University IT
Structured Cabling Standards

Revised: September 2024
Follows guidelines set forth by BICSI & EIA/TIA
Prepared by Telecommunications

INDEX

UNIVERSITY OF
NORTH DAKOTA
LEADERS IN ACTION

1. INTRODUCTION & EXPECTATIONS

1.1. Introduction

1.1.1. This document defines UND's structured cabling standards for the campus telephony and network. These standards apply to all new construction and renovated buildings. Communications equipment room configurations and the structured cabling are to be installed following EIA/TIA standards. This document follows applicable BISCI and EIA/TIA standards.

1.1.2. Any contractor that performs work involving structured cabling at UND must meet the following qualifications:

1.1.2.1.   A company with a minimum of five (5) years' experience of successfully performing this type of work

1.1.2.2.   Employ a BICSI Registered Communications Distribution Designer (RCDD).

1.1.2.3.   Supervisors and installers factory certified by manufacturers of products to be installed.

1.1.2.4.   On site Foreman shall possess a current BICSI Installer 2 Certification.

1.1.2.5.   Employ experienced technicians for all work; show at least 3 years experience in the installation of the type of system specified, with evidence from at least 2 projects that have been in use for at least 18 months.

1.2. Acronyms: Definitions & Expectations (in alphabetical order)

1.2.1. **IDF:** Intermediate Distribution Facility

1.2.1.1.   The IDF(s) is/are the consolidation and termination point(s) for the room cabling. Ideally, each floor will have its own IDF; however, there are instances when that is not feasible and room cabling will need to go up or down a floor to the nearest IDF.

1.2.1.2.   The minimum size of an IDF is 120 square feet, with the minimum length of any side of the room being 10 feet.

1.2.2. **MDF:** Main Distribution Facility

1.2.2.1.   The main communications room within a building. The MDF contains the point-of-entry for the backbone conduit and cable connecting the building to the campus network and supports the critical functions as part of the structured cabling system in the building.

1.2.2.2.   The minimum size of an MDF shall be 150 square feet, with the minimum length of any side of the room being 10 feet.

1.2.2.3.   Copper and fiber risers are to be installed between the MDF and each IDF. Topology of riser cabling shall use a star pattern to avoid daisy chaining multiple IDFs.

1.2.3. **MH:** Manhole

1.2.3.1.   Utility/maintenance hole with an opening to a confined space often used as an access point for an underground public utility, allowing inspection, maintenance, and system upgrades.

1.2.4. **MM (OM4):** Multimode Fiber

1.2.4.1. MM fiber cables enable multiple modes of light to propagate through; however, this limits the maximum of transmissions links possible due to modal dispersion. Thus, these fibers are used for short-distance transmissions of signals.

1.2.5. **SM:** Single Mode Fiber
1.2.5.1. SM fiber is a cable designed to carry only a single mode of light that is the transverse mode. These are used for the long-distance transmission of signals.

1.2.6. **UC:** Unified Communications – division of UIT.

1.2.7. **UIT:** University Information Technology – division of UND
1.2.7.1. UND's technology support unit serving students, faculty, and staff.

1.2.8. **UND:** University of North Dakota
1.2.8.1. UND is the state's oldest and largest university. UND offers 225+ highly accredited on-campus and online degrees.

1.2.9. **WAP (or AP):** Wireless Access Points
1.2.9.1. Networking devices that allow Wi-Fi devices to connect to a wired network.
1.2.9.2. Two (2) Cat6A cables shall be installed to each access point location.

1.2.10. **Furnish**
1.2.10.1. Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.

1.2.11. Install
1.2.11.1. Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
1.2.12. Provide
1.2.12.1. To furnish and install, complete and ready for the intended operation.

2. OWNER (UIT) RESPONSIBILITIES

2.1. Labor

2.1.1. Reviewing and approving proposed cable plant
2.1.2. Providing the wireless access layout
2.1.3. Purchase network equipment
2.1.4. Review and approve cable plant test results
2.1.5. Connect the cable between the backbone, risers, and horizontal cabling
2.1.6. Configuration, installation, and activation of:
2.1.6.1. Network Switches
2.1.6.2. Wireless access points
2.1.6.3. Data connections
2.1.6.4. Phone lines

2.2. Materials

2.2.1. Network equipment used to provide network service will be provided by UIT. Network equipment includes:
2.2.1.1.   Network switches
2.2.1.2.   Wireless access points
2.2.1.3.   MDF/IDF patch cords
2.2.1.4.   Uninterruptable power supplies

3. CONTRACTOR RESPONSIBILITIES

3.1. <u>Labor</u>

3.1.1. Installation of all copper 4P-UTP cable
3.1.2. Installation of all multi-paired copper cable
3.1.3. Installation of all fiber cable
3.1.4. Installation of all equipment listed in the bid specifications
3.1.5. Installation of all wireless access points, unless otherwise directed by UIT
3.1.6. Terminate both ends of all cables
3.1.7. Label faceplates, blocks, and patch panels
   3.1.7.1.   Faceplates shall follow this specific detail: MDF/IDF Room Number – Patch Panel Location #
      3.1.7.1.1.   i.e. 016-001, 016-002, 316-001, etc.
   3.1.7.2.   Patch panels shall be labeled with room number where jack resides
      3.1.7.2.1.   <u>i.e. 100-001, 101-002, 300-001</u>
3.1.8. Furnish Division 27 as-builts to UIT UC when a project is complete
3.1.9. Test all cabling end-to-end following the specifications of the installed cable type and furnish test results to UIT UC

3.2. <u>Materials, include but are not limited to:</u>

3.2.1. 4" PVC conduit
3.2.2. Plywood backboard
3.2.3. 19" two-post rack(s)
3.2.4. Entrance copper cable protectors
3.2.5. Cable tray
3.2.6. Horizontal and vertical cable management
3.2.7. Cat6A copper twisted pair cabling
3.2.8. Cat6A patch panels
3.2.9. Cat6A jacks
3.2.10. Cat6A patch cords
3.2.11. Outlet plates
3.2.12. Fiber optic cabling, SM & MM
3.2.13. Fiber optic termination panels
3.2.14. Fiber optic patch cords
3.2.15. Power strips with 6' cord terminated, as determined by UIT

4. COMMUNICATION ROOMS (MDF & IDFs) SETUP

4.1. <u>Comm Room Framework</u>

4.1.1. <u>Layout</u>

4.1.1.1. Ideally, the MDF and all IDFs will be stacked directly on top of each other as they go floor to floor. If the rooms cannot be stacked, there must be two (2) – 4" conduits connecting the non-stacked IDF(s). SM/ MM fiber riser cables and Category 6A riser cables originate at the MDF and are installed between the MDF and every IDF in the building. There is only one MDF per building. If a secondary point of entry is required and installed for redundancy, it will become an IDF.

4.1.1.1.1. A minimum of (12) SM fibers, (12) MM fibers, and (12) CAT6A copper cables shall be provided for riser cables. Coordinate with UIT for exact requirements for each project.

4.1.1.2. A minimum of two (2) – to be determined by networking needs – two-post racks will be mounted perpendicular to the back wall of the IDF. The racks will be mounted side-by-side in a row extending from the back wall. The fiber will be housed on the rack closest to the wall. Racks must be securely fastened to the floor by the contractor using appropriate fasteners.

4.1.1.3. Specific layout of switches and room cabling will be determined by UIT, based on networking needs. Examples:

4.1.1.3.1. If two (2) racks are required, the first rack will house the fiber and switches, and the second rack will house the room cabling and patch panels.

4.1.1.3.2. If four (4) racks are required, the first rack will house the fiber, the second and fourth racks will house the room cabling and patch panels, and the third rack will house the switches.

4.1.1.3.3. If a comm room is being renovated and already has existing racks, all additional racks must match.

4.1.1.3.4. See the attached room drawings for typical MDF and IDF room layouts.

4.1.2. <u>Framework</u>

4.1.2.1. All Comm Room doors are to be equipped with physical key and electronic door access. Doorways shall be designed with minimum measurements of 3' x 6'8" and shall open outward into the corridor.

4.1.2.2. ¾" grey-fire retardant painted plywood will mechanically fasten to the walls and be mounted in landscape orientation. The lower edge is to be two (2) feet above finished floor and the upper edge is six (6) feet above finished floor.

4.1.2.3. Floors shall be sealed concrete or tile. Bare concrete and carpet are prohibited.

4.1.3. <u>Fire Suppression</u>

4.1.3.1. A wet pipe system shall be installed in all MDF and IDF rooms. Placement of piping shall be coordinated with rack layouts to minimize placement of sprinkler piping directly over equipment racks. Provide sprinkler head guards on all heads within IT spaces.

4.1.4. <u>Grounding</u>

4.1.4.1. All Comm Rooms shall have a grounding bus bar. Bar will be three (3) feet long and four (4) inches wide by ¼ inch thick with predrilled NEMA bolt hole

sizing and spacing. This bar shall be attached to the main building grounding system with a wire not smaller than #6 AWG copper. The ground wire shall not share the cable tray with communications cabling. It may be installed in a separate conduit, which may be attached to the outside of the communications cable tray. NEC and EIA/TIA 607 requirement shall be followed.

4.1.5. Additional Utilities

4.1.5.1. HVAC

4.1.5.1.1. Rooms shall be environmentally controlled to maintain the room temperature range of 75-85° Fahrenheit, with a relative humidity level of 30% to 60%, 24 hours a day, 7 days a week. No plumbing or HVAC shall pass through or be directly above any Comm Room.

4.1.5.2. Electrical

4.1.5.2.1. Lighting shall be four (4) foot LED fixtures that will provide a minimum of 50 footcandles at the floor level.
4.1.5.2.2. A dedicated 208V/3 phase panelboard, minimum capacity of 100 amperes, shall be provided in the MDF room for electrical circuiting for MDF and IDF rooms. This panel shall be connected to the emergency generator where available.
4.1.5.2.3. Two (2) 30-amp, 120V, 60HZ circuits with an NEMA L5-30P mounted at the top of each two-post rack. Each 30-amp circuit shall be on a dedicated circuit breaker.
4.1.5.2.4. Provide two double duplex outlets mounted on the wall near the two-post rack. Each shall be connected to a dedicated circuit breaker that is 20-amp, 120V, 60HZ.
4.1.5.2.5. Outlets shall be mounted at the bottom of the plywood. Exact locations will be determined during the building design/review stage.
4.1.5.2.6. All outlets shall be labeled with panel and circuit location.
4.1.5.2.7. All circuits are to be labeled and identified to avoid being turned off in error.

4.2. MDF-Specific Requirements

4.2.1. Three (3) – 4" conduits are installed connecting the building to the nearest MH in the campus duct bank system. Once installed, these conduits will provide a pathway for the installation of the SM fiber to be installed/spliced to existing SM fiber to connect to the campus backbone. The MH location and splice counts will be different for every installation. Specific counts will be provided by UIT. The SM fiber will be pulled into the MDF and then terminated on a fiber patch panel using LC connectors. Fiber terminations in the MH will be with splice enclosures as described in the attached Outside Plant specifications.

4.3. MDF Accommodations

4.3.1. Three (3) – 4" PVC conduits – outside to the nearest MH.
4.3.2. Minimum of three (3) – 19" racks, to be determined by networking needs.

4.3.3. Fiber patch panels to terminate fiber to each IDF.
4.3.4. Single mode fiber incoming backbone cable.
4.3.5. Single mode fiber patch panel.
4.3.6. Vertical cable management between the racks.
4.3.7. Horizontal cable routing hardware placed in the rack housing the switches, leaving space for switch installation.
4.3.8. Copper entrance cable.
4.3.9. Copper protectors for copper cable entering the building.
4.3.10. Network equipment.
4.3.11. Risers to IDFs for Coax (RG-6 or RG-11.)

4.4. IDF-Specific Requirements

4.4.1. The SM/MM fiber and copper CAT6A riser cables installed from the MDF to each IDF are terminated on a rack-mounted panels at both ends. When the patch cords are installed, the switches in the IDF will connect to the entrance switch in the MDF.
4.4.2. Preferred design is to have one (1) IDF per floor; however, more than one IDF will be **required** when room cabling between a jack and the IDF exceeds 295 feet (90 meters).

4.5. IDF Accommodations

4.5.1. Minimum (2) - 4" conduit sleeves through floor where IDF(s) are stacked.
4.5.2. Minimum of (2) - 4" conduits with 200 lb pull cord connecting any non-stacked IDF(s) to the MDF.
4.5.3. Minimum of two (2) – 19" racks, to be determined by networking needs.
4.5.4. Vertical cable management between the racks.
4.5.5. Horizontal cable routing hardware placed in the rack housing the switches, leaving space for switch installation
4.5.6. Riser cable
    4.5.6.1. Copper Cat6A
    4.5.6.2. Single Mode OS1 fiber cable
    4.5.6.3. Multimode OM4 cable
    4.5.6.4. Coaxial cable (RG-6 or RG-11)
4.5.7. Cat6A Station Cabling and Riser cabling
4.5.8. Coax (RG-6)
4.5.9. Patch Panels
4.5.10. Data Switches

5. Hardware & Cable Management

5.1. Backbone Cabling
    5.1.1. Grounding of all backbone cables and protectors to NEC codes (800-33 & 800-40) unless local codes or the equipment manufacturer's requirements exceed the NEC's.
    5.1.2. When installing copper cabling, building entrance protectors must be installed as close as possible to the cable entrance to the building. The maximum distance outside plant cable, either copper or fiber, may extend into a building is 50 feet. If the protectors are further than 50 feet, the cable must either be installed in continuous Rigid conduit or transitioned to cable designed for indoor cabling.

5.2. Connecting Hardware

5.2.1. Materials used are specified in the attached specifications.

5.2.2. Patch panels are used to terminate UTP cabling in a Comm Room.

5.2.3. UTP cable termination at the jack will be Cat6A.

    5.2.3.1. Maintain twists of ½" from the termination point at the jack and at the Comm Room cable end to the patch panel. Do not peel back the cable jack any more than necessary to terminate the cables.

5.2.4. 75-ohm coaxial cable termination shall follow standard procedures and practices.

    5.2.4.1. All 75-ohm coaxial cable shall be terminated with one piece, compression, male type "F" connectors.

5.2.5. 50/125 MM micron fiber optic cable

    5.2.5.1. Terminated with LC connectors

    5.2.5.2. The maximum optical attenuation at each mated connector shall not exceed 0.5 db. The maximum attenuation for a cross-connect from one terminated fiber to another shall not exceed 1.0 db.

5.2.6. All splices will be done by fusion splicing.

    5.2.6.1. The maximum attenuation for a fusion splice shall not exceed 0.25 db.

    5.2.6.2. 8.3/125 SM fiber optic cable

        5.2.6.2.1. Terminated with LC connectors

        5.2.6.2.2. The maximum optical attenuation for each mated connected shall not exceed 0.5 db.

        5.2.6.2.3. The maximum attenuation for a fiber splice shall not exceed 0.25 db.

5.3. Cable Management Hardware

5.3.1. Vertical Cable Management shall be installed on both sides of all equipment racks. See the attached specifications for vertical cable management requirements.

5.3.2. Horizontal Cable Management shall be installed in all equipment racks above, below, and between each patch panel. There must be enough space between horizontal management hardware that will allow for switch installation. Cable management hardware must be provided and installed to facilitate neat and efficient jumper and patch cord routing on all equipment racks. See the attached specifications for horizontal cable management requirements.

5.3.3. All equipment rack layouts shall be coordinated with UIT prior to installation to determine the exact placement of patch panels, cable management, and owner furnished equipment.

5.4. Horizontal Cabling

5.4.1. Cable distances will follow the EIA/TIA and BISCI standards.

5.4.2. A maximum of 295 feet (90 meters) of Cat6A cabling can be installed between a jack and the termination IDF.

5.4.3. Approved cable types are listed in the attached specifications.

5.5. Horizontal Pathway

5.5.1. Horizontal pathways and work areas are the areas where the cable tray, conduits, or J-hooks are installed for proper installation of structed cabling.

    5.5.1.1. Cable Tray

5.5.1.1.1.   Cabling in a ceiling space is preferred to be in a cable tray. Instances where cable tray is not available, cable must be properly supported and shall not lay on the ceiling tiles, ceiling grid, any piping, HVAC, or water pipes.

5.5.1.1.2.   Structured cabling must be supported, and all TIA standards must be followed.

5.5.1.2.   <u>Conduit</u>

5.5.1.2.1.   Structured cabling at UND does not specify conduit installed between the work area outlet jack and the IDF. Conduits installed at UND will start at the jack in the work area then stub into the access ceiling above, or to the access ceiling of the floor below, the jack. Stub up conduits will have a 90° bend on the end where the conduits enter the ceiling. If a cable tray is present, extend conduits to the overhead cable tray, stopping the conduit just before entering the cable tray. Provide insulated bushing on the end of all telecom conduits.

5.5.1.2.1.1.   All conduits installed where cable is not installed must have a pull cord capable of 200 pounds pulling tension installed by the contractor.

5.5.1.2.1.2.   See attached specifications for additional conduit requirements for telecommunications systems.

5.5.1.3.   <u>Firestopping</u>

5.5.1.3.1.   Shall comply with applicable codes.

6. <u>Minimum cable quantities</u>

6.1. The following are the required minimum number of Category 6A cables for each device

     6.1.1.   (2) for each WAP location

     6.1.2.   (2) for each office data jack location

     6.1.3.   (6) for each lecture podium location

     6.1.4.   (1) for each ceiling microphone location

     6.1.5.   (2) for each printer location

     6.1.6.   (1) for each room scheduler touch panel

     6.1.7.   (2) for each video monitor

     6.1.8.   (2) for each digital signage monitor

     6.1.9.   (1) for each security camera

     6.1.10. (2) for each building automation panel

     6.1.11. (1) for each lighting control panel

     6.1.12. (1) for each card access control panel