communications systems components.

3. Testing

Resistance to building ground shall be measured from each TGB/TMGB to building ground and shall not exceed maximum allowable fall of potential as defined by the Engineer of Record.

CIG-04 - Pathways for Communications Systems

1. General

This section provides direction to designers regarding communications pathways installed through walls and floors to facilitate the placement of communications cabling in new construction and renovations. These pathways are also referred to as sleeves and typically provide a pathway between stacked telecommunication rooms, telecommunication rooms and cable trays routing through corridors, and pathways through inaccessible ceilings between sections of cable trays or equipment rooms. This section also covers firestopping of penetrations.

2. Execution

2.1. Sleeves

2.1.1. EMT Use

EMT conduit shall be used as sleeves in the following areas:

1. Interior partitions.
2. Above suspended ceilings.
3. Above solid ceilings with limited access.
4. Floor penetrations.

EMT conduit shall not be used where tubing, couplings, elbows and fittings would be in direct contact with the earth or underground.

2.1.2. RGS Use

RGS conduit will be used as sleeves in the following areas:

1. Corrosive environments.
2. Building entrance sleeves extending from the duct-bank system that exceed 50’ to the SER shall have one (1) of the compliment of sleeves be RGS.

2.2. Bushings

All conduit sleeves larger than 2” shall be fitted with "screw-on" type plastic bushings (installed on an EMT connector when EMT is used). Push-on type bushings are permitted on conduits 2” or smaller.

2.3. Specific Deployment Requirements

All sleeves shall be sized for the number connections required plus an additional 15% for future growth.

2.3.1. In Telecommunications Rooms

In telecommunications rooms sleeves shall be installed 4” AFF and 4” off the wall with adequate separation to support installation of faceplate hardware and bushings.

2.3.2. Ceiling Penetrations

Sleeves that penetrate ceilings shall extend to 10’ AFF so that they can be accessed easily via ladder.

2.3.3. Horizontal Sleeves in Telecommunications Rooms

Sleeves that reach into telecommunications rooms shall extend 2” into the room. On the outside of the telecommunications room the sleeve shall extend to 4” from the edge of the cable tray.

2.4. Penetration Seals for Fire Stopping

All seals shall utilize UL approved fire stopping assemblies that are approved for that penetration type.

Communications pathways shall be fire stopped according to all state and local code requirements and per the NEC. Non-cementitious firestopping shall be used to seal the interior of sleeves and must be of a type that will remain pliable for ease of removal in future cable installations.

2.5. Grounding

Communications pathways should be bonded to the telecommunications grounding system per section CIG-03.

CIG-05 - Hangers and Supports for Communications Systems

1. General

Communications cabling hangers and supports are only to be used in isolated instances such as minor renovations or moves, adds, and changes where there are no cable trays and conduit raceways available to support cable installations.

Use of cable hangers and J-hooks is only permitted with approval by CommTech Engineering on a case-by-case basis.

2. Execution

All communications cabling must be supported with hangers and supports such as open-top J-hooks securely fastened to building structure. To mitigate against development of harmonics and alien crosstalk, J-hooks should be located using varied and random spacing between 4'-5' centers. To adequately support the communications cabling, spacing between J-hooks shall not exceed 5'.

CIG-06 - Conduits and Backboxes for Communications Systems

1. General

Conduits and backboxes provide a pathway and physical protection for all horizontal communications cabling between the MDF/IDF and workplace outlet locations. Unless otherwise noted, all cabling for University properties will be housed in conduit/backbox systems (as opposed to surface mounted or hung cabling). The scope of conduit/backbox use includes cabling for voice and data communications, CATV, elevator emergency phone, security cameras, fire alarm phone lines, automatic transfer switches, emergency generators, and miscellaneous building and freezer alarm lines.

2. Execution

2.1. Conduit Bends

A maximum of 180 degrees will be allowed between pull points. Conduit runs exceeding 180 degrees of turns require the installation of a fully accessible pull box to facilitate cable installation. The use of LB-type or similar conduits is not permissible.

2.2. Looping

Telecommunications outlets may not be “looped” in the same run of conduit.

2.3. EMT

Each Telecommunications outlet will have a 1” minimum EMT conduit routed from the recessed outlet box that extends to within 4” of a cable tray or home run back to the nearest Telecommunication Room. RGS conduit should be used in corrosive environments.

2.4. Box Size

Standard telecommunications outlet boxes shall consist of a 4” (or 4-11/16”) square back box that is 3-1/2” deep and equipped with an appropriate plaster ring. The outlet conduit shall terminate toward the rear of the outlet box. In cases where wall construction precludes a 3-1/2” box depth, the maximum practicable box depth shall be provided, using box extensions as necessary. Outlets shall be installed at 18” AFF and/or shall be level with nearby electrical outlets. In cases where outlets are installed above countertops the outlet height shall be determined by the designer and noted on the drawings.

2.5. Surface Mounting

Surface mounted raceways in labs or classroom environments must be designed per room based on number of connections and outlet locations. See Section CIG-09 - Surface Raceways for Communications Systems for details. **Note that this is not the preferred architecture.**

2.6. Special Purpose Links

Conduits serving elevator emergency phones, fire alarm phone lines, alarm lines for research freezers, and emergency generator/ATS alarm lines shall home run back to the MDF/IDF or UNC-CH Life-Safety designated equipment location.

2.7. Wall Phones

Outlets for wall phones shall be 4” X 2-1/4” X 2-1/8” single gang with height noted for each location on drawings. Wall phone heights shall comply with ADA accessibility guidelines where applicable.

2.8. Penetration Seals

Penetrations shall utilize UL approved fire stopping assemblies as described in section CIG-04, including the use of non-cementitious firestopping to seal the interior of sleeves and remain pliable for ease of removal in future cable installations.

CIG-07 - Cable Trays for Communications Systems

1. General

Cable trays and basket systems for communications systems provide a pathway, physical protection, and support for communications cabling.

2. Execution

The cable tray system is intended to carry telecommunications cable only; power wiring, control wiring, and fire alarm system cabling are not permitted in the cable tray system.

The system shall be installed according to the drawings and shall consist of a complete cable tray system including straight tray sections, horizontal elbows, vertical risers, crosses, tees, wyes, reducers, coupling accessories, splice plates, and cable tray supports.

2.1. Implementation

2.1.1. General

Cable tray and basket systems shall be top rung type and shall be installed with rung-caps sized to meet or exceed cable fill requirement.

Wall-mounted cable tray of similar manufacture may be presented to CommTech Engineering as a proposed alternative if field conditions dictate.

Intersections, bends, tees, etc. shall use fittings of the same type and model series as straight run sections.

Cable tray system sections shall be joined using only manufacturer-supplied prefabricated splice plates.

Blind end plates shall be provided for trays that dead end. Full width dropouts shall be provided where cables exit from trays.

Nicks, scratches and ends of cut sections in galvanized components shall be deburred and coated with a cold galvanizing compound after tray installation. Application of cold galvanizing compound shall be performed in a manner to produce a smooth finish and in accordance with the manufacturer's recommendations.

2.1.2. Accessibility

Tray system shall be easily accessible and with at least 12" of space maintained about the top and sides of cable trays to permit access for installation and maintenance of cables.

Contractor shall utilize cable tray manufacturer's hardware to accomplish bends and intersections. Connections shall maintain full accessibility and full use of both sides of cable tray once installed.

2.1.3. Expansion

Contractor shall install a set of manufacturer-prefabricated expansion splice plates at intervals of 48 ft in straight runs and where cable tray systems cross building expansion joints.

Contractor shall provide a minimum of one (1) expansion splice plate in straight runs which exceed 12 ft for tray installations in exterior areas.

2.1.4. Support

Trapeze hangers are not permitted to support cable tray systems unless required by field conditions.

Cable tray shall be supported by threaded rods that comply with manufacturer's recommended support and loading requirements.

Total vertical tray deflection shall not exceed manufacturer's recommendations.

Cable shall be equally distributed between both sides of the cable tray to equally distribute weight of cables.

2.2. Grounding

Each cable tray system subassembly shall be connected to building ground as described in section CIG-03.

CIG-08 - Power Poles, Floor Boxes, and Poke Throughs for Communications Systems

1. General

This section provides direction to designers and contractors for new construction and renovation projects for the installation of power poles, floor boxes, and poke throughs for Communications Systems. These devices are typically utilized to provide communications cabling to classroom podiums, conference room tables, and modular furniture.

CIG-09 - Surface Raceways for Communications Systems

1. General

Surface raceways are intended to provide a pathway, physical protection, and support for communications cabling. Surface raceways are typically installed in laboratory or classroom environments to route communications cabling on solid walls and ceiling structure. The use of surface raceway is discouraged except in instances where internal wiring is impractical.

2. Execution

2.1. General

Surface raceways shall be sized for the number of connections required per the manufacturer's requirements.

Surface raceways shall be installed with factory fittings to maintain proper cable bend radius and provide physical separation from electrical wiring.

2.2. Coordination with Electrical Contractor

If the raceway is installed by an electrical contractor (by code or contractual requirement) then the electrical contractor shall provide the faceplates to the communications contractor.

CIG-10 - Underground Ducts and Raceways for Communications Systems

** See CIG-39 – Auxiliary Networks & Devices section 3.1 for information on underground conduit for single devices and small-scale exterior underground pathway.*

1. General

In order to preserve the historic aesthetic of the campus, nearly all utilities and services are underground. The University is its own utility service provider for electricity, steam, chilled water, storm water and telecommunications. Electrical primary cables, electrical secondary cables and telecommunications cables are routed underground in a network of manholes and concrete-encased ducts.

The Communications Technology (CommTech) office of UNC's Information Technology Services is responsible for telephone, CATV and computer network connections, including the majority of the University's underground communications cable plant. While ITS CommTech administers this cable plant, it is the Electric Distribution System (EDS) division of the campus Energy Services Department that administers the underground pathways in which the cable plant resides. EDS plans, installs, repairs and maintains the campus electrical and communications duct bank and manhole network. CommTech and EDS maintain a formal interdepartmental agreement that describes the technical scope and terms of their relationship.

University documents supporting this section of the CommTech guideline can be found at the UNC Facilities Design Guidelines website:

- https://facilities.unc.edu/resources/design-guidelines/

The above design standards are to be strictly adhered to regardless of the circumstance or purpose of the parties engaged in duct bank design, construction, or use. Furthermore, these design standards are to be used when planning, designing, and constructing telecommunications duct bank system including but not limited to the following system components.

2. Execution

Execution of duct bank design and construction shall include coordination of exterior duct bank construction with EDS and in-building routing with CommTech Engineering.

2.1. Service Entrance Facilities:

Campus buildings and facilities are generally fed by a duct bank lateral from the primary duct back distribution trunks throughout campus. These laterals are comprised of more granular conduit systems than the trunks. CommTech Engineering will identify the closest manhole for each facility and the Designer shall develop plans for getting from that point to the building. Generally, the duct bank should terminate directly in the building's service entrance room (SER). However, in some cases it may be necessary to for the duct bank to transition to a conduit system and traverse a Service Entrance Passthrough (SEP). Use of a SEP must be approved by CommTech Engineering.

2.2. Communications Manholes:

All communications manholes shall be constructed in accordance with the plan and section view drawings in the UNC-Chapel Hill University Design and Construction Guidelines. All new manholes shall be fitted with cable racking hardware.

2.3. Service Entrance Ducts:

Unless specifically directed by the UNC-Chapel Hill ITS-Communication Technologies Office, all new buildings will be designed with a minimum quantity of four 4" entrance conduits. These conduits will be of rigid metallic construction or 4" Schedule 40 PVC encased in concrete, as determined by CommTech Engineering and EDS. These entrance conduits shall extend from a communications manhole, designated by CommTech Engineering, to the service entrance room in the building.

No more than two 90-degree bends between the manhole and the building will be permitted.

All conduits and inner ducts shall be installed with marked pull tapes.

The service entrance conduits shall appear and be positioned in the right rear corner of the SER, 4" from the rear wall and shall be stubbed 4" above the finished floor, unless otherwise approved by CommTech Engineering.

Plastic bushings shall be installed on each entrance duct. The use of LB, LL, or LR fittings will not be approved. All metallic entrance conduits shall be installed in accordance with the National Electrical Code.

If the service entrance ducts emerge in the building prior to their termination point in the building SER, they should transition to metallic conduit (if PVC) per the NEC. If the distance between the point of transition and the building SER exceeds 50 ft, then at least one of the quantity of exposed entrance conduits MUST be rigid. Contractor shall consult with CommTech Engineering when special pull boxes or junction boxes are required.

2.4. Duct Bank between Manholes:

Reference UNC EDS requirements for manholes and duct bank for a more complete description of duct bank construction practices. Special thermal protection design considerations must be employed when telecommunications duct bank crosses or runs in same vicinity as steam lines. See the University guidelines for infrastructure in proximity to steam lines.

2.5. Acceptance of Duct Banks:

All duct banks both from the manhole to the building, and between manholes shall be inspected and approved by either the State Construction Office Electrical Inspector or an Electric Distribution Systems representative (by mutual agreement between the two) or BOTH prior to the placement of any concrete. When utility extensions are required as a part of the scope of work for a capital building project, the Designer of Record shall reference the guidelines published for Electric Distribution Systems.

CIG-11 - Rooftop Access for Communication Systems

1. General

Rooftop access for communications systems is a growing requirement at UNC-CH, particularly in support of RF applications. Building roofs may host towers for point-to-point microwave, cellular telephony, and related applications. As a result, UNC-CH requires rooftop access readiness as a general requirement for buildings in anticipation of future needs.

2. Execution

All new building and complete renovation project designs shall provide some level of rooftop cabling access system assembly as part of design components. The minimum access shall be two (2) penetrations of 2" diameter each, however, access assemblies may range in complexity from simple weather head / pitch-pocket assemblies to fully engineered rooftop "huts." The Designer of Record shall discuss the rooftop access requirements for each project early in the design phase to have a good understanding of the programming requirements.

Type, quantity and location of cable access devices shall be determined by function of building and in consultation with CommTech Engineering

In a renovation, the contractor shall be required to work with the original roofer in an effort to maintain the roof warranty.

All work shall be inspected by UNC Facilities Services prior to project acceptance.

CIG-12 - Utility Poles for Communications Systems

1. General

To provide the best physical cable protection and for aesthetic appearances, utility poles for communications system are typically not allowed on the UNC Chapel Hill campus. There may be instances on capital projects where a temporary aerial segment of fiber optic or telephone cable is required as a work-around during site preparation and that cable segment will be removed as soon as the buried duct bank system is completed and the permanent fiber optic and telephone service has been restored. In capital projects where a temporary aerial segment of cable is required to maintain telephone and network connectivity the project is responsible for all design, installation, and cut-over costs associated.

CIG-13 - Identification for Communications Systems

1. General

This section describes labeling requirements for communications systems. Labeling is a critical requirement and should be attended to in detail.

2. Execution

The Designer of Record shall communicate with CommTech Engineering to obtain precise naming details for communications systems components, and these names shall be used on all drawings.

The University prescribes a detailed labeling methodology. When the University's cable identification methods do not specify format, cable identification method shall comply with TIA-606-B as a minimum and be coordinated with the University's Representative.

Unless otherwise specified, professional, non-erasable, adhesive, machine-printed labels shall be used and bear the approved cable identification method. Labels for stainless steel faceplates shall be clear adhesive type with black lettering.

2.1. Buildings and Rooms

Building IDs and room numbers are assigned by UNC Facilities. The Contractor should check with the UNC project manager to ensure the proper building ID and room numbers are used when labeling communications systems components. Note that the Building ID is generally a 3-digit code. This should always be used instead of the common name, which can change.

2.2. Racks

Racks in TRs shall be labeled sequentially starting with 1. The label shall be machine generated, at least 1.5" high and have black letters on a white background. The label shall be plastic or vinyl and adhered to the upper right corner of the rack if possible.

2.3. Risers

All riser communications cabling such as single mode OS2 fiber and 0.500" coax trunk shall be labeled on each end. This is to include originating and terminating Telecom room information, individual fiber strand, and riser patch panel port information. Riser patch panel labeling shall be consecutive.

2.4. Fiber Optic Cabling and Systems

Fiber optic cables and segments have a long lifespan at the University and must conform to University labeling requirements to support identification and computerized management systems already in place.

2.4.1. Segments

2.4.1.1. Naming

A fiber segment is a jacketed set of fiber optic cables, themselves generally enclosed in buffer tubes. A fiber segment is intended to represent the physical cable itself, irrespective of mid-span connections. Mid-spans are given their own segment name. Segments are assigned a unique index of the form:

FS.index

FS indicates that the cable is a fiber optic cable segment. Index is a unique integer. Index does not include leading zeros.

Examples:

FS.400

FS.32

FS.1022

Note that in the campus fiber GIS web map, each portion of a cable segment must be renamed whenever an existing cable is spliced in order to maintain unique names. By convention, these segments shall be renamed with a lowercase alphabetic postfix, segment.a, segment.b, etc. This index shall not be carried into the field on labels but is an internal GIS issue only.

Examples:

FS.400.b – indicates the second segment of cable FS.400.

2.4.1.2. Labeling

Cable segments shall be labeled within 24 inches of any entrance or exit to a conduit, splice enclosure, patch panel, manhole, hand hole, or other transition from visible to concealed location.

All external labels shall be constructed of embossed stainless steel tags. Internal labels shall be made of plastic and machine-generated.

The label shall indicate the segment number.

2.4.2. Individual Fibers

2.4.2.1. Naming

Individual fibers are referred to by the segment name, followed by a fiber identifier. The fiber identifier may either be an index, starting with 1, or a fiber color indicator as specified in TIA-598-C.

Both naming forms are acceptable. In general, the color form is more useful for macro-level design drawings and communications with field technicians. The index form may be more useful when referring to specific fibers singled out from a bundle.

The syntax is of the index form is:

segment.index

The syntax is of the fiber color indicator is:

segment.buffer_tube.strand_color

Examples:

FS.400.1

FS.400.blue.blue // equivalent form of FS.400.1

FS.32.144

FS.32.aqua.aqua // equivalent form of FS.aqua.aqua

2.4.2.2. Labeling

Individual fibers are not generally labeled.

2.4.3. Patch Panels

2.4.3.1. Naming

Patch panels are assigned a unique numeric number of the form:

FP.building_number.room.index.[module].[port]

The *building_number* element is the official UNC building number. The *room* element is the room number where the patch panel is located. Note that leading zeros shall only be included if included in the official building or room name in the EIS documentation. The *index* element distinguishes between multiple patch panels in the same room. Indices start at 1 for the first patch panel in each room and increment. An index of 1 is required in the name even if there is only a single patch panel in the room. The *module* is a letter indicating the module or card number in the panel frame. The *port* element is the specific

port on the patch panel. Note that module port numbers are not needed when naming patch panels, but are included when specifying individual ports for patching or termination purposes.

Examples:

FP.039.29.3 – indicates a patch panel in ITS Phillips (building 039), room 29, patch panel number 3.

FP.625.2905.2.G.5 – indicates a patch panel in ITS Manning (building 625), room 2905, patch panel #2, module G. port 5.

2.4.3.2. Labeling

All patch panels shall be labeled to indicate the patch panel name. Labels shall be machine-generated, high contrast and between 1/2" and 1" high.

2.4.4. Splice Enclosures

2.4.4.1. Naming

Splice enclosures are named according to the form:

FE.location.room.index

The location element is generally the building number, but if MH is present it indicates instead that the location is a manhole. This taxonomy can be extended to include other structures (e.g. TW for tower, etc.) The room element is the room number in which the splice enclosure is located. If MH is present in the location field, then the room element shall be populated with the manhole name.

Examples:

FE.039.29.1 – Indicates fiber enclosure #1 in room 29 of Phillips Hall.

FE.MH.U11-B.1 – Indicates fiber enclosure #1 in manhole U11-B.1

Note that there is a potential name space collision if Facilities ever changes the namespace for building numbers.

2.4.4.2. Labeling

Splice enclosures in manholes and exposed areas shall be labeled on their exteriors with embossed stainless steel tags. Interior splice enclosure labels shall be constructed of plastic and be machine-generated.

2.4.5. Splice Trays

2.4.5.1. Naming

Splice trays names are optional and can be specified by appending a number index to the fiber enclosure name.

Example:

FE.039.29.1.4 – Indicates the 4th splice tray in fiber enclosure #1 in room 29 of Phillips Hall.

2.4.5.2. Labeling

Splice trays may be optionally required to be labeled by Engineering using a machine-generated plastic label. Because of space constraints the label may exclude the full fiber enclosure name and simply display the index (e.g. 1, 2, 3, etc.)

2.5. Copper Data Cabling and Systems

2.5.1. System Drawings

Contractor shall provide three (3) sets of drawings marked with jack numbers. Drawings shall also be provided on a CD in AutoCAD format. One set of cable drawings shall be installed in each telecommunications room. This is a pre-construction submittal requirement due 120 days prior to beneficial occupancy.

2.5.2. Labeling

All cable shall be labeled both at the outlet and the patch panel with an alpha/numeric identification code using the following format: (T-1) indicates telephone one, (T-2) indicates telephone two, (D-1) indicates data one, (D-2) indicates data two, (R-1 indicates riser one, R-2 indicates riser two) etc. In the event a floor is served by more than one Telecom room due to cable distances exceeding 90 meters or other physical restraints, each communications outlet shall be labeled with serving Telecom room number.

Communication outlets served from a TR not on that floor or where more than one TR is required per floor shall be labeled with the serving TR room number on the telecom outlet faceplate.

Each horizontal cable shall be labeled within 6” of cable termination.

2.5.3. Data Horizontal Cabling

2.5.3.1. Cable Destination Chart

Each TR shall contain a Cable Destination Chart that shows the room number destination of each cable leaving that TR. The Cable Destination Chart shall be printed on 8.5” x 11”

paper, placed in a clear, plastic sleeve, and hung from the primary rack housing patch panels.

Additionally, Contractor shall submit a chart of installed cables in Microsoft Excel spreadsheet (or .csv) format.

The chart shall have one worksheet for each TR showing the destination label of each cable as indicated on the faceplate. All worksheets for a building shall be integrated into a single building spreadsheet. The name of the worksheet shall be the TR room number. A sample is shown below.

Termination	Room Number
D100	G013
D101	G013
D102	G015
D103	G015
D104	G110

2.5.3.2. Data Patch Panels

48 port Category 6A data patch panels shall be labeled consecutively beginning with port 1 through 48. Subsequent patch panel port shall be labeled 49-96, 97-144 etc.

2.5.4. Voice Cabling and Systems

Voice connections requiring analog service for Life Safety such as Fire Alarm lines, Elevator Phones, and Emergency Phones shall be labeled with standard "T" numbers at each end. Where voice cables are terminated on 66M1-50 terminating blocks in the Telecomm room, those "T" numbers shall be supplemented with additional labeling on the 66M1-50 termination identifying where each cable is utilized. For Fire Alarm lines “FA-1 / FA-2”, for Elevator phones “Elev 1 / Elev 2”, and for Emergency phones “Emer 1 /Emer 2”.

2.6. 2.6. Hand Holes

Each hand hole shall include a unique, weather-proof label affixed to the top surface. ITS Communication Technologies maintains a registry of hand hole labels and will provide the exact label text upon request. In general, labels are of the form:

UNC-ITS 919.962.4357

HH.xxxx

In this example “HH” indicates hand hole and “xxxx” is the unique hand hole identifier provided by ITS. ITS Communication Technologies Engineering keeps these records in its shared storage space under “Tools/Handhole Master List.xls”. The telephone number is included in the label to assist technicians in the field.

CIG-14 - Schedules for Communications

The Designer of Record is responsible for including the identified components (or their equivalents) in the design package.

The Designer of Record is responsible for ensuring that all components are properly justified, along with the identification of acceptable alternates, in compliance with all State of North Carolina purchasing regulations and North Carolina General Statue §133-3 in particular.

Components and approved vendors are listed by section/functional area.

Preferred products are listed below.

1. Preferred Products

The University strongly prefers the components listed in the following table.

#	Category	Manufacturer	Part Number	Description
1	Cable Management	Hubbell	ECMBR3	Rear mounting bar, 19" X 3", offset, rack mount
2	Cable Management	Panduit	CMPHH2	Cable manager, horizontal, D-rings, installed on panel, 3.5"H x 19.0"W x 5.7"D, front only, 2U
3	Cable Management	Panduit	WMPV45E	NetRunner vertical cable manager
4	Cable Management	Wiremade	As required	Cable basket/tray
5	Connector	Corning-Gilbert	GF-6-AHS-USA	RG-6 type-F connector, crimp on
6	Connector	Corning	95-200-99	Fiber optic connector, Corning Unicam High-performance Connector, type-LC, single-mode (OS2), UPC, ceramic ferrule, blue housing, blue boot
7	Connector	Corning	CCH-CP12-A9	Fiber optic panel, Corning Closet Connector Housing Panels (CCH-CP), duplex type-LC adapters, UPC, 12 fiber, single-mode (OS2)
8	Connector	Hubbell	SFFX	Type-F coaxial connector faceplate insert, Office White
9	Connector	Hubbell[1]	HJU6AR	Category 6A keystone jack with Cobra-Lock termination, red
10	Connector	Leviton[1]	6AUJK-RR6	Category 6A keystone jack, red
11	Connector	Ortronics[1]	KT2J6A-42	Category 6A keystone jack, red
12	Connector	Hubbell[1]	HXJDC25	Data jack dust cover (25 pack)
13	Connector	Leviton[1]	51084-ICN	Data jack dust cover (50 pack)
14	Connector	Ortronics[1]	20309155	Data jack dust cover (100 pack)

15	Connector	Siemon	S66M1-50	50-pair type-66 block
16	Enclosure	Corning	PCH-04U	Fiber optic enclosure, Corning Pretium Connector Housing (PCH), black, 4U, accepts twelve Corning CCH connector panels
17	Enclosure	Corning	PCH-02U	Fiber optic enclosure, Corning Pretium Connector Housing (PCH), black, 2U, accepts four Corning CCH connector panels
18	Enclosure	Corning	PCH-01U	Fiber optic enclosure, Corning Pretium Connector Housing (PCH), black, 1U, accepts two Corning CCH connector panels
19	Faceplate	Hubbell[1]	IFP160W	Keystone faceplate, 6-port, white
20	Faceplate	Hubbell[1]	SFB10	Blank faceplate insert, white
21	Faceplate	Leviton[1]	IM2IA5W	Keystone faceplate, 6-port, white
22	Faceplate	Leviton[1]	41084-0BW	Blank faceplate insert, white
23	Faceplate	Ortronics[1]	IMF2W	Keystone faceplate, 6-port, white
24	Faceplate	Ortronics[1]	KSB10	Blank faceplate insert, white
25	Surface Outlet Box	Hubbell	HSB2WP	Plenum-rated surface-mount outlet box, 2-port, white
26	Fiber Optic Cable	Corning	012E81-33131-24	Corning MIC tight-buffered cable, riser rated, 12-fiber, single-mode (OS2)
27	Innerduct	Carlon	CG4X1C	Corrugated innerduct, plenum-rated, 1¼", orange, w/ pull tape
28	Patch Panel	Hubbell[1]	UDX48E1U	48-port unloaded flat panel, 1U
29	Patch Panel	Leviton[1]	49255-Q48	48-port unloaded flat panel, 1U
30	Patch Panel	Ortronics[1]	SPKSU48	48-port unloaded flat panel, 1U

31	Category 6A Plenum Cable	Berk-Tek[1]	11101255 or 11082058	Berk-Tek LANmark-XTP, White, Category 6A UTP, CMP
32	Category 6A Riser Cable	Berk-Tek[1]	11082063 or 11101258	Berk-Tek LANmark-XTP, White, Category 6A UTP, CMR
33	Category 6A Plenum Cable	Hubbell[1]	C6ASPDSW or C6ASPPDSW	Leviton NEXTSPEED Ascent, White, Category 6A UTP, CMP
34	Category 6A Riser Cable	Hubbell[1]	C6ASRDSW or C6ASPRDSW	Leviton NEXTSPEED Ascent, White, Category 6A UTP, CMR
35	Category 6A Plenum Cable	Superior Essex[1]	6H-246-4B or 6H-272-4B	Superior Essex 10Gain XP, White, Category 6A UTP, CMP
36	Category 6A Riser Cable	Superior Essex[1]	6H-246-4A or 6H-272-4A	Superior Essex 10Gain XP, White, Category 6A UTP, CMR
37	Coaxial Cable	CommScope	5401803	75-ohm trunk cable, size-.500 CommScope P3 500 JCAR black, flame retardant PE jacket, riser-rated (CATVR)
38	Coaxial Cable	CommScope	5781R	75-ohm coaxial cable, type RG-6, quad shield, 60% braid, riser-rated (CMR)
39	Coaxial Cable	CommScope	2227V	75-ohm coaxial cable, type RG-6, quad shield, 60% braid, plenum-rated (CMP)

[1]Note: Category 6A products and related patch panels and outlet assemblies shall be used only in the following combinations: Hubbell cable with Hubbell connectivity; Berk-Tek cable with Leviton connectivity; Superior Essex cable with Ortronics connectivity.

CIG-15 - Communications Entrance Protection

1. General

Cables that enter a building from outside require electrical surge protection. Generally, communication cables that enter a building are provided by service providers under contract with the University. It is therefore not the responsibility of the Designer of Record to provide communications entrance protection for capital construction projects and renovations. However, it is the responsibility of the Designer of Record to coordinate with the owner and service provider to ensure that adequate space exists in telecommunications areas for protective equipment.

CIG-16 - Communications Cabinets, Racks, Frames, and Enclosures

1. General

Communications cabinets, racks, frames, and enclosures are intended to provide physical protection and mounting support for active and passive communications hardware.

2. Execution

Communications cabinets, racks, frames and enclosures shall be grounded and bonded as described in section CIG-03.

All cabinets, racks, frames, and enclosures shall be installed according to manufacturer's recommendations, including secure mounting to the floor or other structure as appropriate.

2.1. Equipment Racks

Owner's preferred item: Hubbell Part No. HPW84RR19 or equal.

Racks shall be constructed of aluminum and painted in black at the factory.

Channel uprights shall be spaced to accommodate industry standard 19" mounting.

Each rack shall be supplied with spare screws.

Each rack shall be 84" in height and shall be self-supporting.

Each rack shall be double-side drilled and tapped to accept 12-24 screws.

Uprights shall be drilled on the back to accept cable brackets, clamps, power strip(s), etc.

2.2. Cable Management for Equipment Racks

Owner preferred rear horizontal manager Hubbell ECMBR3. Rear managers shall be placed above and below each data patch panel.

Owner preferred vertical wire management bracket OCC part number VCM6 or equal. Vertical wire manager shall be placed between each equipment rack.

2.3. Placement

Final placement of telecommunications components shall be determined by CommTech during an on-site meeting.

CIG-17 - Communications Termination Blocks and Patch Panels

1. General

Communications termination blocks and patch panels are utilized to terminate voice, data, security and signaling cable with the purpose of identification, patching and cross-connection of passive communications cabling.

2. Execution

Termination blocks and patch panels shall be installed per Designer's detailed telecom room layout drawings and as directed by UNC ITS Engineering at the pre-installation meeting and throughout the duration of the project.

Provide front and rear horizontal cable management and vertical cable management as directed in section CIG-18 Communications Cable Management and Ladder Rack.

2.1. Copper Cabling for Data

All copper data cabling shall be Category 6A.

Each data station cable shall be terminated in a patch panel as specified in CIG-14. Patch panels supporting station cabling shall be mounted in 7' floor rack dedicated to horizontal/station cabling. Horizontal (rear and front side) and vertical cable management devices, as indicated and listed in CIG-18, shall be installed on those floor racks carrying horizontal/station cable termination patch panels.

2.2. Copper Cabling for Voice

All copper voice cabling shall be Category 6A. All voice riser/backbone cables shall terminate in a "riser cable field" on a 66M1-50 terminating block. Each 66M1-50 terminating block shall be secured to an 89D mounting bracket which in turn shall be secured to a 183A1 metal mounting backboard. Location or placement of the "riser cable field" shall be as indicated on project drawings/details and/or as directed by UNC-Chapel Hill – ITS-Communication Technology representative(s).

Provide sufficient 66M1-50 termination blocks to terminate all voice pairs to be located in each equipment room. Mount blocks on 183 series metal backboards with 89D brackets. Use 187B1 metal backboards with mushroom spools for wire management. Backboards shall be double stacked vertically.

Each voice station/horizontal cable shall be terminated in a "station cable field" on a 66M1-50 terminating block. Each 66M1-50 terminating block shall be secured to an 89D mounting bracket which in turn shall be secured to a 183A1 metal mounting backboard. Location or placement of the "station cable field" shall be as indicated on project drawings/details and/or as directed by UNC-Chapel Hill – ITS-Communication Technology representative(s).

2.3. Fiber Optic Cabling

Fiber Optic Patch Panels and coupling assemblies shall be installed at the MDF and IDFs. Blank covers for unused coupling assembly spaces in panels. Assembly spaces shall be utilized in consecutive order, without skipping module spaces.

Panels shall be enclosed assemblies affording protection to cable subassemblies and terminated fiber strand ends. Enclosures shall incorporate hinged or retractable front cover designed to protect

Mount patch panels and horizontal cable management in 19" equipment racks.

See CIG-14 for preferred optical products.

3. Testing

All communications cabling system components shall be tested per section CIG-02.

CIG-18 - Communications Cable Management and Ladder Rack

1. General

This section provides direction to designers for new construction and renovation projects for the installation of communications cable management and ladder rack. Communications cable management and ladder rack are utilized to route voice and data cabling in telecom rooms for the purpose of providing routing and support for communications cabling.

2. Execution

2.1. Ladder Rack

Ladder rack shall be black in color and sized based on the projected amount of cable it supports.

Ladder rack shall be grounded per CIG-03.

Cable runway shall be tubular stringer style B-Line SB-17-18, or approved equal.

Cable Runway shall be constructed of 0.065” thick steel and utilize tubular stringers to support rungs.

Cable Runway stringers shall be 1-1/2" high. Rungs shall be welded to stringers and shall be spaced 9" on center.

Cable Runway width(s) shall be 12" unless otherwise noted on drawings.

Cable Runway shall be UL Classified. Black Powder Coat is an acceptable color option for ladder runway.

Cable runways shall be supported from the wall, using hardware from cable runway manufacturer specifically intended for that purpose, with 4” separation from edge of tray to the edge of mounting wall.

2.2. Cable Management

Cable management for racks shall include both vertical and horizontal components.

2.2.1. Vertical Cable Management

Vertical Cable management shall be 6” wide, 7’-0” tall, double sided, with black finish and “D” rings approximately 8” on center.

- Approved products: Panduit, Superior Modular Products, Ortronics, or Chatsworth.
- Owner’s preferred item: Panduit WMPV45E.

2.2.2. Horizontal Cable Management (Front of Rack)

Horizontal Cable Management (front of rack) shall be 3.5” high, 5.7” deep, 19” wide, two rack unit device with four horizontal split distribution (“D”) rings.

- Approved products: Panduit, Superior Modular Products, Ortronics, or Chatsworth.
- Owner’s preferred item: Panduit CMPHH2.

2.2.3. Horizontal Cable Management (Front of Rack)

Horizontal Cable Management (rear of rack) shall be 3” high, 3” deep, 19” wide, device with cable management fingers, cable pass-throughs and hinged solid cover.

- Approved products: Hubbell, Panduit, Superior Modular Products, Ortronics, or Chatsworth.
- Owner’s preferred item: Hubbell ECMBR3.

CIG-19 - Communications Equipment Rooms

1. General

This section provides direction to designers and contractors for planning and constructing a telecommunications room (TR). It covers general configuration details for the room, including size, materials, and power requirements.

This section applies to Main Distribution Frame (MDF) and Intermediate Distribution Frame (IDF) rooms.

2. Systems Housed

Due to tightly restricted room access policies, telecommunications rooms shall be dedicated for ITS systems only and no other systems shall be permitted to be housed therein, including but not limited to Audio/Visual systems, Access Control/Security systems, Building Management systems, Fire Alarm systems, and Distributed Antenna (DAS) systems not owned and operated by ITS.

To the extent that other systems may require substantial connectivity to the ITS campus network, those systems may be housed in adjacent spaces with cabling pathways leading directly into TRs (see CIG-39, Section 2). Secure adjacency may also be established in a combined room through the use of cage walls or other separators, as long as the ITS-side equipment spaces meet the requirements outlined herein and access is controlled and restricted to ITS personnel only.

3. Execution

3.1. Physical

TRs shall be 10’ X 10’ minimum in size to support two data racks, 10’ x 13’ minimum where a third data rack will be installed, and an additional 3 ft. shall be added to room length for each additional data rack beyond two (i.e., room length shall equal 4 ft. plus 3 ft. per data rack).

TRs shall be “stacked” vertically between floors wherever possible.

Buildings with multiple floors shall have a separate TR for each floor. per floor.

TRs shall be centrally located to limit cable distances. TR placement shall limit installed cable distances to a maximum of 90 meters. Multiple TRs may be required on a floor to meet this requirement. For planning purposes, the service radius of a TR shall be considered to be 180 linear ft.

TR floors, walls, and ceilings shall be treated to minimize dust. Finishes shall be light in color to enhance room lighting. Concrete floors shall be covered with a sealant/epoxy finish designed specifically for anti-static properties.

3/4" AC grade plywood shall be installed on all walls from the floor to 8' AFF and painted white with fire-rated stamp taped off for building inspector approval. Plywood shall be attached to walls utilizing flush-mounted hardware.

Entry doors to TRs shall open outward.

Buildings with tenants not associated with UNC shall have a dedicated and securely divisible TR on each floor for tenants.

Ceiling height shall be minimum 8' clear, without obstructions, with 10' being preferable to accommodate larger frames and overhead pathways. For maximum flexibility and accessibility, suspended ceilings shall be omitted in TR rooms.

TR doors shall have UNC ONE CARD access reader and door locks installed. Access to TRs shall be restricted to authorized ITS personnel only.

3.2. Environmental

TRs must maintain continuous and dedicated 24 hour/ 365 days TR environmental control not to be affected by building HVAC shut down. Branch electrical circuits serving TR environmental control equipment shall be fed from building emergency generator/ building UPS if available. Environmental control shall maintain positive pressure with one air change per hour required.

3.3. Power Requirements

Power to TRs shall be delivered as follows:

Building power allocated for IT network operations shall be planned based on a minimum of one watt per gross square foot (1W/GSF) of building floor area.

All components of the IT power system, including transformers, shall be dedicated to IT power only and shall not be permitted to be shared with any other loads.

Power panels serving IT equipment shall be located within Telecommunications Rooms (TRs) and shall not serve non-IT functions, as TR access will be restricted.

In buildings with multiple TRs, each TR shall be equipped with a separate electrical power panel. All IT power panels shall be capable of providing 208VAC, 3-phase power.

Regardless of initial requirements, the IT transformer and all IT panels and riser conduits shall be sized to eventually support up to 200A service in each TR.

IT rack power shall be supported by a building generator/UPS where available. At minimum, to support critical functions, two 120VAC, 20A circuits on building generator/UPS shall be provided in each TR and shall be clearly differentiated from non-generator/UPS circuits.

At minimum, rack power for each TR shall consist of the larger of either two dedicated 120VAC, 20A circuits per equipment rack, or one 120VAC, 20A circuit per 5000 GSF served by that TR, with all outlets served from the local IT power panel within the same TR.

In rare cases where building conditions make it impractical to serve IT rack circuits from a dedicated panel, each serving circuit breaker shall be fitted with a mechanical breaker lock to prevent the circuit from being inadvertently switched off.

All rack power outlets shall be mounted to the cable runway above the IT rack row, facing rearward, relative to rack positioning.

In addition to rack power receptacles, each TR wall shall be furnished with convenience power outlets at 18" AFF such that no wall location is greater than six feet from an outlet, or as otherwise required by applicable code. Convenience outlets may be on shared building power.

All receptacles shall be duplex NEMA 5-20R, and all outlets shall be equipped with steel cover plates.

All power outlets shall be clearly labeled with the circuit number from the local, in-room panel. For outlets described in Sections 2.3.7 and 2.3.9, labeling information shall include the panel room number, panel number, and circuit number.

Each equipment rack shall be furnished with one power strip / surge protector with a minimum six rear-facing outlets and a 15-foot input cord, Legrand/Wiremold Perma Power R5BZ20-15 or approved equal. Power strip / surge protectors shall be delivered to the CommTech Engineering project manager.

3.4. Bonding and Grounding

All equipment and cable shields shall be properly bonded as described in CIG-03.

The TMGB shall be mounted at 7' 6" AFF in the MDF.

The TGB shall be mounted at 7' 6" AFF in the IDF.

3.5. Lighting

Provide adequate lighting fixtures to provide a minimum 538 lux (50 footcandles) measured at 1 meter AFF. Lighting fixtures shall be mounted at a minimum of 8.5" AFF and be fitted with wire guard to prevent accidental bulb damage.

TR lighting circuits shall be on emergency power if available.

3.6. Fire Protection

Provide fire sprinkler pipes per applicable code requirements. Where sprinkler heads are installed, install wire sprinkler cages to prevent accidental operation. Drainage troughs shall be installed to prevent equipment damage in the event of accidental leakage.

TRs shall not be located below potential sources of flooding like restrooms, roof drains, or kitchens.

All penetrations shall be firestopped as described in CIG-04.

3.7. Equipment Racks

TRs shall be fitted with a minimum of three (3) equipment racks with front and rear horizontal and vertical cable management as detailed in section CIG-16 Communications Cabinets, Racks, Frames, and Enclosures.

3.8. Cable Pathway in TRs

A minimum of four (4) 4” conduits are required from the serving manhole to the SER. In the event that the conduit distance exceeds 50’ from serving manhole to SER, one 4” conduit shall be Rigid Galvanized Steel (RGS).

Horizontal cable trays and sleeves shall enter TR no lower than 7’6” and no higher than 10’. Cable trays, horizontal and vertical sleeves shall extend 4” into TR. Conduits and sleeves entering TRs shall have screw-on type bushings. Vertical sleeves shall be 4” off wall and trimmed to 4” AFF of TR that sleeve stubs up into and 10’ AFF of TR that sleeve stubs down into.

Cable runway shall be tubular stringer style, B-Line SB-17-12 or equal, constructed of 0.065” thick steel and utilizing 1-1/2” x 3/8” tubular stringers to support cross members (rungs) welded at 9” intervals.

Cable runway width(s) shall be 12" unless otherwise noted on drawings. Minimum cable runway width shall be determined based on a maximum fill of 50%. Provide runway and accessories necessary for a complete system.

Provide cable radius drops above all vertical cable managers—typically two mirrored drops per vertical manager to provide proper radius control for cables routed from both directions. Fasten runway to top of equipment racks with brackets/hardware designed for the purpose. Mount runways a minimum of 6” above equipment racks to allow radius drops to be effective.

Provide wall support kits to support runway from building walls and provide cable runway support kits to secure runway to equipment rack. Mount runway to be min. 4” from walls.

3.9. Cabling

Velcro style reusable self-gripping cable ties shall be used to route and secure communications cabling in the PDR/SDR.

3.10. Cable Destination Charts

Each TR shall have a cable destination chart as described CIG-13 - Identification for Communications Systems, section 2.5.3.1.

CIG-20 - Communications Copper Backbone Cabling

1. General

Copper backbone cabling supports risers for legacy voice and Ethernet data connectivity.

2. Execution

2.1. Data

Installation of copper backbone cabling shall follow the same procedures as horizontal cable installation as described in CIG-25.

2.2. Voice

Installation of copper backbone cabling shall follow the same procedures as horizontal cable installation as described in CIG-25 except that Category 3 multi-pair riser cable shall be used.

3. Testing

All communications cabling system components shall be tested per section CIG-02.

CIG-21 - Communications Copper Cable Splicing and Terminations

1. General

This Section describes work associated with terminating copper UTP cable. For the purpose of this document, copper cable shall refer to Category 6A UTP cable used and installed for voice and data applications.

2. Execution

Splicing of copper UTP cables is NOT permitted for any permanent work.

2.1. At Faceplate

2.1.1. Data Cables

Each Category 6A data cable shall be terminated in a Category 6A jack. Jacks shall be wired as per TIA-568-C.0 using T-568B pinout. Data jacks shall be secured in faceplate in top and middle position on right side of six-position faceplate.

2.1.2. Voice Cables

In those faceplates where analog voice connections are required, each Category 6A voice cable shall be terminated in a USOC jack. Jacks shall be wired using T-568B pinout. Where a voice jack is required, it shall be secured in a wall telephone faceplate or in the top position on the left side of a six-position two-gang faceplate

2.2. In Telecommunications Room

Termination of cables in telecommunications rooms is described in section CIG-17 - Communications Termination Blocks and Patch Panels.

3. Testing

All communications cabling system components shall be tested per section CIG-02.

CIG-22 - Communications Optical Fiber Backbone Cabling

1. General

This section describes design requirements associated with the installation of building backbone/riser optical fiber cables. In general, Campus building Telecommunications Room cable riser systems shall be fitted with a single mode fiber riser system sized per building requirements.

2. Execution

All cable, equipment and hardware shall be arranged to provide a neat appearance and accessibility for servicing. Designer shall supply estimated loss measurements for each cable run.

2.1. Inner Duct

Fiber optic cabling shall be installed in 1-inch inner duct when:

- Installed in 4"conduit runs.
- Installed in cable tray.
- Installed in riser sleeves and spaces.

2.2. Riser Conduit Sleeve

Install all riser fiber optic cabling in a stacked riser conduit sleeve separately from the other riser cables. Completely utilize full placement capacities of each riser conduit sleeve before placing cable in the next empty conduit sleeve.

2.3. Splicing and Connection

Install fiber optic cable runs continuous and un-spliced, from outlet boxes to termination panels. Provide sufficient cable in each termination location to properly terminate cables.

2.4. Preparation of Interior Raceway Systems

Ensure that all cable tray, conduit and other confined routing are free and clear of all debris before cable placement.

Cable shall not be installed into conduit ends that are not reamed and bushed.

2.5. Specifications

Maximum allowable connector loss: 0.75dB

Maximum allowable splice loss: 0.3dB

2.6. Cable Identification

Cables shall be labeled as described in section CIG-13.

3. Testing

Link testing shall not include any components other than the cable and its connectors and splices.

3.1. Presentation of Test Results

Installation Contractor shall utilize test equipment capable of saving results in electronic and printed form. Test results shall be presented in PDF form. Test results shall be saved and labeled according to UNC naming conventions (see CIG-13), typically FS.[sheath_number].[strand_number]. For example, cable segment FS.801 shall have strands FS.801.1, FS.801.2, FS.801.3, etc. Contact CommTech Engineering for naming specifics prior to testing.

OTDR traces shall not show backscatter beyond the end of the fiber.

In addition to PDF requirements, OTDR traces shall be provide in digital form. Contractor shall supply CommTech Engineering with a fully-licensed copy of software capable of viewing the trace details.

3.2. Testing Requirements

Test equipment shall be within the calibration period recommended by the vendor in order to achieve vendor-specified measurement accuracy.

3.2.1. Power Meter Testing

Power meter testing shall be required of all fiber optic cable.

3.2.2. OTDR Testing

OTDR testing shall be required of all fiber optic cable exceeding 100m (328').

Traces shall be taken from both ends of the fiber.

Launch jumpers shall be used at each end of the fiber. Launch jumpers shall be 100m (328') in length.

Reflected ghost patters that obscure critical trace information are not permitted.

For each test, ensure that that traces are viewable at the same linear scale.

Traces shall be taken at 850nm and 1300nm for multimode fiber, and at 1310nm and 1550nm for singlemode fiber.

The OTDR pulse width shall be set small enough to resolve the launch cable connection to the fiber under test.

3.2.3. Unsatisfactory Test Results

Any measurements that show attenuation in excess of the calculated loss shall require the cable in question to be completely removed and a new cable to be installed at no expense to UNC.

CIG-23 - Communications Optical Fiber Splicing and Terminations

1. General

This section describes design requirements associated with the splicing and termination of optical fiber cable.

2. Execution

2.1. Connectors

Unless otherwise specified, fiber shall be terminated in duplex LC type connectors.

2.2. Patch Panels

Termination of cables in telecommunications rooms is described in section CIG-17 - Communications Termination Blocks and Patch Panels.

2.3. Splices

Splices are not allowed unless specifically requested and/or approved by CommTech Engineering.

3. Testing

See CIG-22 for testing requirements.

CIG-24 - Communications Coaxial Backbone Cabling

1. General

The University utilizes a hybrid fiber/coax system for CATV. Signals are delivered to a building via optical fiber and converted to coax in the PDF. The coaxial riser backbone system transports the CATV signal between floors.

2. Execution

A single segment of CommScope P3 500 JCAR or equivalent coaxial cable shall be installed between the MDF and each IDF. A 30-foot coil shall be left at each end (entering and exiting) of the cable segment(s).

3. Testing

No testing requirement.

CIG-25 - Communications Copper Horizontal Cabling

1. General

This Section details product and execution requirements for Horizontal Coaxial Cable for the University of North Carolina at Chapel Hill for both voice and data.

2. Execution

2.1. Cable Type

All horizontal cable for voice and data shall be Category 6A Unshielded Twisted Pair (UTP).

2.2. Cable Placement

Install cables splice-free unless otherwise specified.

Contractor shall provide all required installation tools to facilitate cable pulling without damage to cable jacket.

Pull all cable by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to insure that maximum tensile load for cable as defined by these specifications is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of “break-away” or other approved method.

Pull cables in accordance with cable manufacturer’s recommendations and NFPA-70. All cabling shall be installed in compliance with the latest edition of TIA- 568 and related standards. Manufacturer’s recommendations shall be part of cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cables bent or kinked to radius less than recommended dimension will not be allowed.

During pulling operation adequate number of workers shall be present to allow cable observation at all points of raceway entry and exit, as well as to feed cable and operate pulling machinery.

Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of type that is non-injurious to cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

Pull string (nylon; 1/8” minimum) shall be installed with cable installed in all conduits and innerducts. Pull strings shall be tagged in PDR and SDR and at each corresponding outlet to identify where the string terminates on each floor.

2.3. Cable Dressing and Placement

Cable tray shall be loaded equally.

Install cable in conduit or secured metal raceway system (enclosed wireway) in public areas or as designated on plans. All other routing, such as that found in typical MDF/IDF, shall be kept clear of other trades work and supported according to code utilizing overhead cable runway.

Cabling shall be neatly laced, dressed, and supported. Work not done to the satisfaction of the UNC - Telecommunications Office and the Designer shall be reworked at no cost to the Owner.

2.4. Damage

Contractor shall be responsible for identifying and reporting to Designer any existing damage to walls, flooring, tiles and furnishings in work area prior to start of work. Repair damage to interior spaces caused by installation of cable, raceway or other hardware. Repairs must match preexisting color and finish of walls, floors and ceilings. Replace any contractor-damaged ceiling tiles to match color, size, style and texture.

3. Testing

Testing shall be accomplished as described in CIG-02

CIG-26 - Communications Coaxial Horizontal Cabling

1. General

This Section details product and execution requirements for Horizontal Coaxial Cable for the University of North Carolina at Chapel Hill.

2. Execution

All horizontal coaxial cable and associated termination hardware shall be installed in compliance with an F-type connector.

3. Testing

All horizontal coaxial cabling shall be tested after termination for continuity, DC resistance, length, and attenuation sweeps from DC to 5000MHz.

CIG-27 - Communications Faceplates and Connectors

1. General

This Section provides direction with regards to communication outlet faceplates and connectors that typically are installed in those faceplates.

2. Execution

All faceplates and associated termination hardware shall be installed in compliance with TIA-568-C series standards.

Faceplates shall be labeled as describe in CIG-13.

3. Testing

All communications cabling system components shall be tested per section CIG-02.

CIG-28 - Communications Custom Cable Assemblies

1. General

Communications Custom Cable Assemblies are special and unique cable requirements above and beyond the standard building wiring specified in this document. These may include nursing station cables, audio-visual system cables, and specialty networking cables.

Unless otherwise specified for the project, Communications Custom Cable Assemblies are not the responsibility of the Communications Contractor.

See CIG-29 for patch cords, station cords and cross-connect wire.

CIG-29 - Communications Patch Cords, Station Cords, and Cross Connect Wire

1. General

Neither the Designer of Record nor the Contractor of Record is responsible for the following items. These will be provided by the University.

1. **Patch cords**: short cables that connect between two ports on the front side of a patch panel, or between patch panels.
2. **Station cords**: short cables that connect telephony instruments to a communication outlet.
3. **Cross connect wire**: short wires to interconnect telephony signals on punch-down terminals.

CIG-30 – Data Communications

1. General

Active electronics for data communications, including routers, switches, supporting UPS system, and related equipment are designed, procured, installed, and maintained by the University. The Designer of Record shall not provide work in this area.

2. Scheduled Access

Data communications is a fundamental campus utility and must precede most other building occupation activities. Therefore, the Designer of Record and Contractor of Record shall work with CommTech Engineering to support building access by University personnel to install and test data communications equipment in telecommunications rooms in the weeks leading up to final building acceptance. This support shall consist of the following activities.

- Inclusion of data networking electronics installation in the project schedule.
- Early keying of locks on telecommunications rooms to allow the equipment to be securely placed.
- Access to telecommunications rooms by University personnel to install the electronics.

CIG-31 - Voice Communications

1. General

The University of North Carolina has for many years utilized Centrex voice services provided by a third party carrier. More recently, the University has begun to deliver voice services via VoIP, also provided by a third party carrier.

The University maintains a staff of customer service and technical support personnel to manage service delivery and instrument deployments. Thus, the Designer need not consider general purpose voice services in a project design. However, there are a number of exceptions at the periphery of the voice services network for which the Designer must account. These include elevator phones, emergency phones, alarm lines, and similar ancillary connections. These are discussed in specific sections of this document.

Related sections:

CIG-19 Communications Equipment Room Fittings

27 15 00 Communications Horizontal Cabling

CIG-33 Elevator Telephones

CIG-34 Ring-Down Emergency Telephones

CIG-32 – Telephone Sets

1. General

Telephone sets are provided as an available service option to UNC ITS customers and are not included as part of the capital project designer's responsibility. Horizontal cabling for phone connectivity is to be included in capital project design as referenced in sections 27 15 00 Communications Horizontal Cabling, CIG-33 Elevator Telephones, and CIG-34 Ring-Down Emergency Telephones.

CIG-33 – Elevator Telephones

1. General

This section provides direction to designers for new construction and renovation projects for the installation of emergency telephones for elevators and chairlifts. Emergency telephone for elevators and chairlifts are required and operate as ring-down telephones, contacting the Department of Public Safety**.** These systems operate using dedicated PSTN telephony and are not a part of the campus VoIP system.

2. Execution

Elevator phones are to be provided and installed by the elevator manufacturer or their contractor as part of the elevator installation.

The installation of a ¾" homerun conduit from the nearest Telecom room to each elevator control cabinet is required with a Category 6A cable installed to each elevator control cabinet as described in section CIG-25 Communications Copper Horizontal Cabling.

CommTech Engineering must be notified 15 days in advance of elevator phone service dial tone requirement to provide service provider adequate time to complete service order.

3. Testing

Testing of elevator phones shall comply with State Construction Office and NC Department of Insurance requirements.

CIG-34 – Ring-Down Emergency Telephones

1. General

This section provides direction to designers for new construction and renovation projects for the installation of Ring-Down Emergency Telephones. Emergency telephones are required at designated areas on campus as determined by the Department of Public Safety.

2. Execution

During project design the designer, building owner, and DPS representative shall meet to discuss requirements for wall-mounted or free-standing ring-down emergency phones. Any required ring-down emergency phones shall be referenced in the project contract documentation including marked drawings of emergency phone location and installation details.

The installation of a ¾" homerun conduit from the nearest telecom room to each ring-down emergency phone is required with a Category 6A cable installed to each emergency phone as described in section CIG-25 Communications Copper Horizontal Cabling. In the event underground conduit is required the cable shall be rated for direct bury/ duct placement with no splice points allowed between the emergency phone and nearest telecom room.

Each emergency phone requires the installation of a 110 volt 20 amp circuit served from the dedicated telecom room electrical panel if possible. If there is no dedicated electric panel in the serving telecom room the circuit breaker serving the emergency phone should be fitted with a mechanical lock to prevent the emergency phone power from being inadvertently disconnected.

3. Testing

Upon emergency phone installation completion UNC ITS technicians completing the service order for analog phone service shall test the ring-down circuit and verify that caller ID information appears appropriately at the Department of Public Safety operations center.

*** Important**: Emergency alarm lines shall be installed early in the process because these lines must be provisioned within UNC's internal systems and the external voice carriers before 911 can be tested. Caller ID will not profile correctly if this process is not completed at least one day in advance of testing.

CIG-35 - Master Antenna Television Systems

1. General

The University operates its own campus-wide cable television service that delivers over 100 channels of standard definition and HDTV programming. Programming is collected at a headend facility and distributed via a hybrid fiber-coax system. Each building receives CATV signals via fiber. These optical signals are converted to electrical signals, typically in the MDF, and distributed via coaxial riser and horizontal cables.

Designers and Contractors are responsible for identifying areas that require service and installing cables. Taps and amplifiers are installed as appropriate by University technicians to distribute the signal. The University then provides the signal to the building.

More information on the CATV system can be found at http://its.unc.edu/service/cable-tv-channel-lineup/.

CIG-36 – RF Systems

1. General

The University operates numerous systems that utilize radio frequency (RF) communications. These include a pervasive Wi-Fi network, a distributed antennae system (DAS) for mobile voice/data carriers, an emergency responders' network, multiple microwave links, and two radio stations. Care must be taken to ensure that systems newly introduced to campus do not interfere with existing systems and that RF spectrum is managed appropriately for the University's growing wireless needs. Toward that end, designers considering the use of RF systems should be aware of the following:

A. Operation at 2.4GHz and 5GHz ISM bands will not be permitted due to interference with the University's Wi-Fi network.

B. Operation in the unlicensed "Internet of Things" bands including 433MHz and 902-928MHz may become objectionable in the future as the University develops its own sensor networks to operate critical infrastructure. However, currently, those networks do not exist.

C. The FCC is in the process of re-allocating the 600MHz spectrum and will re-groom the 500MHz spectrum starting in 2020. This will cause changes in the permissible use of RF on campus and may necessitate changes to systems operating in these bands.

D. In general, the use of licensed spectrum is far less problematic for the University than the use of unlicensed spectrum.

E. RF transmission of University data shall be encrypted at all times.

2. Design and Operational Considerations

Designers shall submit to the University a map showing the location of all proposed devices that emit RF energy, including the latitude and longitude, operating frequency, and power level of each device. Any proposed changes to the location, operating frequency, or power level of RF devices shall be submitted to the University for an additional engineering review.

3. Third-party RF Networks

Non-University entities will not be permitted to operated RF systems on the campus or its leased locations except under a written and duly executed license agreement.

4. Changes to RF Operations

The University reserves the right to restrict RF usage on campus without notice.

CIG-37 - Wi-Fi Systems

The University maintains a wireless local area network (WLAN) across campus. All aspects of WLAN design and operation are regulated by the University's Information Technology Services (ITS) group and tightly integrated with the overall campus data network.

A. Design Scope

The Designer shall specify the design and installation of a wireless local area network (WLAN) employing the 2.4 GHz, 5 GHz and 6 GHz bands and covering all indoor and outdoor areas required for the project.

B. Preliminary Budgeting

For budgetary purposes, preceding subsequent design development, WLAN systems should be based on an estimate of one wireless access point (AP) for every 750 square feet of space and, in spaces where greater user density is planned (e.g., classrooms), one AP per 50 occupants within each such space.

C. Designer Qualifications

All WLAN design activity shall be performed by a WLAN design professional with, at minimum, the following qualifications:

1. Certified Wireless Network Administrator (CWNA) certification as administered by the Certified Wireless Network Professionals (CWNP) organization
2. Demonstrated proficiency in WLAN design incorporating the Aruba product line
3. Minimum of two years of WLAN design experience involving systems of comparable scope and magnitude, including both indoor and outdoor WLAN applications
4. Minimum of 1 year of experience in the proficient use of WLAN modeling software by Ekahau or equivalent as recognized by ITS.
5. Qualifications of the Designer shall be subject to review by ITS, who reserves the right to require replacement of any Designer that does not meet the above criteria.

D. Design Process

The WLAN design shall be based on principles and product sets determined by ITS and shall reflect the business, aesthetic and technical objectives of the project, the Owner and ITS.

All aspects of WLAN design shall be modeled using software specifically designed for predictive analysis of WLAN system performance based on the building and environmental characteristics anticipated for the spaces being served. The modeling software used shall be manufactured by Ekahau. Substantially similar software may be substituted only if approved in advance by the ITS. Modeling shall be submitted by the Designer at key points during the design cycle and each submittal shall be subject to review by ITS.

The sharing of design models between the Designer and ITS shall establish an interactive process whereby both parties work to concur regarding AP placements and configurations. The Designer shall ensure that models remain coordinated with building architecture, interiors, structural elements, etc.

E. System Infrastructure

Each AP location shall be served with two Category 6A cables or, where required by distance or need for electrical isolation, by six type-OS2 optical fibers with type-LC terminations. In general, cabling of WLAN data outlets shall comply with CIG-25 of these Guidelines. The following shall also apply:

1. For AP locations in areas with accessible acoustical ceiling tile systems, cabling distances shall be limited to 80 meters (262 feet) to allow for potentially long connecting cords between APs and data outlets. This shall be emphasized by the Designer in drawing notes and horizontal cabling specification documents.
2. To prevent infiltration of dust and debris, all data jacks in ceiling-based data outlets shall be equipped with protective shutters, and all fiber optic data outlet ports provided with dust covers.
3. Like other data outlet cabling, all WLAN cabling shall be contained in conduit along its entire route. Each AP location shall be served by a separate conduit homerun to a cable tray or directly to the nearest telecom room. The minimum conduit trade size shall be one inch.
4. Because APs will be powered via PoE, locations served by Category 6A cabling shall not require a separate electrical outlet; however, AP locations served by fiber optic cabling shall require a separate NEMA 5 power receptacle at each location.

F. Design Coordination

Placement details of all wireless access points (APs) shall be indicated by the Designer and shall be coordinated with architecture and all elements of buildings and grounds as required.

Placement details shall note the following per AP placement:

1. AP model
2. Mounting height
3. Mount type
4. Enclosure type (where applicable)
5. Effective Isotropic Radiated Power (EIRP) for each radio (2.4 GHz, 5 GHz and 6 GHz)
6. AP orientation

Typical mounting heights shall be between 8 and 10 feet above the finished floor, or at single-story ceiling heights up to 12 ft. AFF for ceiling-mounted devices. Exceptions shall be considered

on a case basis in coordination with ITS. Attachments to suspended ceiling systems shall be made on main runners of ceiling tee grids, avoiding cross tees.

Wall-mounted devices shall provide for a minimum of six inches of clearance below the ceiling. All alternative placements and mounting types shall be coordinated with and approved by the Owner and ITS prior to finalization.

Access point mounting types, and any related enclosures and hardware, shall be included in the design and construction documents and shall be coordinated with architecture, building elements and landscaping, including each of the following, as applicable:

1. Ceiling mounts for each ceiling type
2. Interior wall mounts
3. Exterior wall mounts
4. Building structure mounts
5. Pole mounts
6. Bollard mounts

Where indicated by project objectives, provisions for concealing wireless access points and their mounts shall be specified by the Designer. Concealment methods may include vinyl wraps applied by manufacturers, RF-transparent enclosures, paintable enclosures and mounts, or other commercially available methods. All such concealment measures shall be approved in advance by the Architect, Owner and ITS. All concealment shall be coordinated with architectural details, interior designs, exterior facades, landscaping, and all other elements of buildings and grounds in consideration of both aesthetic impact and system performance, and all methods shall be approved by the Architect, the Owner, and ITS.

The Designer's construction drawings shall detail each type of mounting scenario to be employed. To the greatest extent practicable, the Designer shall provide for maximum flexibility in the mounting and positioning of wireless access points to enable system optimization.

Where fiber optic cabling is required in a horizontal link based on distance or need for electrical isolation, the design shall include media converters, device-end PoE injectors and/or provisions for local device powering. All components specified shall be suitable for the environments in which they will be installed, including temperature extremes (assuming full solar loading), relative humidity, susceptibility to dust and moisture, and other relevant conditions.

The construction documents prepared by the Designer shall clearly emphasize the following:

1. Contractor qualifications shall be stated to include experience in the installation of Aruba equipment and capability to complete all installation processes described in these Guidelines.
2. All wireless access points (APs) shall be furnished by ITS and installed by the Contractor.
3. All AP-end components other than the APs themselves shall be provided (furnished and installed) by the Contractor, including but not limited to the following:

a. Interior and exterior mounting brackets and related hardware, including any kits for pole mounting, wall mounting, ceiling mounting and/or mounting to building structure, as well as any interior and exterior enclosures.

b. Any required painting or other concealment of enclosures and/or mounts. (Application of vinyl wraps on AP devices only, where specified, shall be provided by ITS.)

c. Environment-appropriate (e.g., ultraviolet resistant) data and power connecting cords, including glands/gaskets and any other weatherproofing measures required.

d. Any other elements required for a complete working system

e. The following exceptions shall apply for exterior bollard locations only: All exterior Wi-Fi bollards, equipment mounts inside of bollards, media converters, PoE injectors, power supplies and connecting cords shall be furnished by the Owner and installed by the Contractor. For all bollards, the Contractor shall provide concrete footings, grounding electrodes and building-connected electrical and data conduits and cabling.

All components provided by the Contractor shall be compatible with the respective AP models furnished by ITS and shall be subject to review and approval by the ITS.

G. Design Deliverables

The following deliverable documents shall be required during WLAN system design and construction:

1. Schematic Design: Narrative discussion of the WLAN system, indicating the design principles applied and any project-specific variations, referencing applicable points cited in these Guidelines. For budgetary purposes, one wireless access point per 750 square feet should be assumed, and one AP per 50 occupants for spaces with high user density (e.g., classrooms).
2. Design Development:
   a. Software-based WLAN modeling in the form of Ekahau data files or a substantially similar format approved in advance by ITS. WLAN modeling may also be shared at any point throughout the design process and as often as required to maintain design coordination with ITS. The Designer shall provide interim modeling data files to ITS at any point upon request.
   b. Progress versions of installation details for each access point mounting scenario.
   c. Bill of materials of AP models and their associated quantities represented in the design.
3. Construction Documents: Finalized versions of all items listed for the Design Development phase.
4. Construction Administration: The Designer shall be required to verify placement details and general workmanship for all wireless access points per the construction documents.

H. Summary of Responsibilities for WLAN Systems

1. Owner/ITS Responsibilities:
   a. Review Designer's qualifications.
   b. Review design criteria and product set with Designer.
   c. Review Designer's SD narrative and DD and CD modeling and installation details.
   d. Review all mounting hardware, enclosures, media converters, PoE injectors and power supplies intended for use.
   e. Furnish all wireless access points, each fully configured, identified with a unique device name and an IP address, and designated for a singular specific location in the WLAN design.
   f. Where required, provide vinyl wrapping only of wireless access points.
   g. Perform validation surveys at the discretion of ITS to verify deployment details relative to design objectives. (Note: This is separate from, and does not alleviate the Designer of, any responsibility for regular construction administration activity associated with the WLAN system.)
2. Designer Responsibilities:
   a. Provide proof of qualification as a WLAN design professional for review by ITS.
   b. Review design criteria and product set with ITS and Owner.
   c. Produce SD narrative and DD and CD modeling and installation details.
   d. Submit to ITS all mounting hardware, enclosures, media converters and PoE injectors intended for use. Submit all mounting hardware and enclosures to Owner and Architect.
   e. Create WLAN design based only on wireless access point models approved by ITS.
   f. Coordinate all design and installation details with architecture, interiors, structure, MEP, landscaping and all other building and grounds aspects and details.
   g. Instruct Contractor, where required, to paint wireless access point mounts and/or enclosures, specifying paint materials and methods of application as approved by ITS, Owner and Architect. (Note: Paints shall not include metallic components.)
   h. Ensure that placement of wireless access points and all other aspects of the WLAN design meet the manufacture's specifications and all applicable requirements, standards and regulations of the University and local, state and federal agencies.
   i. Meet with ITS via teleconference at their request throughout the design process.
   j. Conduct inspections of Contractor's installation details and workmanship as required to verify compliance with construction documents.
   k. Respond where needed to findings of field validation surveys performed by ITS and initiate and complete action with Contractors as required for any needed remediation. (Note: This

is separate from, and does not alleviate the Designer of, any responsibility for regular construction administration activity associated with the WLAN system.)

3. Contractor Responsibilities:
    a. Furnish and install all mounting brackets, enclosures and related hardware and appurtenances required for the secure installation of all wireless access points per the construction documents.
    b. Install all wireless access points furnished by ITS per the construction documents and device-specific location assignments provided by ITS, including all data and power connections.
    c. Where required, paint wireless access point mounts and/or enclosures. All painting shall use paint materials and methods of application as approved in advance by ITS and the Owner and Architect. (Note: Paints shall not include metallic components.)
    d. Coordinate scheduling of wireless access point installations with ITS.
    e. Remediate any issues exposed by validation surveys performed by ITS and field inspections performed by the Designer, Owner and/or Architect.

CIG-38 - Cable Color Codes

The following table describes current and historical uses of cabling jacket colors used at the University of North Carolina at Chapel Hill.

Color	Type	Description	Status
Beige	Category 3	Voice	Historical
Blue	Category 5e	Voice	Historical
Yellow	Category 5e	Data	Historical
Purple	Category 6e	Access Control	Historical
White	Category 6e	Data	Historical
Red	Various	Riser Cables	Current
White	Category 6A	Data	Current
Green			Reserved for future use
Orange			Reserved for future use
Black			Reserved for future use

CIG-39 – Auxiliary Networks & Devices

Designers may be called upon to provide devices or networks of devices which connect to the campus data network or are independently housed in UNC buildings. These devices and networks can include sensors, audio-visual equipment, surveillance cameras, environmental control systems, and various controllers. Some systems may even employ data switches for device aggregation and signal distribution. The purpose of this section is to clarify how these systems can interconnect or otherwise coexist with the campus data network.

1. Equipment Compatibility Consultation and Verification

ITS Networking will work with designers and integrators to test proposed equipment and designs for compatibility with the campus network. Reach out to ITS Networking ***prior*** to Schematic Design to ensure that proposed systems and approaches are compatible. ITS cannot guarantee compatibility with all third-party equipment, so early communication is in everyone's best interest.

1.1. Minimum Endpoint Connectivity Requirements

Devices connecting to the campus network should meet at least the following basic connectivity requirements.

1.1.1. Wired Network

Devices connecting to the campus wired data network should support 100Mb/s full duplex Ethernet at a minimum. Campus data network switches will provide PoE. PoE devices connected to the network should be compatible with IEEE 802.3at powering. For devices requiring 802.3bt powering, switch accommodation must be coordinated with ITS Networking.

1.1.2. Wi-Fi Network

Devices connecting to the Wi-Fi network should support IEEE 802.11n or later. Devices must support either WPA2-PSK or WPA2-Enterprise (EAP-TLS) authentication. Systems utilizing WPA2-PSK must support a passphrase length of up to 32 characters. No open Wi-Fi connectivity is supported. The University regularly changes the campus Wi-Fi passwords, so end users should be provided with a means to easily update passwords across devices.

1.1.3. Switches

The University prefers that devices connect directly to the campus network rather than through switches provided by designers and integrators, however, the University recognizes that this may not always be practicable due to the need for device integration or specific features. In this case, unmanaged switches should be utilized with no Spanning Tree protocol enabled. All switches will have to be approved by ITS Networking prior to being placed on the campus data network.

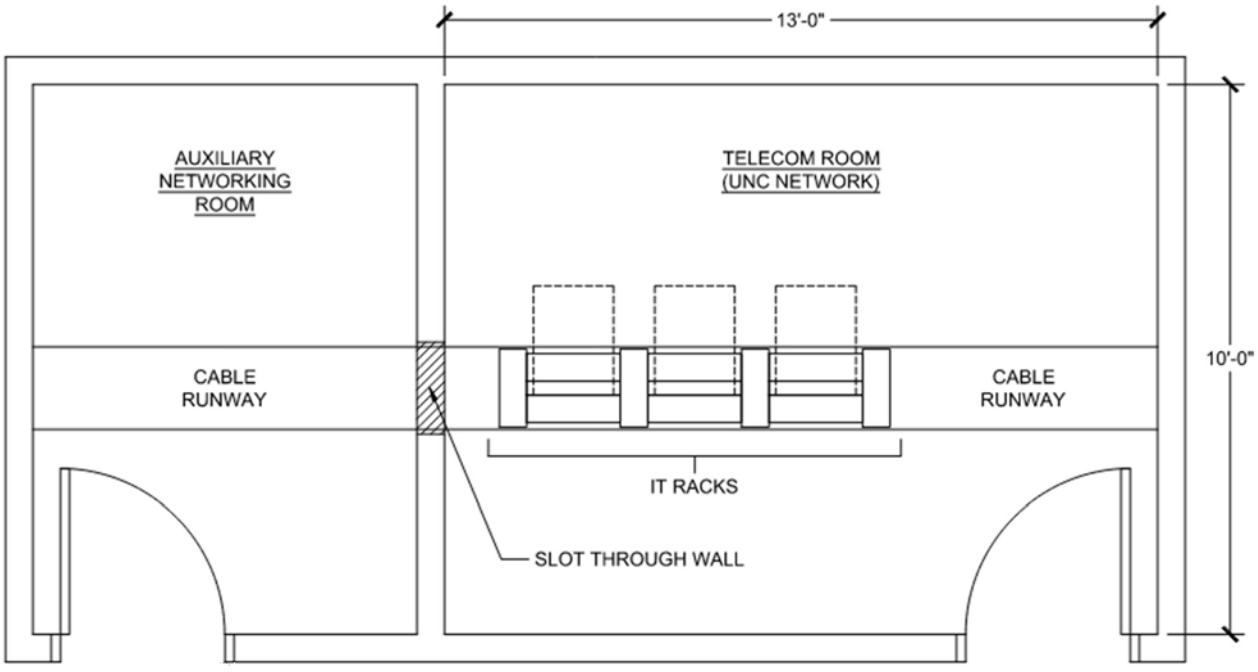
1.1.4. Routers & Related Devices

Routers, firewalls, and load balancers should not be included with any design as these may affect the operation of the campus network. If an application calls for these devices, contact ITS Networking for a consultation.

2. Auxiliary Networking Rooms

Due to various legislative statutes and State guidelines regarding privacy and security, access to campus telecommunications rooms is highly restricted. For this reason, only campus data network equipment and infrastructure can be located in telecommunications rooms. Third party equipment may not be located in telecommunications rooms, including servers, cameras, data switches, sensors, alarms, control systems, and patch panels. If users require space to house equipment, it is recommended that designers include auxiliary equipment rooms.

In some cases, as with audio-visual systems, the architecture will require that specialized devices distributed throughout a building connect back to a central location where interconnection, patching, routing, and switching may occur. We define this central interconnection point as an ***auxiliary networking room***. In this case the preferred solution is an auxiliary networking room adjacent to the telecommunications room. This allows the user easy access to their specialized equipment, while facilitating simple, short run, and secure connection to campus data network infrastructure. This preferred solution is illustrated below.



The cable runway above the IT racks in the telecommunications room shall be extended to traverse the adjacent auxiliary networking room through a rectangular slot in the common wall between the two rooms. The slot shall consist of a finished opening that is wide enough to accommodate the width of the cable runway plus a minimum of one inch on each side, and high enough to facilitate convenient cable passage - no less than 6”H and no more than 12"H. Where the auxiliary

networking room must be separated from the telecommunications room, the designer shall provide for a continuous pathway of similar capacity that complies with the requirements of this document for building pathways.

If an auxiliary equipment room must be located away from the telecommunications room, then ***the entire footprint of the wiring service area must be reduced*** so that the full path from end station to telecommunications room to auxiliary equipment room does not exceed the IEEE 802.3 maximum of a 100-meter channel between interconnected equipment ports (90 meters of permanent link cabling plus 10 meters of patch/connecting cords). This could result in a requirement for additional telecommunications rooms per floor, which is the reason for the strong adjacency preference.

3. Exterior Remote Connections

An increasing number of exterior edge devices require connectivity to a nearby campus building or point of presence. These include exterior cameras, parking gates, 5G small cell antennas, and other utilitarian devices. This section describes guidelines for pathways, media, and power for exterior remote devices.

3.1. Pathways

All underground conduit shall be sized for a maximum of 40% fill after cable placement is complete. The minimum conduit size shall be 1.0” trade size. Conduit composition shall be galvanized rigid metal or Schedule 40 PVC or as otherwise specified in UNC Electrical Distribution Guidelines. Depth of cover shall be a minimum of 18” or as otherwise specified in UNC Electrical Distribution Guidelines. Coordinate with ITS CommTech Engineering for any additional pathway hardening requirements, such as concrete encasement for certain critical applications. Provision shall be made for the future electronic location of all underground pathways. Route coordination shall be carefully coordinated with ITS CommTech Engineering as early as practicable in the design process, and all route planning shall comply with UNC GIS Design and Construction Surveying Guidelines.

3.2. Cabling

All fiber optic cabling, regardless of application, shall be single mode, minimum Type OS2, with G.655 preferred to support future DWDM applications. To preclude requirements for cable transition splicing, all fiber optic cable assemblies shall be rated for both outside plant duct placement and interior routing through plenum-rated environments. Where copper network cabling is to be used for shorter reach outside plant network distribution, it shall consist of a Category 6A cable assembly rated for outside plant duct placement with proper Category 6A compatible lightning protection on each end. All copper conductors, regardless of type, must be lightning protected.

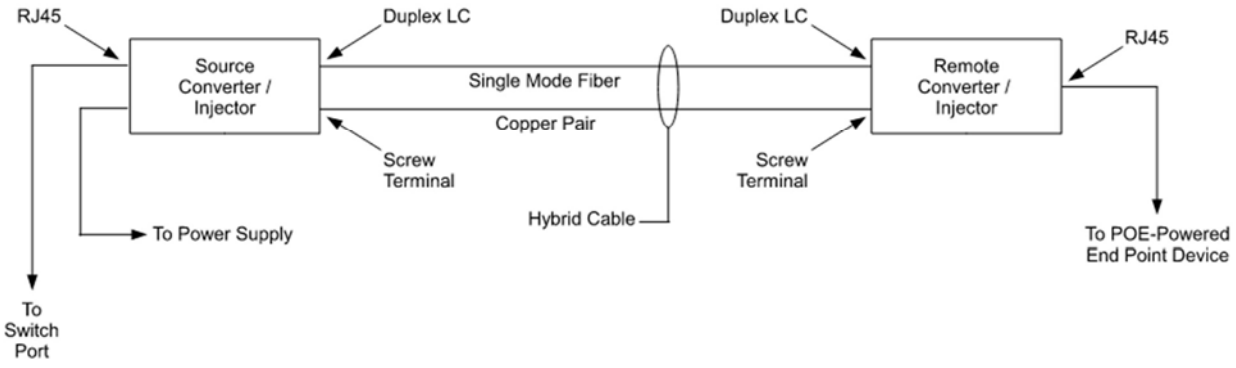
3.3. Labelling

All fibers shall be labelled according to "CIG-13 - Identification for Communications Systems" including exterior tags. See ITS Communication Technologies Engineering to obtain fiber numbers for labelling purposes.

3.4. PoE Powering

When facilitating PoE powering of remote network devices that will utilize fiber optic signaling, designers shall specify hybrid cables that incorporate both optical fibers and copper conductors under a shared cable sheath, so that a single cable assembly is used to connect the remote device location with the switch location. Copper conductors of such hybrid cables shall be sized to properly deliver PoE power compliant with IEEE 802.3bt, considering the line length between end points. Designers shall coordinate with UNC CommTech Engineering regarding methods for interfacing the copper pairs with PoE sources and end point devices. Designers shall specify that wire gauge of copper conductors be included in as-built documentation for each cable (wire gauges might differ for cables of different lengths). This configuration is illustrated as follows:

Method for Remote Device Powering via POE in Channels Exceeding 100 Meters



3.5. Documentation

All network cabling shall be certified with report submitted per the relevant requirements of this document. Final outside plant routing shall be indicated on as-built telecommunications and electrical site drawings. GIS details of proposed and built pathway routing and cable contents shall be provided to the University in both PDF and georeferenced AutoCAD formats during design phase and in as-built record drawings.

CIG-39 – Demolition

The demolition of any network cabling or other network components may be performed as general labor activity only if first carefully coordinated with ITS CommTech Engineering and only after notification from ITS CommTech Engineering that elements to be removed have been decommissioned and instructions for salvaging/preservation have been communicated. Demolition of network cabling and components that are operational may not be performed as general labor activity, and workers shall not be permitted to access operational telecommunications rooms. Where demolition is to occur in an active networking environment, it may be performed by qualified data communications technicians if first carefully coordinated with ITS CommTech Engineering. The applicable requirements of this section shall be communicated by the designer in project specifications and sheet notes.

Appendix 1: Telecommunications Designer Scope of Services

1. Scope of Services by Project Phase

The following is a summary of the tasks and deliverables required of the Telecommunications Designer of Record at each stage of a capital project. See additional requirements in CIG-37.

A. Schematic Design (SD) Phase

1. Provide site routing, duct bank and outside plant (OSP) cabling requirements to the following Professionals of Record:
    a. Architect
    b. Civil Engineer
    c. Electrical Engineer
    d. Plumbing Engineer
    e. Mechanical Engineer
2. Provide telecommunications room (TR) space requirements to the Architect of Record
    a. Locations of TRs required to facilitate standards-compliant horizontal cabling distances
    b. Minimum dimensions (not area) per TR
    c. Locations, sizes and swing directions of TR doors
    d. Restrictions on TR locations
        1. Non-adjacency (sides and above) to water flow spaces or locations subject to flooding
    e. Restrictions on non-TR functions being housed in or passing through TR spaces
3. Provide telecommunications pathway/raceway requirements to the Electrical Engineer of Record
    a. Quantities and sizing of building entrance ducts, where applicable, and any associated outside plant duct bank and manholes
        1. Min. bend radius of 10x conduit diameter
    b. Quantities, sizing and schematic placement of backbone/riser conduits and sleeves
        1. Min. 4” trade size EMT or RMC
        2. Min. bend radius of 10x conduit diameter
        3. Criteria for use, sizing and placement of pull boxes
    c. Sizing criteria for basket-type corridor cable tray
        1. Max. 50% cable fill

d. Box types for typical telecommunications outlets
    1. Min. 4” square box, 3.5” deep
    2. 2-gang plaster ring, matching thickness of wall board to create flush opening
    3. Methods for securely mounting to building structure
e. Outlet conduit requirements
    1. Min. 1” trade size EMT or RMC
    2. Min. bend radius of 6x conduit diameter (10x for conduits greater than 2” size)
    3. Criteria for use, sizing and placement of pull boxes
    4. Continuous routing, stubbed to within 4” of cable tray (use of J-hooks not permitted)

4. Provide overall electrical requirements per TR to the Electrical Engineer of Record
    a. Rack power projected maximum load, plus 50% spare capacity
    b. Convenience power requirements on perimeter walls
    c. General lighting requirements per TR
    d. Restrictions on non-TR functions being housed in or routing through TR spaces
5. Provide bonding and grounding requirements for telecommunications to the Electrical Engineer of Record, based on the latest revision of ANSI/TIA-607, including sizing and other essential characteristics for the following [terminology beginning with Revision C / terminology prior to Revision C]:
    a. Telecommunications Bonding Conductor (TBC) / Bonding Conductor for Telecommunications (BCT)
    b. Telecommunications Bonding Backbone (TBB)
    c. Primary Bonding Busbar (PBB) / Telecommunications Main Grounding Busbar (TMGB)
    d. Secondary Bonding Busbar (SBB) / Telecommunications Grounding Busbar (TGB)
    e. Backbone Bonding Conductor (BBC) / Grounding Equalizer (GE)
6. Provide overall environmental requirements per TR to the Mechanical Engineer of Record
    a. Projected maximum heat load, plus 50% spare capacity
    b. Environmental conditions to be maintained
        1. Temperature range
        2. Humidity range (non-condensing)
        3. Air exchange cycle
        4. Positive air pressure relative to surrounding spaces

c. Continuous 24/7 operation

d. N+1 system redundancy

7. Provide overall requirements for floor loading in telecommunications rooms to the Structural Engineer of Record.
    a. Consideration especially given to racks containing substantial UPS gear
        1. Allow for future expansion of UPS systems – system capacity and run time
8. Provide general requirements to the Plumbing Engineer of Record
    a. Restrictions on non-TR functions being housed in or routing through TR spaces
9. Provide general requirements to the Security System Designer of Record
    a. Access control and monitoring requirements for TR spaces
    b. Restrictions on non-TR functions being housed in or routing through TR spaces
10. Provide preliminary requirements for fire suppression systems in TR spaces to the appropriate MEP Engineer of Record or other design professional, as appropriate.
11. Provide preliminary requirements for fire stopping of telecommunications pathways to the appropriate MEP Engineer of Record or other design professional, as appropriate.
    a. Fire stopping systems shall provide for ongoing re-entry, to enable altering of pathway contents, and subsequent restoration to required rating.
12. Advise the Architect and the designers of record for the following systems (and any others) about restrictions on the placement of any equipment, cabling, or other system components within the secured TR space.
    a. Audio-Visual Systems
    b. Digital Antenna Systems (DAS)
    c. Security Systems
    d. Fire Alarm Systems
    e. Building Management Systems
13. Provide project-specific general requirements for backbone and horizontal cabling systems.
14. Provide preliminary cost estimate.
15. Summary of SD Phase Deliverable Documents (at minimum) required of the Telecommunications Designer:
    a. Design Narrative
        1. Systems descriptions
        2. Citation of all requirements stated above
    b. Preliminary Cost Estimate

B. Design Development (DD) Phase

1. Coordinate and verify site routing, duct bank and outside plant (OSP) cabling requirements with the Architect and with Civil and MEP Engineers.
2. Coordinate and verify telecommunications room (TR) space requirements with the Architect
    a. Quantities and locations of TRs to facilitate standards-compliant horizontal cabling distances
    b. Dimensions (not area) per TR
    c. Locations, sizes and swing directions of TR doors
    d. Restrictions on TR locations
        1. Non-adjacency (sides and above) to water flow spaces or locations subject to flooding
    e. Restrictions on non-TR functions being housed in or passing through TR spaces
3. Coordinate and verify telecommunications pathway/raceway requirements with the Electrical Designer
    a. Quantities and sizing of building entrance ducts, where applicable, and any associated outside plant duct bank and manholes
        1. Min. bend radius of 10x conduit diameter
    b. Quantities, sizing and schematic placement of backbone/riser conduits and sleeves
        1. Min. 4” trade size EMT or RMC
        2. Min. bend radius of 10x conduit diameter
        3. Usage scenarios, sizing and placement of pull boxes
    c. Sizing and routing of basket-type corridor cable tray
        1. Max. 50% cable fill
        2. Clearances for cable tray access
        3. Transition to conduit of matching capacity for inaccessible areas
        4. Placement of access hatches as required in inaccessible ceilings
    d. Box types for typical telecommunications outlets
        1. Min. 4” square box, 3.5” deep
        2. 2-gang plaster ring, matching thickness of wall board
    e. Outlet conduit requirements
        1. Min. 1” trade size EMT or RMC
        2. Min. bend radius of 6x conduit diameter (10x for conduits greater than 2” size)

3. Usage scenarios, sizing and placement of pull boxes
4. Continuous routing, stubbed to within 4” of cable tray (use of J-hooks not permitted)

4. Coordinate building pathways, including any penetrations, with other building systems, including Structural, Mechanical, Electrical, Lighting, Fire Alarm, Security, Building Management, Plumbing, Sprinkler, and any other, as applicable.
5. Coordinate and verify electrical requirements per TR with the Electrical Designer
   a. Projected maximum equipment load, plus 50% spare capacity
   b. Power outlet configurations, quantities and placement
   c. Convenience power requirements on perimeter walls
   d. General lighting requirements per TR
   e. Restrictions on non-TR functions being housed in or routing through TR spaces
6. Coordinate and verify bonding and grounding requirements for telecommunications with the Electrical Designer, based on the latest revision of ANSI/TIA-607, including sizing and other essential characteristics for the following [terminology beginning with Revision C / terminology prior to Revision C]:
   a. Telecommunications Bonding Conductor (TBC) / Bonding Conductor for Telecommunications (BCT)
   b. Telecommunications Bonding Backbone (TBB)
   c. Primary Bonding Busbar (PBB) / Telecommunications Main Grounding Busbar (TMGB)
   d. Secondary Bonding Busbar (SBB) / Telecommunications Grounding Busbar (TGB)
   e. Backbone Bonding Conductor (BBC) / Grounding Equalizer (GE)
7. Coordinate and verify environmental requirements per TR with the HVAC Systems Designer
   a. Projected maximum heat load, plus 50% spare capacity
   b. Environmental conditions to be maintained
      1. Temperature range
      2. Humidity range (non-condensing)
      3. Air exchange cycle
      4. Positive air pressure relative to surrounding spaces
   c. Continuous 24/7 operation
   d. N+1 system redundancy
8. Coordinate and verify requirements for floor loading in telecommunications rooms with the Structural Engineer of Record.

a. Consideration especially given to racks containing substantial UPS gear
b. Allow for future expansion of UPS systems
    1. System capacity
    2. System run time

9. Coordinate and verify requirements with the Plumbing Designer
    a. Restrictions on non-TR functions being housed in or routing through TR spaces
    b. Drainage for HVAC condensate and sprinkler systems, where present
10. Coordinate and verify requirements with the Security System Designer
    a. Restrictions on non-TR functions being housed in or routing through TR spaces
11. Coordinate and verify requirements for fire suppression systems in TR spaces with the appropriate MEP Engineer of Record or other design professional, as appropriate.
12. Coordinate and verify requirements for fire stopping of telecommunications pathways with the appropriate MEP Engineer of Record or other design professional, as appropriate.
    a. Fire stopping systems shall provide for ongoing re-entry, to enable altering of pathway contents, and subsequent restoration to required rating.
13. Coordinate and verify with the Architect and systems designers for the following systems (and any others) about restrictions on the placement of any equipment, cabling, or other system components within the secured TR space.
    a. Audio-Visual Systems
    b. Digital Antenna Systems (DAS)
    c. Security Systems
    d. Fire Alarm Systems
    e. Building Management Systems
14. Specify equipment room layouts per TR
    a. Locations of penetrations / emergence of building pathway components
        1. Building entrance ducts
        2. Backbone/riser conduits/sleeves
        3. Horizontal cabling conduits/sleeves (interfacing with cable trays)
        4. Individual outlet conduits for horizontal cabling, where applicable
    b. Equipment rack quantities and placement, showing proper clearances
    c. Cable runway (ladder rack) sizing and placement
    d. Preferred location of SBB/TGB (or PBB/TMGB) – coordinate with Electrical

e. Preferred location of power panel – coordinate with Electrical

15. Specify backbone cabling system
    a. Quantities, types and characteristics of backbone cabling and terminations
        1. Fiber optic
        2. Multipair copper
        3. Coaxial
    b. Schematic point-to-point termination plan (i.e., riser diagram)
16. Specify horizonal cabling system
    a. Outlet configuration types
    b. Category 6A cable and jack types
    c. Coaxial cable and connector types, where applicable
    d. Horizontal fiber optic cable and connector types, where applicable
17. Provide DD-level detailed cost estimate.
18. Summary of DD Phase Deliverable Documents (at minimum) required of the Telecommunications Designer:
    a. Revised Design Narrative, as applicable
    b. Site Plans (Duct Bank and Outside Plant (OSP) Cabling Plans)
    c. Floor Plans (Data Outlet Location Plans)
    d. Enlarged Plans of Telecommunications Rooms
    e. Building Pathway Plan / Conduit Riser Diagram
    f. Grounding and Bonding for Telecommunications Riser Diagram
    g. Outline Specifications (Division 27)
    h. DD Cost Estimate

C. Construction Documents (CD) Phase

1. Specify bidder qualifications.
    a. 5 years of experience with projects of similar scope and magnitude
    b. All activity under purview of RCDD
    c. BICSI-certified technicians
    d. Manufacturer-certified contractor in one of the following programs, as applicable: Hubbell Mission Critical Warranty, for Hubbell cable and connectivity; nCompass Warranty, or 25-year warranty program, for Superior Essex cable with Legrand

(Ortronics) connectivity; Leviton Networks Solutions Warranty for Berk-Tek cable with Leviton connectivity.

2. Specify general scope of work associated with network support to be performed by general construction, trades, and other disciplines, outside of the scope of work of the Communications Contractor.
    a. Site construction
        1. Site routing
        2. Duct bank requirements
        3. Outside plant (OSP) cabling support
    b. TR construction
        1. Adjacency restrictions
        2. Minimum dimensions (not area)
        3. Door positioning
        4. Floor loading
        5. Plywood backboard requirements (all walls)
        6. Power requirements
        7. Lighting requirements
        8. Environmental requirements
        9. Fire protection requirements
        10. Fire stopping requirements
        11. Security requirements
    c. Building pathway/raceway systems (conduits, sleeves, cable trays)
        1. Pathway sizing / fill ratio
        2. Bend radius constraints
        3. Pull box sizing and positioning
        4. Outlet box configurations
        5. Fire stopping requirements
    d. Bonding and grounding for telecommunications
        1. Sizing of bonding backbone conductors (TBB, TBC/BCT and BBC/GE)
        2. Summary of bonding inclusions (panel ground, building steel, etc.)
        3. Bonding methods (bonding lug types, exothermic welds, etc.)
        4. Reference to latest revision of ANSI/TIA-607

3. Coordinate and verify all requirements reflected in the Design Development section, above.
    a. Telecommunications room (TR) placement and space characteristics
    b. Telecommunications building pathway/raceway requirements
    c. Electrical requirements per TR
    d. Bonding and grounding requirements for telecommunications, per ANSI/TIA-607
    e. Environmental requirements per TR
    f. Plumbing requirements per TR (condensate drainage, sprinklers, etc., as applicable)
    g. Restrictions on non-TR functions being housed in or routing through TR spaces
4. Provide detailed, enlarged plans (min. scale 1/4" = 1’-0”) of each TR showing equipment layouts
    a. Locations of penetrations / emergence of building pathway components
        1. Building entrance ducts
        2. Backbone/riser conduits/sleeves
        3. Horizontal cabling conduits/sleeves (interfacing with cable trays)
        4. Individual outlet conduits for horizontal cabling, where applicable
    b. Equipment rack quantities and placement, labeling proper clearances
    c. Cable runway (ladder rack) sizing and placement
    d. Location of SBB/TGB (or PBB/TMGB), as coordinated with Electrical
5. Provide rack elevation drawings per TR showing all equipment racks and equipment mounting
6. Provide floor plans showing types and locations for all data outlets
    a. Provide TR assignment for each data outlet
7. Provide detailed specifications of equipment room fittings
    a. Equipment racks
    b. Vertical and horizontal cable management
    c. Fiber optic enclosures and copper patch panels
    d. Cable runway (ladder rack), including accessory components
    e. Bonding and grounding components for telecommunications
8. Provide detailed specifications of backbone cabling system
    a. Quantities, types and characteristics of backbone cabling and terminations
        1. Fiber optic
        2. Multipair copper

3. Coaxial

b. Schematic point-to-point termination plan (i.e., riser diagram)

9. Provide detailed specifications of horizonal cabling system
    a. Outlet configuration types
    b. Category 6A cable and jack types
    c. Coaxial cable and connector types, where applicable
    d. Horizontal fiber optic cable and connector types, where applicable
10. Provide detailed specifications of labeling/identification system, per ANSI/TIA-606
    a. Labeling scheme (nomenclature, etc.)
    b. Label placement
    c. Label and ink types and materials
11. Provide detailed specifications of acceptance testing and commissioning requirements
    a. TIA-compliant parameters, methods and test equipment
    b. Test equipment factory/3rd-party calibration within prior year
    c. Reporting requirements
        1. Parametric test data per link
        2. Test procedures (equipment setups) per test type
        3. Proof of current test equipment calibration
12. Provide CD-level detailed cost estimate.
13. Summary of CD Phase Deliverable Documents (at minimum) required of the Telecommunications Designer:
    a. Revised Design Narrative, as applicable
    b. General notes characterizing TR construction (including power, lighting and HVAC requirements), pathway systems (including pull box sizing and placement), grounding and bonding for telecommunications, and structured cabling systems (including routing constraints)
    c. Symbol legend defining counts and types of cables and terminations, back box types, data outlet elevations and other mounting requirements for each outlet type
    d. Site Plans (Duct Bank and Outside Plant (OSP) Cabling Plans)
    e. Floor Plans (Data Outlet Location Plans)
    f. Enlarged Plans of Telecommunications Rooms
    g. Rack Elevation Diagrams

h. Building Pathway Plan / Conduit Riser Diagram
i. Backbone / Riser Diagram and Termination Details
j. Data Outlet Details
k. Labeling Plan
l. Grounding and Bonding for Telecommunications Riser Diagram
m. Detailed Specifications (Division 27), including acceptance testing criteria
n. CD Cost Estimate

D. <u>Construction Administration (CA) Phase</u>

1. Respond to Requests for Information (RFI) from bidders, as required
2. Attend/host pre-bid conference and walk-through, as required
3. Review and comment on submitted bids for communications scope
    a. Bidder qualifications
    b. Apparent grasp of scope
    c. Pricing
        a. Commitment and ability to meet construction schedule
4. Review contractor submittals
    a. Identity and qualifications of key project personnel
    b. Product data
    c. Shop drawings
5. Attend/host construction meetings and walk-throughs, as required
6. Respond to Requests for Information (RFI) from contractors, as required
7. Conduct field inspections as required to verify scope compliance and workmanship
    a. Issue field reports as required
8. Generate punch lists to guide completion of work
9. Witness system acceptance testing, as required
10. Review test reports submitted by contractor
11. Perform final inspection and commissioning
12. Review close-out submittals from contractor
    a. As-built drawings
    b. Operation and Maintenance Manuals

13. Determine completeness of all communications scope of work
14. Summary of CA Phase Deliverable Documents (at minimum) required of the Telecommunications Designer:
    a. RFI Responses, as required
    b. Submittal Review
    c. Field Reports, as required
    d. Review of Contractor Pay Applications, as required
    e. Punch List(s)
    f. Test Report Reviews
    g. Memorandum verifying completion of communications scope

Appendix 2: Submittals & Detailed Drawings

1. Submittal Requirements

The following tables summarize all submittals required for telecommunications infrastructure described in this document. For detailed requirements, see Appendix 1: Telecommunications Designer Scope of Services.

Submittals shall follow the format requirements described in CIG-01.

1.1. Prior to Installation

Section	Description	Format
CIG 01 Communications	RCDD certificates for communication designers. BICSI Technician level certificate for lead installers. Hubbell Mission Critical / Legrand nCompass / Leviton Network Solutions certificate for installation contractor.	PDF
CIG 02 Testing and Acceptance of Cabling Systems	The test plan.	PDF
CIG 03 Grounding and Bonding for Communications Systems	Product data sheets for TMGB and TGB.	PDF
CIG 03 Grounding and Bonding for Communications Systems	Telecommunications grounding riser diagrams.	PDF
CIG 05 Hangers and Supports for Communications Systems	Product data sheets for all components used.	PDF
CIG 05 Hangers and Supports for Communications Systems	Plan view drawings down to outlet level showing the location of cable pathway segments that utilize hangars and supports and the type.	PDF

CIG 06 Conduits and Backboxes for Communications Systems		
CIG 07 Cable Trays for Communications Systems	Plan view drawings showing all horizontal and vertical conduit routing, cable trays/baskets, and pull box locations. Conduit runs to individual outlets need not be indicated.	PDF
CIG 07 Cable Trays for Communications Systems		PDF
CIG 07 Cable Trays for Communications Systems	Cable tray product data sheets and supplemental information showing: Type of tray Width, depth, length, thicknesses, and radius of bends (where applicable) Rung spacing Cable-bearing surface dimensions Material construction and finish Accessories	PDF
CIG 08 Power Poles, Floor Boxes, and Poke Throughs for Communications Systems	Prior to procurement and installation, all materials intended to be used in association with power poles, floor boxes, and poke throughs shall be submitted for review and approval by the designer and CommTech Engineering.	PDF
CIG 08 Power Poles, Floor Boxes, and Poke Throughs for Communications Systems	Detailed plan and elevation view drawings showing room layout to include power pole, floor box, and poke through location.	PDF
CIG 08 Power Poles, Floor Boxes, and Poke Throughs for Communications Systems	Detailed drawings showing product description and recommended manufacturer installation details to be included.	PDF

CIG 09 Surface Raceways for Communications Systems	Product data sheets showing Raceway part numbers with details on size and cable capacity Raceway fittings part numbers Raceway outlet box part numbers with details on faceplate capacity	PDF
CIG 10 Underground Ducts and Raceways for Communications Systems	As per EDS requirements	
CIG 11 Rooftop Access for Communication Systems	Elevation drawings showing penetration detail.	PDF
CIG 11 Rooftop Access for Communication Systems	Plan view drawings showing penetration detail.	PDF
CIG 13 Identification for Communications Systems	Provide a detailed sketch to CommTech Engineering of the faceplate identification and labeling method to be used if it deviates from that described herein.	PDF
CIG 16 Communications Cabinets, Racks, Frames, and Enclosures	Detailed rack elevation drawings showing all components.	PDF
CIG 16 Communications Cabinets, Racks, Frames, and Enclosures	Plan view room layout drawings showing rack placements.	PDF
CIG 16 Communications Cabinets, Racks, Frames, and Enclosures	Product data sheets for all racks, frames, enclosures, and related elements.	PDF
CIG 17 Communications Termination Blocks and Patch Panels	Detailed elevation drawings showing termination blocks and patch panels.	PDF
CIG 17 Communications Termination Blocks and Patch Panels	Product data sheets for all termination blocks, patch panels, and accessories.	

CIG 18 Communications Cable Management and Ladder Rack	Product data sheets for all materials.	PDF
CIG 19 Communications Equipment Room Fittings	Detailed plan and elevation view drawings showing equipment room size/layout to include equipment rack locations, equipment rack configuration, door size, environmental supply/return, TMGB/TGB location, electric outlet locations, cable pathways, sleeve locations, lighting, voice horizontal and riser backboard location, cable ladder routing, HVAC supply and return location, copper and fiber optic termination hardware, and plywood location and installation requirements. These drawings shall be reviewed and approved by UNC ITS Engineering project manager prior to contractor beginning project.	PDF
CIG 19 Communications Equipment Room Fittings	In buildings with multiple TRs Designer shall include in contract documents detailed riser drawing showing distance from PDR to each TR, number of copper riser connections, number of strands of single-mode and multi-mode fiber riser, CATV coax riser, multi pair telephone riser pairs and number and size of riser conduit from PDR to each TR.	PDF
CIG 20 Communications Copper Backbone Cabling		
CIG 21 Communications Copper Cable Splicing and Terminations	Product data sheets for all materials	PDF
CIG 22 Communications Optical Fiber Backbone Cabling		
CIG 22 Communications Optical Fiber Backbone Cabling	Plan view drawings of fiber routes	PDF
CIG 22 Communications Optical Fiber Backbone Cabling		

CIG 23 Communications Optical Fiber Splicing and Terminations	Product data sheets for all components	PDF
CIG 24 Communications Coaxial Backbone Cabling	Product data sheets for selected cable	PDF
CIG 25 Communications Copper Horizontal Cabling	Product data sheet for selected cable	PDF
CIG 26 Communications Coaxial Horizontal Cabling	Product data sheets for RG-6 coaxial cable RG-6 F-connector RG-6 faceplate bulkhead	PDF
CIG 27 Communications Faceplates and Connectors	Faceplate details drawing shall indicate faceplate and faceplate termination hardware layout.	PDF
CIG 27 Communications Faceplates and Connectors	Plan view drawing showing location of each faceplate with a letter designating the type of connection as follows: D – data T – telephone V – video	PDF
CIG 27 Communications Faceplates and Connectors	Product data sheets for all faceplates and connector types	PDF
CIG 33 Elevator Telephones		PDF
CIG 34 Ring Down Emergency Telephones	Product data sheets for all proposed instruments and components.	PDF
CIG 36 RF Systems	Map showing the location of all proposed devices that emit RF energy, including the latitude and longitude, operating frequency, and power level of each device.	PDF

CIG 37 Wi Fi	Floorplans showing the proposed Wi-Fi access point deployment. The design shall include as much RF-sensitive building detail as possible such as wall/door/ceiling types so that RF propagation can be estimated. Ref. CIG-37 for more complete requirements.	PDF
CIG 39 Auxiliary Networks & Devices	Telecommunications site plan for exterior remote devices including underground pathway, copper, and fiber in PDF and georeferenced AutoCAD formats.	

1.2. After Installation

Section	Description	Format
CIG 02 Testing and Acceptance of Cabling Systems	Test results for each component, organized by location, and clearly labeled.	PDF
CIG 03 Grounding and Bonding for Communications Systems	Telecommunications grounding riser diagrams.	AutoCAD
CIG 03 Grounding and Bonding for Communications Systems	Ground resistance test results.	PDF
CIG 05 Hangers and Supports for Communications Systems	Plan view drawings down to outlet level showing the location of cable pathway segments that utilize hangars and supports and the type.	AutoCAD
CIG 06 Conduits and Backboxes for Communications Systems	Plan view drawings showing all horizontal and vertical conduit routing, cable trays, and pull box locations. Conduit runs to individual outlets need not be indicated.	AutoCAD
CIG 07 Cable Trays for Communications Systems	Plan view drawings showing all horizontal and vertical conduit routing, cable trays, and pull box locations. Conduit runs to individual outlets need not be indicated.	AutoCAD
CIG 07 Cable Trays for Communications Systems	Elevation/coordination drawings showing relationship between cable trays, HVAC, fire suppression, etc.	AutoCAD
CIG 08 Power Poles, Floor Boxes, and Poke Throughs for Communications Systems	Elevation drawings showing penetration detail.	AutoCAD
CIG 08 Power Poles, Floor Boxes, and Poke Throughs for Communications Systems	Plan view drawings showing penetration detail.	AutoCAD
CIG 10 Underground Ducts and Raceways for Communications Systems	Survey quality, plan view duct bank route maps.	AutoCAD

CIG 10 Underground Ducts and Raceways for Communications Systems	Butterfly drawings showing elevations of each surface (North, East, South, West) of each utility vault and the type and arrangement of conduits on each face.	AutoCAD
CIG 11 Rooftop Access for Communication Systems		AutoCAD
CIG 11 Rooftop Access for Communication Systems	Plan view drawings showing penetration detail.	AutoCAD
CIG 13 Identification for Communications Systems		MS Excel
CIG 16 Communications Cabinets, Racks, Frames, and Enclosures	Detailed rack elevation drawings showing all components.	AutoCAD
CIG 16 Communications Cabinets, Racks, Frames, and Enclosures		AutoCAD
CIG 17 Communications Termination Blocks and Patch Panels	Testing results	PDF
CIG 19 Communications Equipment Room Fittings		AutoCAD
CIG 19 Communications Equipment Room Fittings	As-built documentation shall include serving TR when multiple floors are served with a single TR or where a floor has multiple TR's.	AutoCAD
CIG 19 Communications Equipment Room Fittings		printed and installed in TRs
CIG 20 Communications Copper Backbone Cabling	Test results using the same methodology as CIG-25.	PDF
CIG 20 Communications Copper Backbone Cabling		AutoCAD

CIG 22 Communications Optical Fiber Backbone Cabling	OTDT test results	PDF and digital with reader software
CIG 25 Communications Copper Horizontal Cabling		PDF
CIG 26 Communications Coaxial Horizontal Cabling	Test result	PDF
CIG 27 Communications Faceplates and Connectors		
CIG 27 Communications Faceplates and Connectors	Testing results as described in CIG-02.	
CIG 36 RF Systems	Map showing the location of all devices that emit RF energy, including the latitude and longitude, operating frequency, and power level of each device.	PDF
CIG 37 Wi Fi	Floorplans showing the installed Wi-Fi access point deployment. Ref. CIG-37 for more complete requirements.	PDF
CIG 39 Auxiliary Networks & Devices	Telecommunications site as-built drawings for exterior remote devices including underground pathway, copper, and fiber in PDF and georeferenced AutoCAD formats. Network media testing reports. All fibers labeled as described in this section.	

Appendix 3: Pre-Installation Meeting

1. Submittal Requirements

A pre-installation meeting is required between the communications subcontractor and CommTech Engineering to review details of the work and procedural requirements.

The following topics will be covered in this meeting.

- Review the overall installation and review processes, including submittals, State Construction meetings, etc.
- Describe the role of ITS Communication Technologies Engineering and Operations representative.
- Review project responsibilities for ITS and communications contractors.
- Review scope and timetables.
- Review/confirm cable types. (color, CMR/CMP, etc.)
- Review telecom room layout and equipment placement.
- Review testing plan and procedures.
- Review labeling requirements.
- Review general installation practices.
- Review project-specific issues.

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