Division 27 - Communications

This document is designed to assist certified Information Transport System designers such as Professional Engineers and Registered CommunicationsDistribution Designers (RCDD®) in the preparation of ITS documents in the appropriate Construction Specifications Institute (CSI) format that will accompany a full set of Telecommunications drawings for new construction projects, major renovation projects, and minor renovation projects on the Old Dominion University Campus. This document is also intended as a standard by which all low voltage telecommunications infrastructure shall be installed University wide.
Old Dominion University's Information Technology Services Group is responsible for the maintenance of this document. Changes to this document shall be made using the change process specified in the Old Dominion University Design and Construction Standards, of which thisdocument is an appendix. Suggested changes to this document or variances from this standard must be coordinated through the manager of ODU IT's Services Group at 757 683-3017.

27.1 Introduction

27.1.1. Overview: Communication technologies are a critical element in the design of all new and renovation building projects. Whether it be voice, data and video transmission, security and fire alarm systems, building automation systems, audio/visual systems, or other communication technologies, it is important that a team of experienced professionals be involved in the design of these complex systems.
A Structured Cabling Plant is a key concept in enabling Information Technology for the ODU community. In order to maximize network functionality, and to minimize labor and materials costs, a common set of network codes and standards shall be complied. To accomplish this, ODU has adopted a policy in which these codes and standards are managed and administered centrally. The Old Dominion University Information Technology Services group (ITS) is charged with this responsibility. Specific ODU entities have additional requirements and should be consulted to ensure standards are maintained (refer to Appendix 6).

a. Definitions

i. ODU IT: Old Dominion University Information Technology Services group

ii. ODU NST: Old Dominion University Network Services Team

iii. ODU NST Construction Management: The Network Services project managers interact with ODU Department of Design and Capital Construction (https://www.odu.edu/construction), architects, and engineers as the owner representative in regards to Information Technology Services telecommunications infrastructure for the design and construction of new and renovated buildings.

iv. ODU Department of Design and Capital Construction: Old Dominion University's Planning, Design, and Construction oversees all ofthe University's major and minor construction and renovations.

27.1.2. General: Designers shall verify that all applicable portions of these standards are incorporated into the project's design, drawings, specifications and final construction. Requests for variances from these standards shall be submitted in writing to ODU Department of Design and Capital Construction. Use the Standards Variance Request Form found in the bid documents.

27.1.3. Telecommunications Projects Eligibility Requirements: All projects designed by an architect/consulting engineer, shall have the telecommunications infrastructure designed by the consultant team (Designer) and installed by the Contractor and ODU personnel. This infrastructure shall include all pathways and telecommunications room construction installed by the contractor, and cabling, terminations, and testing

completed by ODU personnel. The Designer shall provide these services in accordance with these standards and asdirected by the ODU NS Construction Management.

27.1.4. Old Dominion University's Final Provisioning Work for all Projects: For all construction projects for the Old Dominion University, construction budgets are required to fund all internal and external telecommunications assets. This includes all wiring, telecom rooms, connectivity products, electronics, etc. Furthermore, the construction budget is required to pay for any additions to outside plant infrastructurethat is needed to support the operation of the building. Designers and Contractors shall be required to develop construction schedules that allow adequate time for ODU IT or other responsible organizations to complete this final provisioning work, prior toSubstantial Completion and the Owner's occupancy of each part of a project.

a. Contractors shall be required to cooperate with ODU IT personnel and allow themequal access to the jobsite to inspect and complete any work necessary in the completion of the project, concurrent with other work underway by the Contractor.

27.1.5. Codes and Standards: ODU's communications systems shall follow the codes and standards set forth in the following: NEC, NESC, NFPA, ANSI/TIA Telecommunications Building Wiring Standards, FCC, IEEE and BICSI'S Telecommunications Distribution Methods Manual. These codes and standards are to be used as references when designing Structured Cabling Systems.

a. Old Dominion University promotes the use of widely accepted industry standards in deploying the University telecommunications infrastructure. Employees of the university, consultants and contractors working on behalf of the university should have a working knowledge of these standards prior to performing work for the university and should follow the university preferred standards and practices while deploying telecommunications infrastructure. University employees, consultants and contractors should contact ODU NST Construction Management for clarification and interpretation of these standards. The following standards are practiced at Old Dominion University:

   a. ANSI/TIA-568-C.0. Generic Telecommunications Cabling forCustomer Premises
   b. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
   c. ANSI/TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and components Standard
   d. ANSI/TIA-568-C.3 Optical Fiber Cabling Components
   e. ANSI/TIA-569-D- Commercial Building Standard for Telecommunications Pathways and Spaces
   f. ANSI/TIA-606-B Administration Standard for the Telecommunications Infrastructure. See Appendix 1 for the current ODU Labeling standard based on ANSI/TIA/EIA-606-B
   g. ANSI/TIA-607-B Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
   h. ANSI/TIA/-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard
   i. ANSI/TIA/-862-A Building Automation Systems Cabling Standard for Commercial Buildings
   j. ANSI/TIA-942-A Telecommunications Infrastructure Standard for Data Centers
   k. NECA 1-Standard Practices for Good Workmanship in Electrical Contracting

b. These standards can be obtained through BISCI at www.bicsi.com as well as www.tiaonline.org. This manual is based on the version of the standards indicated. In practice, the most recent version should be used.

c. These standards are not intended to be used as the final specification or bid document for any specific new construction. The standards are to be used as a starting point in a process of collaboration between the architect/designer, the occupant, and ODU IT.

d. All outside plant telecommunications connecting into the ODU network conduit system managed and

maintained by ODU NST shall be coordinated with ODU NST Construction Management. Any outside plant work associated with communications shall be provided by the ODU NST approved and designated underground services contractor.

e. Building interior telecommunication installation is managed by ODU NST.

f. The expected outcome of this document is a detailed listing of commonly accepted design standards for ODU telecommunication and structured wiring systems. These documents are to include a set of appropriate division specifications per Divisions 25, 27, and 28 of the CSI Master Format as well as Telecommunications Drawings or Sheets (a.k.a. T-Drawings or T- Sheets).

27.2 Entrance Facility (ODU typically does not utilize a separate Entrance Facility U.O.N.)

27.3.1. Overview: The Entrance Facility (EF) is the main telecommunications building service entrance. It is the area where the demarcation between the inter-building and intra-building cabling systems is affected. This securable room is to be dedicated to this purpose with no other building services sharing the space except as noted below. This room can be collocated with the Main Telecommunications Room (MTR). In the case of collocation of the Entrance Facility and the Main Telecommunications Room, the Entrance Facility square footage must be added to that of the Main Telecommunications Room to accommodate for the entrance conduit, cable, and breakout.

27.3.2. Size: A minimum of 35 square feet must be provided to house the Entrance Facility of a new building. This space may be expanded for larger buildings. If incorporated into the MTR, allow for the minimum, dedicated Entrance Facility space in the MTR.

a. Minimum ceiling height is 9' 6", with the bottom of the exposed structure considered the ceiling. The wall shall extend to the bottom of the exposed structure. There shall be no suspended ceiling.

b. All rooms shall be square or rectangular with walls at right angles to each other. No triangular rooms or walls with curves shall be allowed. No columns shall be allowed inside the room.

27.3.3. Location: The service entrance room location shall be in a location to allow ease of access for both OSP and ISP cabling. This room shall be completed early in the construction phase and turned over to ODU, so the copper, fiber and broadband feeder cables to the room can be installed. This room should not be used as a temporary electrical entrance or distribution. The room shall be dedicated to Telecommunications Services.

27.3.4. Casework in an Entrance Facility: When installing a floor-mounted rack or cabinet, without panels, fasten the rack or cabinet to the floor and bond the rack or cabinet to the ground bus. Location of the rack or cabinet will be identified during the design phase.

27.3.5. Disconnect Modules: The ODU NST Construction Manager shall coordinate with the public utility on the installation of the building entrance terminal protectors when the feeder cables are installed.

27.3.6. Door: Rooms shall have a fully opening, lockable door opening into an indoor publicly accessible area. The door shall be at least 36" wide and 80" in height. The door shall have electronic access control installed and connected to ODU's existing campus system. (See Electronic Access Control section for more information)

27.3.7. Electrical: Equipment rack electrical outlets should be tied to dedicated telecommunications panels and on emergency power when available. (1) courtesy outlet should be located on each wall.

a. See associated drawings ???? for electrical outlets.

b. Every electrical outlet shall be labeled with printed labels to indicate the serving power panel and breaker.

c. Location of electrical panels should take in to account the design and layout of other equipment in

the telecommunications rooms to ensure proper equipment spacing and access as defined by electrical code. The designers should avoid placing an electrical panel(s) within the wall cavity adjacent to the telecommunications room.

d. Electrical panels, except those exclusively for telecommunications equipment, shall not be located within the telecommunication rooms.

27.3.8. Grounding: Provide a building ground cable, with bus bar, to the room. Locate the bus bar as noted on telecom room drawings on the fire rated backboard. Refer to Grounding section of these standards. (See Grounding and Bonding – Appendix 2)

27.3.9. Identification: The Entrance Facility shall be identified and labeled per ODU Department of Design, & Capital Construction standard procedures.

27.3.10. Interior Finishes: To minimize dust, floors shall be of vinyl composition tile or sealed concrete. All exposed concrete, brick and gypsum board walls shall be painted or sealed.

27.3.11. HVAC: Per TIA/EIA Standard. If active electronics are installed in this space, environmental control system shall maintain temperature between 64 degrees F and 75 degrees F with a relative humidity between 30% and 55%.

27.3.12. Lighting: Provide a minimum equivalent of 500 lux (50 foot candles) measured at 1 m (3 ft) above finished floor

27.3.13. Pathways entering the Entrance Facility: The number and type of telecommunications circuits that will be brought into the building shall determine the number and size of inter-building conduits entering this room. The minimum number of conduits to a building is four (4), with two (2) each entering the facility from two diverse hand holes / manholes. Conduit size will be determined based on building size. All service entrance conduits shall terminate in the entrance facility. For Telecommunications bonding backbone, a 1" sleeve or conduit is required for proper grounding pathway. All conduits are required to be fire stopped per NEC.

a. If the Service Entrance Facility is not serving as the Main Telecommunications Room for the building, then an equal number of 4" conduits must be installed to connect these rooms. All service entrance conduits shall terminate in the service entrance room.

27.3.14. Pathways in the Entrance Facility: A 12 inch, or greater, cable ladder style tray shall be installed that will encircle the room at 8.5' AFF. Additionally, trays shall be installed to service equipment rows, cross-connect areas, and conduits entering the room. Waterfalls must be installed where cables drop from the cable ladder tray.

a. Bond each section of the cable tray to the ground bus, or bond each section to the next and then to the ground bus per NEC. There must be a path from each section to ground. Location of the cable tray shall be identified by ODU NST Construction Management during the design phase of the project.

27.3.15. Plumbing: Entrance Facility shall not have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab below the room.

27.3.16. Backboard Panels: Each wall shall have listed and fire rated backboard consisting of 3/4" X 4' X 8' sheets of A-C Grade plywood installed on them for anchoring termination strips and other devices. The listed and fire rated backboard panels shall be gray in color with 100% acrylic latex primer/sealer applied to front and sides of plywood substrate. Labels must clearly indicate the listing and fire resistivity and be affixed to the backboard.

a. The backboard shall reach from corner to corner. Install the backboard vertically at 12" AFF and anchor securely to wall substrate with a minimum of five (5) equally spaced fasteners along each vertical edge and down the centerline of each panel. Backboard kits shall include fasteners for masonry, hollow block, steel frame and wood frame walls. Fasteners must be flush with surface of backboard. Fasteners shall be of the appropriate type for each substrate. Provide blocking or additional studs in framed walls to receive backboard panel fasteners.

27.3.17. Card Key Access and Security: ODU Security Policy calls for the protection of all IT infrastructure, equipment, and hardware located within a building. If a new or renovated building includes integration of an access control system, telecommunications rooms shall also be integrated into the access control system for secure entry and monitoring. Systems employed must match those currently being deployed throughout campus.

27.3 Main Telecommunications Room (Typically doubles as the Entrance Facility)

27.3.1. Overview: This space provides for the demarcation between inter-building and intra-building telecommunications service. This area contains the electronic equipment that transitions between the core campus data, voice and video backbones and the building backbone. This securable room is to be dedicated to this purpose with no other building services sharing the space. This space is typically co-located with the Entrance Facility, provided the room is sized for both functions. ODU typically does not differentiate in design or use a Main Telecommunications Room from other telecommunications rooms within a building with the exception of OSP conduit entering the room. This room would be located on the 1st floor of a building.

a. A Main Telecommunications Room shall meet all the basic requirements as those previously indicated for the Entrance Facility. In addition, Main Telecommunications Rooms will have additional requirements as noted below.

27.3.2. Size: Each Main Telecommunications Room shall have the minimum size restrictions based on the overall square footages of the ***total building area*** being served. The following are minimum guidelines – consult ODU NST Construction Management for approval on final design:

In larger buildings, the size of the TR size should be increased in increments of 10 ft2 for every increase of 100,000 ft2 in gross building area.

Total Building Size in Gross Sq. Ft.	Minimum MTR Size
up to 500,000	**9' x 11'**

Coordinate all final telecom room and space sizing with ODU NST Construction Management during the design process for the project.

b. Where a Main Telecommunications Room will also provide service as an Entrance Facility or Telecommunication Room, the minimum size of the room shall be determined by summing the square footage requirements of all services that will be supplied by that room.

c. Security access control panels: Where a Main Telecommunications Room may house security access control panels, the minimum size of the room shall be provided, in fact, larger rooms may be needed depending on the amount of equipment proposed. Coordinate wall mounting of access control panels with ODU NST Construction Management prior to installation. No servers or other ancillary security equipment shall be installed in Telecommunication Rooms. Security panels shall have their own power

source and additional power should be designed into Telecommunications Rooms that house access control panels.

27.3.3. Location: The Main Telecommunications Room shall be located to ensure that the room has access to the intra- and inter-building backbone pathway, is accessible for delivery of equipment, away from potential sources of EMI, away from machinery that causes vibration, and away from steam pipes, drains, and clean-outs. If the Main Telecommunications Room is on a different floor than the Entrance Facility, it should be vertically aligned above the Entrance Facility Room.

27.3.4. Casework in the Main Telecommunications Room: Install 4-post 7' racks or cabinets, without panels, to support video, voice and data network termination devices and electronics. All data equipment shall be rack-mounted and the infrastructure design should reflect this. The amount of service required to support the building might require more than one rack or cabinet to be installed. Fasten the rack(s) or cabinet(s) to the floor and bond the rack or cabinet to the ground bus.

a. Number and location of the racks or cabinets shall be supplied during the design phase of the project (see Telecommunications Room Examples – Appendix 3). Four post racks shall be secured to the wall behind them with a ladder rack. A good working environment for a telecommunications room includes at least three feet of clear space extending out from the front of the equipment mounted on a wall and at least three feet out from the front and back of equipment mounted in a rack with two feet of clearance on each side.
b. All racks and cabinets shall be provided with cable management for horizontal and backbone cabling. (See Telecommunications Room Examples Appendix 3).

27.3.5. Disconnect Modules: As per Entrance Facility.

27.3.6. Door: As per Entrance Facility.

27.3.7. Electrical: There shall be six (6) 110V 5-20R outlets and four (4) 208V L6-30R outlets behind the proposed rack location(s). Each of these outlets shall be on a dedicated circuit. (Number of outlets varies depending on number of equipment racks – See Section 4.2 or Telecommunications Rooms Examples Appendix 3 for requirements)

a. On each wall, there should be a minimum of one courtesy 120Vac/20A electrical duplex outlet at 18" AFF.
b. A dedicated circuit shall serve every outlet that provides electrical service to networking equipment, such as switches or power supplies. This is not necessary for the general service outlets 18" AFF. Every electrical outlet shall be labeled with printed labels to indicate the serving power panel and breaker.
c. If standby power is or will be available, the electrical circuits for the racks shall be included in optional standby power design.

27.3.8. (HOLD)

27.3.9. HVAC: Equipment Rooms that house electronics shall have a stand-alone HVAC source to maintain continuous control of temperature and humidity (24 hours per day, 365 days per year). The ITS designer must consider the heat produced

by each piece of equipment (the BTU rating) that will be placed in each Equipment Room. The final Equipment Room design must accommodate any special or specific requirements for heating and cooling. Temperature and humidity shall be controlled at 64 to 77 degrees

- and 40% to 55% RH respectively. Additionally, design as needed heat dissipation of 5000 BTU/hr per cabinet to accommodate installed electronics. Temperature: 18 – 27°C (64 – 81°F)
- Maximum relative humidity (RH): 60%
- Minimum dew point: 5.5°C (42°F)
- Maximum dew point: 15°C (59°F)

a. **HVAC Location:** The installed location of the HVAC unit and pipes feeding the unit shall be designed to minimize risk of dripping fluids on the network electronics and shall not be above the network electronics rack. (Ideal location – Split system above door – See Telecommunications Rooms Examples Appendix 3)

27.3.10. Identification: As per Entrance Facility.

27.3.11. Interior Finishes: As per Entrance Facility.

27.3.12. Lighting: Provide a minimum equivalent of 500 lux (50 foot candles) measured at 1 m (3 ft) above finished floor.

27.3.13. Pathways entering the Main Telecommunications Room: If the Entrance Facility room is not serving as the Main Telecommunications Room for the building then a minimum of (3) 4" conduits must be installed to connect these rooms. (May vary depending on building size and use)

a. A minimum of three (3) 4" conduits shall be installed between each Telecommunications room and the Main Telecommunications Room. For Telecommunications bonding backbone, a 1" sleeve or conduit is required for proper grounding pathway. All conduits are required to be fire stopped per NEC.

27.3.14. Pathways in the Main Telecommunications Room: As per Entrance Facility.

27.3.15. Plumbing: As per Entrance Facility.

27.3.16. Listed and Fire Rated Backboard Panels: As per Entrance Facility.

27.3.17. Card Key Access and Security: As per Entrance Facility.

27.7.27. Telecommunications Rooms

27.4.1. Overview: These rooms provide for demarcation between the per-floor horizontal service distribution cabling and the building video, data, and voice backbone cabling. A Telecommunications Room provides the connection point between the building backbone and horizontal distribution pathways. These securable rooms are to be dedicated to this purpose with no other building services sharing the spaces (except as noted below in paragraph 4.2.1 for the security panels). A Telecommunications Room may be co-located with the Entrance Facility and/or Main Telecommunications Room provided the room is sized for both functions.

27.4.2. Size: For new construction the preferred size is as shown in table below. Rooms will have one door opening into a major publicly accessible hallway.

Telecommunication Outlets per floor	# of 4 Post Equipment Racks	Minimum Room Size - Ft	Rack Power
Up to 192	1	7 x 9	4 – 110V 5-20R 2 – 208V L6-30R
193 to 336	2	9 x 9	6 – 110V 5-20R 2 – 208V L6-30R
337 to 672	3	11 x 9	6 – 110V 5-20R 4 – 208V L6-30R

673 and above – 2nd TR required	N/A	N/A	N/A

a. Security access control panels: As per Main Telecommunications Room.

27.4.3. **Location:** A Telecommunications Room shall be centrally located in reference to the area it serves. This is to minimize the horizontal cable lengths and duplication of electronic equipment.

27.4.4. At a minimum, a Telecommunications Room shall be provided for each floor of the building. The Telecommunications Rooms should be located above each other on the different floors. If the Telecommunications Rooms are not stacked, the Telecommunications Room shall have a means to access the Telecommunications Rooms on the floor above and below via metal conduits or sleeves.

27.4.5. Maximum distance between the Telecommunications Room on each floor and a telecommunications work area data outlet is 295 feet, as measured per the cable pathway.

27.4.6. Casework: As per Main Telecommunications Room.

27.4.7. Disconnect Modules: As per Entrance Facility.

27.4.8. Door: As per Entrance Facility unless a special room size is approved.

27.4.9. Electrical: As per Main Telecommunications Room.

27.4.10. Grounding: As per Entrance Facility.

27.4.11. HVAC: As per Main Telecommunications Room.

27.4.12. Identification: As per Entrance Facility.

27.4.13. Interior Finishes: As per Entrance Facility.

27.4.14. Lighting: As per Entrance Facility.

27.4.15. **Pathways Entering the Telecommunication Room:** If the Telecommunications Rooms are stacked one above another, three (3) 4” sleeves shall be installed between each Telecommunications Room. Should Telecommunications Rooms not be stacked, a minimum of three (3) 4” conduits shall be installed between each Telecommunications Room and the Main Telecommunications Room. For Telecommunications bonding backbone, a 1” sleeve or conduit is required for proper grounding pathway. All conduits are required to be fire stopped per NEC.

27.4.16. P**athways in the Telecommunication Room:** As per Main Telecommunications Room.

27.4.17. **Plumbing:** As per Entrance Facility.

27.4.18. **Listed and Fire Rated Backboard Panels: As per Entrance Facility.**

27.7.28. <u>Backbone Pathways</u>

27.28.1 **Overview:** Communications conduit requirements depart from that for “normal” electrical power distribution. Communications conduit sizing does not follow NEC in terms of the maximum number of conductors allowed per unit volume. Due to the need for facilitating frequent additions, moves and changes to the telecommunications systems, communications conduits are generously sized larger.

a. Conduits serving as a backbone pathway for telecommunications cables are a minimum of 4”. Conduits serving as a pathway for grounding conductors are a minimum of 1”.

b. Conduits shall be used to feed the Entrance Facility from the Outside Plant (OSP). Conduits or sleeves shall be used to connect the Entrance Facility to the Main Telecommunications Room. Conduits or sleeves shall be used to connect the Main Telecommunications Room and the Telecommunications Rooms.

27.28.2 **Entrance Facility Conduits:** Reference the Outside Plant section (of this standard for complete design guidelines. The following shall only act as a general guide for initial backbone pathway considerations.

a. A minimum of four (4) conduits shall be used to provide connections from the Outside Plant into the Entrance Facility. (2 each from diverse hand holes/manholes) (Conduit size will vary depending on size of building)

b. Conduits entering the building are a minimum of 2" in size with some type of sub-space partitioning.

c. Conduits shall terminate 1” to 3” inside the Entrance Facility per TIA-569-B and be reamed and bushed.

d. All Entrance Facility conduits shall be sealed so as to be water and gas tight after installation.

e. Conduits shall not contain more than two 90-degree bends and be placed with a minimum of ¼ inch per foot slope, away from the Entrance Facility, to allow proper water drainage from the ducts.

f. If the Main Telecommunications Room is not also functioning as an Entrance Facility, conduits or sleeves of equal number and size shall be installed from the Entrance Facility into the Main Telecommunications Room.

g. An additional 1” conduit or sleeve shall also be provided from the Entrance Facility to the Main Telecommunications Room to provide a pathway for the Telecommunications Bonding Backbone cable.

27.28.3 Main Telecommunications Room Conduits: A minimum of two (2) 4” conduits or sleeves shall be installed between the Main Telecommunications Room and each individual Telecommunications Room.

a. One (1) 1” conduit or sleeve shall be installed between the Main Telecommunications Room and the Telecommunications Room. The Telecommunications Bonding Backbone cable shall use this conduit or sleeve.

27.28.4 **Telecommunications Room Conduits:** A minimum of two (2) 4” conduits or sleeves shall be installed between the Main Telecommunications Room and each individual Telecommunications Room.

a. One (1) 1” conduit or sleeve shall be installed between each Telecommunications Room and the one above. The Telecommunications Bonding Backbone cable shall use this conduit or sleeve.

b. Conduits between building telecom rooms shall be a minimum of 4" in size.

27.6.0 <u>Horizontal Pathways</u>

27.6.1. Overview: The standards adopted by this University provide that a clear and accessible pathway for horizontal telecommunications cabling be provided. These pathways are located between the Telecommunications Rooms and the rooms containing the telecommunications outlets. The Design Team shall prepare Telecommunications drawings and specifications that ensure a clear and accessible pathway for telecommunications cabling. Any pathway that is not accessible or does not provide a clear and workable pathway will be rejected.

a. There are several methods available for providing a pathway for supporting telecommunications cables. The architectural design of each building is unique and requires an analysis of which method(s) are best suited for that building.

b. Conduits run directly from the Telecommunications Room to the Work Area Outlet or Cable Trays with Work Area feeding conduits are accepted for horizontal pathways. “J hooks” or other similar

types of cable pathway devices should be avoided in any new construction or major renovation project design. MUTOA's, CP's, and TP's are not to be used unless authorization is approved during the design phase.

27.6.2. Cable Trays: Cable Trays are the preferred pathways for supporting horizontal telecommunications cables. Cable trays shall be provided from the Telecommunications Rooms to support the horizontal cabling. Cable tray should be run in publicly accessible spaces, any cable tray run through private offices, conference rooms, classrooms, etc. that are intended as major cable paths will not be accepted.

a. **The minimum cable tray width is 8" and minimum cable tray depth is 2".** The actual cable tray size(s) shall be determined during the design phase of the project. The cable tray shall be installed in accordance with the applicable electrical code. The cable tray is to be dedicated for use only by low-voltage cabling systems. Cable tray should be trapeze supported or wall mounted. If wall mounted, additional threaded rod supports should be provided from the ceiling to the outer edge of the wall mounted tray. Center support cable trays shall not be accepted.

b. Cable Trays should have devices installed at all inside corners to prevent minimum cable bending radius from being exceeded.

c. The specification for this cable tray shall be provided along with the design layout.

d. Cable tray clearances shall follow ANSI/TIA 569-D Standards.

27.6.3. Horizontal Conduit: Conduit may feed WAO boxes directly from the Telecommunications Room (home-run). Conduits shall not run continuously for more than 100' before installing a pull box.

a. Conduits shall not contain more than two 90-degree bends without a pull box. Directional changes shall be made outside pull boxes. At no time shall a pull box be accepted in favor of a bend in the conduit.

b. Label all conduits as per ODU Labeling Standard. (See ODU Labeling Standard in Appendix 1) Label all pull and junction boxes with the letters IT (See ODU Labeling Standard in Appendix 1).

c. A minimum of one (1) 1" conduit shall connect from the work area outlet box to the nearest cable pathway. Conduits connecting a Work Area Outlet and the Cable Tray shall terminate within 4" and above the cable tray. Conduit fills shall not exceed 40 percent of the conduit capacity.

d. Conduits shall be reamed and bushed.

e. Each conduit shall contain a nylon pull cord with a 200 LB pulling tension.

27.6.4. Prohibited Components: No LB type fittings of any size are to be used for communication conduit. No PVC conduit or PVC sleeves are to be used for communications conduit within the confines of a building.

27.6.5. Conduit Grounding: Horizontal pathway conduits shall be grounded to the cable tray to ensure a proper grounding path. This may be accomplished by bonding the conduit to the cable tray, using a grounding strap, and/or a grounding bushing.

27.7.0 Work Areas

27.7.1. Overview: Design of Work Area Outlets (WAO) change more often than any other piece of the design process. Different needs demand different solutions. As such, this section details only the most basic requirements and innovative designs that keep these minimal standards in mind are acceptable.

27.7.2. WAO Cable Count: A Work Area Outlet must be able to support at least two unshielded twisted pair (UTP) cables to support telecommunications needs. Customer and department needs will dictate the number of connections needed. however, the standard is one cable per WAO. Wireless access points, IP cameras and emergency notification speakers will also have a single cable.

27.7.3. **WAO Rough-in:** Telecommunications outlet boxes installed in drywall, plaster, or concrete block wall must be at least 4 X 4 inches and 2.5 inches deep with a minimum 1 inch conduit stubbed to accessible ceiling pathways. All work-area outlet boxes should have a single-gang mud ring.

a. Floor boxes pose several future issues. The design team should plan a pathway to the floor box that allows future accessibility while following horizontal pathway bend radius and pull box requirements. Floor boxes have proprietary inserts for data communications parts that need to be purchased by the project and furnished to the ODU IT qualified low-voltage contractor.

b. Modular furniture also poses an issue if the data cables are to be integrated into the furniture. A permanent pathway between the wall or floor and the furniture needs to be designed and installed in accordance with horizontal pathway bend radius and pull box requirements. The use of “whips” is acceptable but must be coordinated up front to ensure that no scope gaps occur.

27.7.4. **WAO Room Count:** All office areas should have at least two Work Area Outlets. These outlet boxes shall be installed on opposing walls. Customer and department needs may require additional locations to meet the users’ needs.

27.7.5. **WAO for Wireless:** In conjunction with ODU IT, the design team should conduct a wireless survey and design the wireless system. One work area outlet shall be dedicated to each wireless access point location. See Section 19.0 Wireless Networks for additional design requirements.

27.7.6. **WAO Conduit:** See Horizontal Pathway section of this standard for conduit requirements.

27.7.7. **WAO Labeling:** Label all work area outlets (WAO) and WAO terminations. (See ODU Labeling Standard in Appendix 1).

27.7.8. **WAO Video Needs:** See Video section of the standard for details on video cabling and pathways requirements.

27.8.0 **Backbone Cable**

27.9.1. **Overview:** The building backbone system connects Telecommunications Rooms to each other, to the Main Telecommunications Room and the Main Telecommunications Room to the Entrance Facility. ODU specifies several separate cable systems to provide for the data, video and voice needs of the building occupants. Riser-rated twisted-pair copper multi-pair cables, coax, and single-mode fiber along with their termination systems are specified.

27.9.2. **Entrance Facility to Main Telecommunications Room Backbone Cable:** Where an Entrance Facility is not collocated with the Main Telecommunications Room the backbone cables connecting these two rooms shall be equal in content to the cables provided to the Entrance Facility from the Outside Plant. These cables may differ in composition (i.e., rated for interior use) than the entrance backbone cable shall have a pair count, strand count and so on, sized for the needs of the building.

27.9.3. **Copper Cable Backbone:** Installation of a copper cable backbone will be decided on a case-by- case basis. Please consult the NST project manager to determine if installation is necessary. If necessary, a minimum of one 25-pair category-5e or better riser cable shall be installed from the Main Telecommunications Room to each Telecommunications Room. Building design, use and/or services may dictate additional pairs for riser cable needs.

27.9.4. **Copper Cable Testing & Records:** The contractor shall provide the following electrical test records per the Deliverables section of this document for all backbone copper cables:

a. Continuity tests on all pairs (test for opens).

b. Test for crosses and shorts, on all pairs.

c. Test for loss at 100.4 MHz, on all pairs.

d. Test for noise metallic and noise to ground, sampling can be used.
e. Test for insulation resistance, sampling can be used.

27.9.5. Fiber Optic Cable Backbone: A minimum fiber optic intra-building backbone cable consisting of one 48-strand single- mode shall be installed from the Main Telecommunications Room to each individual Telecommunications Room.

27.9.6. Installation: The fiber-optic backbone cables shall be terminated at all locations in a rack-mounted fiber panel. There shall be 10 ft. of jacketed cable slack managed outside of the fiber panel to facilitate future re-terminations. This is typically placed in the cable tray. There shall be 3 ft. of slack (with the outer jacket removed) managed inside the fiber panel.

a. Termination: All fiber strands may not be terminated during construction, direction will be provided during the planning phase. Terminate required fiber strands via fusion splicing and pig-tail style LC type connectors.

27.9.7. Fiber Optic Cable Testing: The contractor on all backbone fiber cables shall provide the following documentation and tests records for each fiber-optic cable installed:

- Identifier as specified by ODU Labeling standard (See Appendix 1)
- Termination fiber panel identifiers for both sides of the cable.
- Total fiber-strand type and count in the cable
- Distance in meters for actual cable length
- Test for end-to-end dB loss, both directions, at 850 nm and 1300 nm for multimode and 1310 nm and 1550 nm for single mode for each individual fiber strand.

a. End to end loss measurements shall be made with a power source and light meter. Multi-mode fiber measurements shall be tested in accordance with ANSI/TIA/- 526-14-A method B. Single mode fiber measurements shall be tested in accordance with ANSI/TIA/-526-7 method A.1. Maximum allowable loss:

Maximum allowable loss for splices is .15 dB

Maximum allowable loss for connectors is .5 dB per pair

27.9.8. CATV Backbone: See Video Specification Guidelines, Section 12.0.

27.9.0 Horizontal Cable

27.9.1. Overview: To satisfy today's telecommunications requirements, the horizontal cabling shall be planned to reduce on-going maintenance and relocation. It shall also accommodate future needs since horizontal cabling is often much less accessible than the backbone cabling. In keeping with this effort, Category 6 unshielded twisted pair (UTP) cabling or better shall be installed in all new construction and major renovations university wide. The time, effort, and skills required for changes can be extremely high. In addition, access to the horizontal cabling frequently causes disruption to occupants and their work. These factors make the choice and layout of horizontal cable types very important to the design of the building cabling. Consideration should be given to accommodating a diversity of user applications in order to reduce or eliminate the probability of requiring changes to the horizontal cabling as user needs evolve.

27.9.2. **Contractor Certification:** ODU has standardized on the Belden Structured Wiring System and all installers shall be Belden certified. Contractors new to ODU should provide certification documents along with bids.

27.9.3. **Cabling Distance:** The cable run from the Telecommunications Room to the WAO, shall not exceed 295 feet and contain no splices. These cables are to provide service for both voice and data communications as an integrated telecommunications system.

27.9.4. **Cable Installation:** Installation and physical protection of Category 6 cable is a critical element for the cable to deliver its rated bandwidth. A "kink", "pinch", a bend radius less than 1.25 inches in diameter, or the manufacturers specified bend radius, or stretching of the cable by exceeding the 25 pound maximum pulling tension during installation will damage the cable to the point that it will not meet rated specifications and shall be replaced.

a. No open or exposed wiring or conduits shall be permitted below finished ceilings.

27.9.5. **Cable Termination:** All UTP horizontal cable should be terminated to T568A pinout. Requirements for terminating Category 6 cable requires that no more than the minimum amount of the common sheath be removed than is required for termination and no more than 1/2 inch of untwisting of conductors.

a. Horizontal cables shall terminate in a rack-mounted patch panel in the Telecommunications Room.
b. When designing the layout of the Telecommunications Rooms rack-mounted patch panels, racks, UPS's, etc., reference the example provided in this standard. (See Telecommunications Room Example in Appendix 3).

27.9.6. **Cable Slack:** At the Work Area Outlet, there shall be 12" of slack after termination to facilitate future re-terminations. Slack will be coiled in ceiling above WAO or at cable tray.

a. In the Telecommunications Room, the cable shall reach the punch-down patch panel and have 10' of slack. Coordinate with ODU NST Construction Management on the placement of the managed slack.

27.9.7. **Cable Type:** All data and voice horizontal cables shall be unshielded twisted-pair cable, each consisting of four twisted pairs of solid conductors type CMP, (Non-plenum cable is not acceptable) Category 6 or better for all new construction and major renovation projects (as specified by ODU NST). The preferred type of communication cable shall be approved by the ODU IT Representative during the design phase of each project.

27.9.8. **Clearances:** The installation of these data and voice cables shall conform to the following clearances:

a. At least 127 millimeters (5 inches) from power lines carrying 2KVA or less
b. At least 305 millimeters (12 inches) from power lines carrying from 2 to 5KVA
c. At least 915 millimeters (36 inches) from power lines carrying more than 5KVA
d. At least 127 millimeters (5 inches) from all fluorescent lights and other sources of electromagnetic interference

27.9.9. **Horizontal cable testing and records:** Each cable shall have a permanent link test performed. For Category-6-rated links a level III tester must be used to certify the cable to 500 MHz. All testers shall be manufacturer certified annually to ensure accuracy.

27.9.10. **Identification:** Each cable shall be labeled on each end with an appropriate cable identifier (i.e., 1A-1A01) (See ODU Labeling Standard in Appendix 1).

27.9.11. Elevator Communications: A single horizontal UTP cable shall be installed to support elevator telephone and emergency communications. There shall be a means of disconnecting and testing the telephone line at or adjacent to the elevator control panel.

27.9.12. Energy Management Systems: Those energy management systems employing the campus data network for communication shall install their physical infrastructure in accordance with these University Telecommunications standards.

27.9.13. Other low voltage cabling systems: Other low voltage cabling systems must adhere to the telecommunications standards as well. These cables may share the use of common cable trays as needed. These types of cables include, but are not limited to, HVAC control cables, fire control cables, and security systems cables.

a. If other low voltage systems are to use the campus data network for communicating, these systems must also conform to the campus telecommunications standards. All low voltage systems using the ODU network shall be inspected by ODU NST Construction Management and the Network Security Group for compliance with these standards.

27.10.0 Grounding and Bonding

27.10.1. Overview: All cabling systems and electronics-distribution equipment shall be grounded for both safety and minimization of electromagnetic interference. Specifications for this are found in this section. Telecommunications grounding systems are composed of Telecommunications Bonding Backbones (TBB) and Telecommunications Grounding Bars (TGB). Bonding requirements for Telecommunications at the Old Dominion University follow the ANSI/TIA607-B standard.

27.10.2. TBB Grounding Wire: The TBB shall be a green insulated grounding wire with a minimum size of 6 AWG.

27.11.0 Deliverables

27.11.1. Overview: Architects and contractors have come to accept the rigid industry standards that data communications / information transport systems impose. To a large degree, specialized skill sets are required for the design and installation of these systems and the technology of telecommunications cabling continues to advance dramatically. For this reason ODU prefers a Registered Communications Distribution Designer (RCDD) on the installation team. Additionally, the installed systems must be documented in a way that allows for minimal ongoing labor in the maintenance and management of the installed system.

27.11.2. Telecommunication Contractor's Obligations: ODU typically provides all structured cabling system materials. The contractor shall provide labor and consumables to install the complete structured cabling system, including installation of communication cables, installation of communication outlets, and termination of all cables in the Entrance Facility, the Main Telecommunications Room, and Telecommunications Rooms. The contractor shall install all of this material per these standards.

a. Contractor to provide weekly time logs to NTS project manager for the duration of a project.
b. Contractor is responsible for obtaining ODU daily or monthly parking passes as needed. odu.edu/life/parking-and-transportation/parking.html.html
c. The contractor shall test and certify all cable and provide documented results of the testing. If any cable run tests defective, the contractor shall replace defective cable.
d. A one-year labor warranty shall be provided on all cable and hardware installed by the telecommunications contractor (In the event the contractor provides materials, they will be

responsible for the parts warranty as well). This shall be in addition to any and all factory warranties that can be provided.

27.11.3. As-Built Drawings and Information: The Contractor shall prepare and submit record drawings at an appropriate scale (1/16" or 1/8" preferred in PDF -- follow ODU Design Services Guide) using an acceptable electronic media format. The record drawings shall convey the following information:

a. Locations and Identifiers of all work area outlets.
b. All horizontal pathway elements including but not limited to cable tray and conduit.
c. Location and identifiers of all Entrance Facilities, Main Telecommunications Rooms, Telecommunications Rooms.
d. All backbone pathway elements.
e. Emergency speakers, emergency phones, and wireless access points.

27.11.4. Test Results and Documentation Required: As a condition of Substantial Completion, the Contractor shall be responsible for providing the following information:

a. <u>Concerning the horizontal cable installation:</u>

i. Complete test results for each horizontal cable. This test information shall be delivered in electronic, Fluke® Linkware™ compatible format.
ii. A cable record for each horizontal cable including the following information:
1. Cable identifier as per ODU labeling standard (see Appendix 1)
2. Termination point on the host end identified as per ODU labeling standard (see Appendix 1)
3. Termination point on the user end identified as per ODU labeling standard (see Appendix 1)
4. Termination hardware used at the host end (patch panel type)
5. Termination hardware used at the user end (outlet jack type)

b. <u>Concerning the backbone and entrance fiber cable installation:</u>

i. Complete test results for each backbone fiber cable strand. This test information shall be delivered in electronic, Fluke® Linkware™ compatible format.
ii. Provide complete path record for newly installed backbone OSP cable per Appendix 1.
iii. An electronic copy of every insert supplied with every fiber panel
iv. A cable record for each fiber cable including the following information:
1. Cable identifier as per ODU labeling standard (See Appendix 1)
2. Termination point on the first end identified as per ODU labeling standard (see Appendix 1)
3. Termination point on the second end identified as per ODU labeling standard (see Appendix 1)
4. Length of the fiber cable
5. Fiber strand count in the individual cable

c. <u>Concerning the terminals of ODU-owned entrance copper cable:</u>

i. Each terminal identifier
ii. Quantity and type of protectors
iii. Quantity and type of termination blocks
iv. Cable identifier and pairs entering or leaving

d. Concerning the UTP riser cable:
   i. Cable identifier
   ii. Cable type
   iii. Size
   iv. Pair counts
   v. Length of the cable

27.11.5. Inspections: Coordinate site inspections with ODU IT for the various phases listed below:
   i. Outside plant – in ground inspection
   ii. Above ceiling inspection
   iii. Behind-wall inspection
   iv. Telecom Room inspection
   v. Substantial completion

a. Note: No network electronics will be activated until the Telecom substantial completion inspection and the remediation of any punch list items. In order to activate ports for building commissioning, at a minimum, the following must be completed as part of the Telecom substantial completion:
   i. Racks properly secured to the floor.
   ii. The TR needs to be secure and lockable.
   iii. Cooling and ventilation must be provided. (Portable AC units are an acceptable temporary solution). Maintain positive pressure in space to reduce dust contamination.
   iv. All power requirements need to be met.
   v. The room must have adequate lighting.
   vi. The TR must have all walls and ceilings in place as to prevent dust and debris from falling onto and into our equipment.
   vii. Cable trays must be installed and ready to use as to prevent dust/debris from falling onto/into our equipment.
   viii. All fiber needed for the project must be installed, tested, and ready.
   ix. Once everything is installed (i.e. cable trays, racks, lighting, power, walls, etc.) the room must be cleaned of dust/debris.
   x. Test results for the horizontal cabling serving the ports requesting activation must be received and approved. Horizontal cabling and WAO must be properly labeled.

27.12.0 **Video Specifications Guidelines**

27.12.1. As of January 2021, Old Dominion University no longer provides intra-campus cable television service.

27.12.2. Projects requiring a wired or satellite television signal should be initiated via ODU Planning, Design and Construction project request. ODU IT will no longer be involved in television signal distribution unless access is needed to our telecommunications rooms.

27.13.0 Outside Plant

27.13.1. ODU ITS manages all OSP pathways and cabling on campus. Service providers are not allowed on campus without special permission.

27.13.2. Overview: Outside Plant (OSP) backbone cable shall fulfill all requirements of backbone cable specified in the Backbone Cable section of this standard.

27.13.3. OSP backbone fiber cable: OSP backbone fiber cable shall be loose-tube cable. Indoor-outdoor loose-tube cable construction is acceptable.

a. Each new structure shall be connected to the nearest core location or Communications Cabinet with a minimum 72SM fiber cable. This cable shall pass through the Entrance Facility and terminate in the Main Telecommunications Room. If the Entrance Facility and the TR are not collocated, 20 feet of managed slack shall be placed in the Entrance Facility. NOTE: per NEC code, non-rated OSP cables must be terminated or transitioned to rated cables within 50 feet of being exposed within the building. OSP cables in conduit are not considered to be exposed.

27.13.4. OSP backbone copper cable: ODU no longer installs new copper/ analog telephone service to buildings.

27.13.5. Splicing Materials: Old Dominion University does not allow splicing of the Outside Plant. If an emergency arises and a splice becomes necessary, contact ODU NST.

27.13.6. Permit: In the event new pathways are installed on City of Norfolk owned property, the contractor is responsible for obtaining Right of Way permits.

27.13.7. Utility Marking: Contractor is responsible for utility marking, contact Miss Utility for public utilities and C3 Communication Construction Corp. for ODU owned utilities (757 592-1382). ODU will provide irrigation marking.

27.13.8. Trenching: Trenching must be performed by hand wherever obstacles or existing utility lines are known to be in the area. The contractor is totally responsible for ensuring that no utility or service interruptions occur and that existing utilities or obstructions shall not prohibit installation of service to be provided under this contract at proper grade and location. Where clear and unobstructed areas are to be excavated, appropriate machine excavation is allowed but only when machine weights and operation shall not damage sub-surface structural components or piping.

27.13.9. Safety: Contractor is to ensure the safety of all students, faculty, staff and property during the installation and maintenance of OSP cable. Proper safety practices and supervision of work area must be adhered to at all times.

27.13.10. Tree Protection: All outside work shall be in compliance with **ODU DESIGN & CONSTRUCTION STANDARDS** on tree protection.

a. **Do not park vehicles or equipment on or near root systems.**

27.13.11. Concrete Cap: Occasionally, it shall be necessary to provide extra mechanical protection to mainline or subsidiary conduit in certain areas of campus.

a. The contractor shall provide a concrete cap with a minimum thickness of 2" consisting of non-reinforced 2500-psi concrete. There must be a minimum of 6" compacted fill between the top of the conduit and the bottom of the concrete cap. Backfill specifications must be followed. Even with the concrete-cap protection, the metallic warning tape must be placed above the cap. Depending on the depth of the cap, the warning tape should be placed at least 6" above the cap.

27.13.12. Barricades: All pits or trenches left open overnight or unattended must be barricaded with caution lights and a plate placed over the opening. A ¼" steel plate or a plywood sheet of sufficient size and thickness may be used for this purpose. In road openings, only a steel plate with sufficient traffic-bearing strength shall be allowed, and in this case barricades are still required. Shoring must be employed in the event of unstable soil conditions.

27.13.13. Repairs: All landscaping should be returned to pre-installation standards including topsoil, reseeding (ODU to approve seed type), straw/hay (if needed), repair all ruts, etc.

27.13.14. All concrete or asphalt should be repaired with like material. (I.E. Asphalt should not be used to patch concrete)

27.14.0 Aerial Pathways

27.16.1. Review Required: Old Dominion University prefers not to install aerial cable and/or pathways and requires special reviews to be approved on a case by case basis for their use.

27.15.0 Underground Pathways

27.15.1. Schedule 80 PVC conduit is preferred for all new underground conduit installations. The preferred method of installing new conduit is simultaneous boring and jacking.

27.15.2. Soil Materials: Any additional soil augured from boring process should be removed. Both the jacking pit and the target pit must be backfilled and well-compacted and landscaping should be repaired.

27.15.3. Trenching, Backfilling and Compaction:

a. **Sand:** Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be mortar sand grade with 95% passing a No. 8 sieve, and not more than 8% passing No. 10 sieve.

b. **Gravel:** Clean, well-graded hard stone or lime rock gravel, free from organic material. Size ranges acceptable from No. 4 screen retention to 1".

c. **Earth:** Free of stones, wood, roots or rubbish.

d. **Backfilling:** Deposit earth or sand, depending on the type of trench requirements, carefully in 4" layers, maintaining adequate side support. Compact fill in 4" layers to meet 95% Modified Proctor Test, using mechanical means up to the top elevation of the conduit and 12" layers to finish grade. Replace surface to the original condition, i.e., sodding in main campus areas, and seeding in the outer areas of campus. Facilities Services Grounds shall assist in determining sod or seed.

27.15.4. Identification: Provide identifying metalized plastic warning tape above conduit when trenched. Warning tape shall be placed 6" minimum and 18" maximum above the conduit.

a. Identification Tape: Polyethylene 0.004" thickness minimum, with metalized locator, 6" wide, yellow or green in color, black letters indicating "Communications" or “Fiber Optic”.

b. All conduits shall be labeled inside maintenance holes, hand holes and Telecommunications Rooms using stamped steel or aluminum tape per Appendix 1 of this standard.

27.15.5. Excavation: Excavation shall be maintained in satisfactory condition during the progress of the work. Sub-surface structures must be constructed in adequately sized excavations with de-watering equipment installed and properly maintained where necessary. In all cases, to protect materials and personnel from injury, shoring must be employed in the event of unstable soil conditions. The standard depth of all trenching is 30 inches as measured from the top of the topmost conduit to the ground line.

a. The contractor, shall at all times, keep the construction area, including storage areas used, free from accumulation of waste material or rubbish. The contractor must exercise reasonable care to prevent construction debris and excavated material from washing into University storm drains. Upon completion of the construction, the contractor shall leave the work and premises in a clean, neat and workmanlike condition, satisfactory to the University.

27.15.6. Non-Paved Restoration: All non-paved surfaces (grass, sod, gravel, etc.) must be restored within 7 days of backfilling and compaction.

a. Sidewalks: Follow guidelines set in the ODU Design & Construction Standards. Sidewalks thickness is 6” with 6x6 number 10 reinforcement wire, 1/2” reinforcement bar and 3000-psi concrete. Removal of sidewalks must be from expansion joint to expansion joint. Sidewalk width should be a minimum of 5 feet, and should match surrounding sidewalk patterns and widths. A float, trowel, and light broom finish is standard.

b. Sod: The standard for sod shall follow guidelines set in the ODU Design & Construction Standards.

c. Service Drives: Follow guidelines set in the ODU Design & Construction Standards. Service drives shall have an 8-inch base of rock compacted to 95% of maximum density. Paving should be 2-inch (min.) type S-1 asphalt. Cuts made through any paved surface must be repaired in a non-discernible fashion. Cuts through concrete must be repaired by replacing the section between the nearest two joints - either construction or expansion. Cuts through asphalt must be repaired so that depressions or humps do not develop during the warranty period. If depressions or humps develop, they shall have to be re-worked until corrected. When cuts extend through pavement markings, the replaced pavement shall be marked to match the existing pavement.

27.15.7. Paving and Surfacing: Follow guidelines set in the **ODU DESIGN & CONSTRUCTION STANDARDS**.

a. Technical Specifications for Construction and Materials: Construction procedures must follow the usual practices of the Virginia Department of Transportation for work of similar character and extent. The provisions and specifications of the "Road and Bridge Specifications," Virginia Department of Transportation edition 2016 shall apply, where applicable, except where modified herein or specifically designated otherwise. References to compensation do not apply. Where reference is made to the "engineer," substitute the appropriate representative of ODU Facilities Services or ODU IT.

b. The contractor must adequately and fully protect all parts of his work against damage until completed and accepted by ODU for maintenance. The contractor at no additional expense to ODU must properly repair damages prior to acceptance.

c. The contractor must protect exposed surfaces adjacent to the work from physical damage resulting from construction activities and from becoming stained during application of paving materials. The contractor shall clean, repair, or replace, as required, surfaces damaged during the course of the work at no additional expense to ODU.

d. The contractor must provide temporary barricades, properly lighted, to keep traffic off the work throughout the duration of the contract.

e. Site Work: Preparation of a new paved road over a new base course:

i. Prepare rock base as detailed in the Virginia DOT Specifications: Allow additional rock for compaction of minimum 6" rock base prior to paving. This is to be in addition to compaction as required in the Virginia DOT Specifications. Asphalt Concrete Surface Course: Surfacing must consist of Type S-3 asphalt concrete in a ½" finishing course following the tack course.

27.15.8. Paved Restoration: Follow guidelines set in the ODU Design & Construction Standards. All roads, streets, sidewalks of concrete or asphalt construction must be restored or repaved within 3 days from the time of backfilling and compaction.

a. 15.8.1 Newly poured concrete roads, streets, curbs, or sidewalks must be protected AND guarded from graffiti from passersby until the concrete has sufficiently cured to resist such molestation. Failure to prevent molestations (graffiti) shall result in the new concrete having to be removed and replaced. This requirement shall warrant the contractor in taking the necessary steps in preventing such incidents, which shall include guarding the project after hours.

27.15.9. Conduit: PVC Conduit and Fittings: Conduit must be made of poly-vinyl-chloride, PVC schedule 80 pipe. Solvent weld fittings are to be used and joints must be watertight. All conduits must be provided with a

sequentially marked pulling tape in English or metric markings with a minimum of 1200 lbs. pulling tension. Conduit must be thoroughly cleaned after lying. During construction and after the conduit is completed, the ends of the conduits must be plugged. After the conduit line has been completed, a mandrel not less than 10" long, having a cross-section approximately ¼" less than the inside cross-section of the conduit shall be pulled through each conduit, after which a stiff bristle brush shall be pulled through.

27.15.10. Conduit Formation: Where practical, conduit formations using single-bore conduit should be arranged so that orderly cable racking can be accomplished within the maintenance hole or hand hole and that minimum changes are made in the formation as it enters the maintenance hole. Ducts must terminate in maintenance holes or hand holes in a manner that is conducive to orderly cable racking. Main conduit formations shall enter the end walls of a maintenance hole as nearly equidistant between the floor, roof, and sidewalls as is practical. Subsidiary conduit (the additional ducts required for housing cables that would extend from the main conduit system) to a building location shall be located on top of the main conduit formation. Conduit formations that are to terminate in a minimum 36"x48"x24" hand hole must splay before reaching the hand hole and enter the bottom when possible.

27.15.11. Bends: The contractor must use the longest radius bends possible. The minimum bend radius to be used on main conduit formation is 15 feet and on subsidiary conduit is 6 feet. These minimum radius bends must also be encased in concrete along the full length of the bend. Use factory manufactured bends (heated bends are discouraged). On 4 inch PVC conduits, anything less than an 80 foot bend radius requires concrete encasement. In other words if you cannot bend a 4 inch diameter straight section of PVC pipe in the ditch without heating or deforming the pipe and need to use sweeps then the bend will need concrete encasement.

27.15.12. Terminating Conduit: The practice of terminating conduit (most often subsidiary duct) in the sidewalls of maintenance holes or hand holes is not acceptable but, in certain situations, a variance may be given. In this case, the holes for the ducts must be positioned near the upper end-corner of the sidewall and then core-bored. All hand hole and maintenance hole designs in this document can accommodate such locations due to the absence of rebar in this area.

27.15.13. Mainline Conduit Sizing: Mainline conduit is defined to be the conduit supporting feeder cables that serve buildings and other structures. Lateral or subsidiary conduits are routed from the mainline conduit system to each building, structure, and fiber interface cabinet or communications cabinet. Sizing is defined as the determination of the number of conduits to be placed between maintenance holes, hand holes or to the buildings along the route. A full sized 4" conduit shall be used for all installations.

a. **Consider the following for sizing:**
   I. Initial copper cable placement.
   II. Initial optical fiber placement.
   III. Initial energy, fire and security cable placement.
   IV. Future growth in all cable systems (voice, data, video, and energy management).
   V. Maintenance conduit needs**.**

b. A mainline conduit system is allocated to have one 4" conduit for each of the following categories, some of which may be equipped with four 1" innerducts.
   Depending on the immediate use of the conduit system under design, only one (1) 4-inch conduit may be required to be equipped initially with innerducts and/or tube cable during construction.

Future innerduct and/or tube cable installation shall be necessary as the need develops. The following are mainline conduit allocations:

I. Initial fiber placement for voice and network with four 1” innerducts. (Innerduct requirements will be determined on a case by case basis) a. Initial ODU IT and Energy Management Control System (EMCS) Network placement .

II. Copper telephone cable, no innerducts.

III. Maintenance duct, no innerducts.

IV. Growth, no innerducts.

c. Total: six 4" conduits, of which two (2) full sized conduits are equipped with innerducts. (Innerduct requirements will be determined on a case by case basis) This would be the ultimate configuration of mainline conduit.

d. Lateral conduit to a communications cabinet shall consist of five (5) full-sized conduits. One (1) conduit may be equipped with four 1" innerducts , unless the fiber hub is within 30 feet of the hand hole or maintenance hole, and having no more than one 90-degree bend.

e. Future innerduct and/or tube cable installation will be necessary as the need develops and shall be the responsibility of the department or project needing the additional facilities.

27.15.14. Innerducts: Innerducts used on campus must conform to standard C.I.S. 4-86, which is a standard specification for corrugated innerducts produced to I.P.S. dimensions. This specification establishes the parameters common to polyvinyl chloride (PVC) and polyethylene (PE) innerducts. Caution must be taken to use only polyvinyl chloride (PVC) innerduct in building entrance conduit.

27.15.15. Safety: Contractor is to ensure the safety of all students, faculty, staff and property during the installation or maintenance of underground pathways. Proper safety practices and supervision of work area must be adhered to at all times.

27.16.0 Vaults and Pedestals

27.16.1. Maintenance hole / Hand hole: Maintenance holes are recommended for roads, streets, parking lots and where a less obtrusive surface structure is desired. A 30" diameter cast iron lid is less noticeable and safer than a 4' x 4' or 4' x 6' steel plate.

a. All maintenance holes, hand holes and pedestals shall be labeled in accordance with Appendix 1 of this standard.

27.16.2. Pre-cast: Contractors are encouraged to use pre-cast polymer concrete hand holes wherever possible. All hand holes and their associated covers must be rated as traffic bearing. Pre-cast hand hole designs must be in accordance with the requirements set forth by the American Association of State Highway and Transportation Officials.

27.16.3. Sizes: Typical hand hole sizes used at the University are as follows. Maintenance hole sizes will be determined on an as needed basis.

Item	Size	Chimney	Cover Type
Hand hole	36”x48”x24”	Ground Line	Traffic bearing Pre-Cast
Hand hole	48”x48”x36”	Ground Line	Traffic bearing Pre-Cast

a. All hand hole/ maintenance hole covers must be stenciled with "Communications" and be equipped with a hole or other device for cover extraction. Hand hole cover plates shall be

constructed of pre-cast polymer concrete with an anti-skid design and be traffic-bearing. The hand hole shall be equipped with a recessed metal ring to accept and cradle the cover.

b. Typical maintenance hole/hand hole sizes and racking requirements to be used at the University are the same sizes listed for pre-cast listed above.

c. There will be times when access to an existing conduit formation is necessary. An intercept maintenance hole/hand hole would then be placed over the existing conduit formation. The new hole must be located so as to allow the existing conduit to parallel the length of the hole along one side. This allows the cables to be formed and racked along the wall once the conduit casing has been carefully removed within the boundary of the hole.

27.16.4. Construction Points: Concrete with 28-day compressive strength of 4000 psi. Reinforcing steel with yield strength of 60,000 psi grade 60. Reinforcing bars with kinks or bends are not be used except where bends are specified. Reinforcing bars should be clean and free of loose rust, oil or other matter that might weaken the concrete-metal bonding. Forms for cast-in-place maintenance holes should be designed to permit easy removal, constructed to conform to the required maintenance hole dimensions, substantially leak-proof, and capable of being placed and secured to prevent displacement while concrete is being poured.

a. The concrete for the maintenance hole floor should be poured in a continuous operation with a plastic water stop placed in the construction joint between the floor and walls. The concrete for the walls should be poured in a continuous operation. If it is not possible to complete the walls in one (1) pour, a construction joint with a continuous plastic water stop must be formed. Maintenance holes shall have concrete reinforced floors as detailed in attachment drawings. However, maintenance holes shall have a solid leak-proof floor with a sump depression while a hand hole shall have a "sump like" hole used as a French drain complete with coarse gravel.

b. When pouring, do not place concrete in contact with the earth walls of the excavation. Close sheeting placed to support the earth wall may be used as forms for the outside surfaces of the maintenance hole walls. Specially constructed outside forms may also be used.

c. To raise the cast-iron frame and maintenance hole cover to the proper height above the maintenance hole, some combination of pre-cast concrete collars of various heights, i.e., 3, 9 and 15 inches, may be used. The frame and each collar must be set in mortar at the top of the maintenance hole or on another collar. The frame shall be set on a collar constructed of bricks or concrete segments and mortar.

d. Temperature reinforcement has been designated as #5 rebars with nominal 12- inch spacing. No. 5 rebars must be run parallel to the floor-wall, and wall-wall junctions to provide a means for fully tying the end of the rebars together to form an electrical grid. No. 14 annealed steel wire should be used to make wire ties for the rebar. Welding of the bars is not permitted. The rebars must extend to a point 1 to 2 inches from the outside edge of the concrete slabs. All concrete slabs shall have reinforcement in two (1) directions. Rebars for the floor slabs are designated as "W" and "L" reinforcement, and those for the wall slabs are designated as "H" and "L" or "H" and "W." The "H" reinforcement is placed parallel to the height (H) dimension, the "W" reinforcement parallel to the width (W) dimension, and the "L" reinforcement parallel to the length (L) dimension. The reinforcement in one (1) direction also has an "I" designation. The "I" indicates reinforcement which must be located nearest the inside surface of the slab, 1" minimum from the inside surface of roofs and walls and 3" for floors. The other reinforcement must be located next to the "I" reinforcement and toward the outside surface of the slab.

e. A diagonal pattern of rebars must be placed around all openings in slabs except where single duct subsidiaries can be located between the reinforcement. The diagonal reinforcement should consist of #5 rebars placed at 45 degrees to the slab sides and, where practical, extend to within 1 to 2 inches of the exterior slab edges. The first diagonal is placed 2" from the edge of the opening and each succeeding parallel bar is located 3 to 4 inches on center away from the opening. Diagonals located between the openings should extend uninterrupted to the slab edges to provide additional structural integrity to the slab.

27.16.5. Cable Bonding: A cable bonding ribbon must be provided in the center of each splicing bay of the maintenance hole/handhole. The bonding ribbons should be included in the roof slab in the case of a maintenance hole clamped to one of the reinforcement bars or to a reinforcement bar in the wall in the case of a hand hole. One continuous length of bonding ribbon can serve two (2)-splicing bays on opposite walls. The bonding ribbon should be run within the wall slab and brought into the maintenance hole at a point approximately 3" below ceiling level.

27.16.6. Pull-in-Irons: Pulling-in irons are required as a point of attachment for blocks, sheaves, etc., to place and remove cables. The pulling-in iron must be installed to extend into the hand hole with a clear opening of 3". One (1) pulling-in iron is placed opposite and in line with the centerline of each duct entrance formation and a minimum of 3" above the floor.

27.16.7. Conduit Lengths: Conduit section lengths (the measured distance between two 2 holes) must never exceed 500 feet with any more than two 90-degree sweeps allowed in a conduit section. A full 180 degree sweep (full reversal in direction) is definitely not permitted without a maintenance hole or hand hole inserted within the sweep.

27.16.8. Maintenance Hole and Handhole Sizing: Several factors determine when a maintenance hole or hand hole is to be installed.

a. Maintenance holes are recommended over handholes when the total number of 4" conduits to be terminated in the walls exceeds twelve. The total number of conduits terminated in a hand hole or maintenance hole is determined by counting all conduits terminated in the "end" and "side" walls.

b. A 4' x 4' x 4' size hand hole can be used to support up to eight 4" conduit terminations, only if copper telephone cables of 200 pair or less are to be spliced in the hole.

c. A 4' x 6' x 4' hand hole can be used to support up to twelve 4" conduit terminations and can support copper telephone cables exceeding 200 pairs.

d. When a situation calls for a special size and shape maintenance hole and one of the four (4) sizes cannot be used, ODU NST shall design the maintenance hole and provide drawings.

27.16.9. Communications Cabinet: Not used at ODU

27.17.0 Blue Light Emergency Telephones

27.17.1. Overview: ODU NST Construction Management is responsible for the installation, maintenance and operation of the Blue Light Emergency Telephones located throughout campus. The location of blue light phones is to be coordinated with and approved by the University Police Department. Installation shall be coordinated with ODU NST Construction Management. Designate Blue Light Telephones on project plans as “by others” and provide dedicated electrical power connections, pathway for communications cabling and concrete pad for mounting. Coordinate work with all trades including landscaping.

27.17.2. Models: The models of Blue Light Emergency Phones is subject to change; please consult ODU NST before ordering any equipment. Currently only the Talk-A-Phone® models match ODU criteria of being

listed and Singlewire® Informacast® compatible. Talk- A-Phone has created SKUs unique to ODU specifications.

27.17.3. Power Connections: These units require a constant, dedicated 120VAC power source. The building, room, panel number, and position of the circuit breaker must be labeled at the receptacle.

27.17.4. Blue Light Strobe: To conform with NEC codes, the lights may need to be connected to and powered via a listed, outdoor direct current transformer.

27.17.5. Installation: Blue light phones are typically located exterior to buildings, either wall-mounted at building entrances or away from the building in the parking areas in a free standing configuration. The Old Dominion University Police Department (ODUPD) should be consulted for locations.

a. A special concrete base is needed. Talk-A-Phone's manufacturer drawings are shown in Appendix 5.
b. Place separate 1" minimum PVC conduits for both the power and telephone service to the units.
c. Tower units shall have four CAT 6 UTP burial grade cables run to a designated telecommunications space. Lightning surge protection shall be installed and properly grounded within the tower and telecommunications space. The surge protectors must be CAT 6 and power over Ethernet (POE) compatible.
d. Wall-mounted units shall have two CAT 6 UTP cables run to a designated telecommunications space. Consult with the ODU IT NST project manager to determine if surge protection or burial grade cables are needed.

27.17.6. Test and Inspection: Coordinate test and inspection with ODU IT NST. ODU IT NST will test phones and put into production mode with the University Police Department's approval. Emergency phones not in production mode must have electrical power turned off and be wrapped with black plastic to prevent accidental use.

27.18.0 <u>Mass Notification System (MNS)</u>

27.18.1. Overview: ODU IT NST is responsible for the installation and maintenance of the Mass Notification System (MNS) located throughout campus and coordinated through Old Dominion University Emergency Management (ODUEM) as part of the university's emergency notification systems. This system provides the capability to send live or prerecorded messages delivered simultaneously to all campus devices or to specific zones (typically by building). The location of the alert devices (IP speakers, IP phones, outdoor PA speakers, signage, desktop notification, etc.) is to be coordinated with and approved by ODUEM. Installation shall be coordinated with ODU IT NST Construction Management.

27.18.2. IP Paging System: The notification system uses the InformaCast broadcasting solution from Singlewire Software in conjunction with the campus Voice over IP system (Cisco Systems). All campus IP phones provided as part of a new construction project shall have an InformaCast license.

27.18.3. Indoor IP Speaker: The indoor IP speakers shall be Atlas Sound brand of Informacast compatible speakers. Power shall be provided by 802.3af compliant POE network switch or via local 12VDC to 18VDC power injector. Provide indoor IP speaker (or IP Phone as noted below) in general assembly areas and as directed by ODUEM. Target locations are primarily academic classrooms, classroom laboratories and other assembly areas. Use the following table as a guideline only (building environment and surrounding noise levels will affect final design):

Indoor IP Speaker Count	Coverage Area
Zero -- use IP phone	Less than 1,000 sq. ft.
1	1,000 sq. ft. to 3,000 sq. ft.
2	3,000 sq. ft. to 5,000 sq. ft.
3 or more	Over 5,000 sq. ft. -- design per manufacturer's recommendations

27.18.4. Outdoor IP Speaker: The outdoor IP speakers shall be Atlas Sound brand of Informacast compatible speakers. Power shall be provided by 802.3af compliant POE network switch or via local 12VDC to 18VDC power injector. Design and place outdoor IP speakers as directed by ODUEM.

27.18.5. Outdoor Loudspeaker System: Large outdoor areas are typically covered by furnishing an audio amplifier with an IP interface that uses long throw outdoor speakers. When ODUEM requests coverage of surrounding areas for a building, the design team shall follow these guidelines and coordinate all installation work with ODU IT Telecom and Network Infrastructure.

a. Audio Amplifier: Use Atlas Sound Strategy Series (e.g. CP700) sized accordingly. Amplifier shall have dual channels and rated as a commercial audio amplifier. Provide power conditioner and surge suppression sized to meet the amplifier load.
b. Enclosure: Amplifier shall be mounted in Atlas Sound AWR series tilt out wall mount rack, sized accordingly.
c. Outdoor Loudspeaker: Building conditions and surrounding environments greatly affect the design and layout for an outdoor paging system. The design team shall recommend and provide an appropriate solution to meet ODUEM request for coverage. The solution shall use Atlas Sound equipment to be compatible with the existing system in place. Again, all outdoor equipment shall be sized accordingly with appropriate mounting brackets and accessories specified to meet the need.

27.18.6. WAO for MNS: The design team should conduct a mass notification survey and design the IP speaker(s) / phone placement. One work area outlet shall be dedicated to each IP speaker. WAO for MNS needs one cable only.

27.18.7. Test and Inspection: Coordinate test and inspection with ODU IT NST and ODU Police. ODU IT NST will test IP phones and IP speakers and put into production mode with the ODU Police approval.

27.19.0 <u>Wireless Networks</u>

27.19.1. Wireless Network Design: The wireless network design and Wireless Access Point selection shall be coordinated with the ODU NST Wireless engineering group so as to seamlessly integrate with the existing campus wireless system. The wireless network shall be designed to provide high quality wireless Internet coverage for the entire building, including all publicly accessible exterior spaces as defined by the project site plan. Incorporate specific needs of the user group into the wireless design for the project.

27.19.2. Wireless Access Point Locations for Interior Spaces: The ODU wireless engineers will provide a floor plan with WAP locations.

a. Minimum Spacing Between Wireless Access Points: Access Point locations require a minimum separation of 30 feet.
b. Minimum Signal Strength Specification for Interior Spaces: Wireless Access Point placement design must provide a wireless footprint utilizing IEEE 802.11a that shall provide minimum signal strength of at least -71dBm in all locations (this assumes an Access Point running in the 5GHz spectrum transmitting at a maximum 50mW).
c. Access Point Equipment Specifications: Actual deployment equipment specifications, if desired, can be obtained by contacting ODU NST Project Manager.

27.19.3. Work Area Outlets for Interior Access Point Locations: Wiring drops for access point locations shall be located in above-ceiling spaces and in easily accessible locations no more than twelve feet above a walkway with adequate space to safely deploy a conventional stepladder. If ceiling construction prohibits use of above-ceiling space then surface mount locations on the ceiling should be considered. In the event that architectural or aesthetic concerns prohibit ceiling mounting locations then wall mount locations can be considered.

27.19.4. Wireless Access Point Locations in High Population Areas: High density classroom, auditorium, and meeting spaces shall have access point locations distributed evenly throughout the space at the required one to twenty five person ratio.

a. Maximum Number of Access Points in a Single Room: The number of Access Point locations in a single room shall not exceed 12. (i.e. The Access Point count for a single space shall not be scaled beyond 300 people.)

27.19.5. Wireless Coverage for Exterior Spaces: The minimum signal strength for exterior spaces as defined by the site plan shall be -70dBm utilizing IEEE 802.11g. (This assumes an Access Point running in the 2.4GHz spectrum transmitting at a maximum power of 100mW).

a. Exterior Antennas: If building materials are such that they block or absorb RF radiation, and the internal Access Point locations are not sufficient to provide the necessary outside coverage, then provision must be made for external antennas to provide outside coverage.

27.19.6. Testing Wireless Network Deployment: Field tests shall be performed following building substantial completion to insure that operable signal strength levels are available throughout the entire building with additional Access Points deployed or repositioned as required.

Appendix #1 – ODU Labeling and Naming Conventions inAccordance with ANSI/TIA-606-B

Introduction: The administration standard as presented in the ANSI/TIA-606-B addresses the need for an independent and scalable labeling standard in the administration of telecommunications cabling infrastructure. In order to standardize and administer the entirety of the infrastructure at the Old Dominion University, it is necessary to have a complete standard for labeling so that technicians do not need tolearn new standards as they move from one building to the next. Contractors need aconcrete labeling scheme furnished to them so that they can make their products as useful as possible.

According to the ANSI/TIA-606-B standard, what we are presently concerned with would be considered a class 3 labeling standard. We have multiple buildings and outside pathways that must be documented. All identifiers are independent and scalable. All labels read from the general to the specific from left to right.

There are three significantly different pieces to consider in developing a system for the administration of any complex system: naming, labeling, and supporting documentation.

Naming is the process of assigning every piece of identifiable equipment a unique identifier to differentiate it from others. Unique names enable the use of databases inadministration of the supporting documentation. In this system, the style of a name differs based upon the type of equipment named. This allows a quick and easy identification of the hardware.

Labeling is the process of affixing tags to the hardware so that their names can be determined. The tag affixed to the hardware is not always the full name of the piece of infrastructure. As will become apparent later, a number of pieces of a name can bedetermined based upon the location of the hardware. Because of this, it is not necessary to affix the entire name to every piece of hardware. This distinction becomes critical when the piece of equipment is too small to accept a label that contains its full name.

Supporting documentation is the key to any successful administration. Naming and labeling assure that everyone on campus can use the same basic keys for accessing information about the infrastructure but the supporting documentation holds all the information that individuals will need to know: fiber-optic strand count, termination points, last test date, copper pair counts, manufacturer of the cable and so on. This document deals primarily with the naming and labeling process in order to support contractors installing the network infrastructure here at the Old Dominion University. Aside from the deliverables required by ODU Telecommunications Standards, the contractor is not responsible for maintaining any documentation of campus infrastructure.

Naming: There are four distinct styles of naming telecommunications infrastructure here at the Old Dominion University. They all use the same identifiers in the construction of a name but differ in their order and presentation.

Every component of the telecommunications infrastructure has a unique and independent identifier.

Label Target	Example	Explanation
Building	BAL	Old Dominion University official buildingname. 3 Letter abbreviation
Telecommunications Room	T1	Telecommunications Room 1 within this building
Maintenance Hole	PMH001	Maintenance Hole #1
UTP communicationspanel	A	Designates communication panel A
Other communicationspanel	1	Designates communication panel 1,most commonly a fiber panel
Panel Type	D	Designates Panel Type; V – Voice, D – Data, C - Coaxial
Port	1	Port #1 in a module orcommunication panel

Individual identifiers can be combined to create an overall and accurate picture of a cabling plant. Names will use a combination of these identifiers in an established format to completely identify any piece of the cabling plant. This, in turn, requires thatevery piece of equipment be labeled so that a technician can determine the name of any piece of infrastructure while in the field.

Constructing a name (location): There are four fundamental identifier types that shall be used at the beginning of any name: building names, telecommunications room identifiers, room numbers, and communications cabinet identifiers. These are used to designate locations and include all location types here at the Old Dominion University. Assignment of any location identifiers should be coordinated with the Department of Planning & Capital Construction in the case of building and room numbers, or the ODU IT in thecase of Telecommunication Room (TR) identifiers or Communications Cabinet identifiers.

Building names: Old Dominion University has determined official building-initial designations for each building on and off campus. These initials shall be used to reference the buildings in all names. These initials can be obtained from ODU's Department of Planning & Capital Construction. For example, BAL is the official building initial of the Batten Arts and Letters Building.

Telecommunication Room Identifiers: Each Telecommunication Room (including Entrance Facilities and Main Telecommunications Rooms) shall be identified with twalphanumeric characters i.e., T1.

Room Numbers: Room numbers are assigned by the University and reflect individualrooms that are not serving as TR's.

Outside Plant (OSP) Locations: ODU maintains a system of OSP locations that are individually named to allow for their documentation. The locations currently administered by ODU consist of the following: communications cabinets, hand holes, andmaintenance holes. Each location's name is created by assigning the correct three letter prefix and following that with a 3 digit numeric identifier.

PMH001 is a maintenance hole identified and labeled as Maintenance Hole #1.PHH009 is a hand hole identified and labeled as Hand hole #9.
PCB048 is a communications cabinet identified and labeled as cabinet #48.

Labeling: Labeling is the process of affixing tags to the infrastructure components inorder to effectively communicate the name of that piece of equipment to the technicianin the field. In many cases this can be as simple as tagging a piece of equipment withthe official name but under some circumstances this may not be feasible due to the size of the piece of equipment or other factors. Additionally, the labeling may communicate other pieces of information such as what fiber cable is located in what FPL in a particular Telecommunications Room. And finally, this standard addresses the need for each piece of equipment to be labeled in exactly the same fashion so that

technicians can expect the same standards of repair to be used at each Old Dominion University location.

All labels are to be mechanically generated. Handwritten labels are not acceptable. All label adhesive shall have a functional lifespan equal to the infrastructure being labeled.

Following is a comprehensive list of how each piece of network infrastructure will belabeled at the Old Dominion University. If there are any questions concerning these requirements, please contact ODU IT NST.

Backbone Conduit

An installed conduit shall be labeled with its full name as discussed in the naming portion of this standard above. The backbone conduit will be labeled at both ends within 4 inches of termination of the conduit. The backbone conduit will also be labeledwhere it enters and where it exits any pull boxes that have been installed along its path.

Communications Cabinet

Communications Cabinets are to be labeled with their full name. Cabinets should be labeled outside on the most visible side. Cabinets should be labeled inside as well. The inside label will be applied to the interior of the fiber-side door with the locking assembly. Purchasing of labels for use on external Communication Cabinets must be coordinated through ODU IT NST.

Entrance Facilities, Main Telecommunications Rooms andTelecommunications Rooms

Room labeling will consist of a plastic sign on the outside door of theTelecommunications Room consistent with the style of other room signs in the building. This sign should designate the use of the room as a Telecommunications Room and display the appropriate identifier for that specific room such as 'Telecommunications Room 1A'.

Fiber- Optic cable

The fiber optic cable should be labeled at both termination points on the outside jacketof the cable within 8 inches of the breakout point for the individual strands. This labelwill contain the full name of the cable. This label will be applied outside of the fiber panel.

Individual fiber strands should be inserted into any fiber panel following the standard color code for fiber with Blue being first, as per TIA-598-C. This color code should befollowed so it can be read from left to right and from up to down for each module as viewed from the front of the fiber panel. In the documentation, strand numbers will begin at 1 and ascend in keeping with the color code, i.e., blue=1, orange=2, green=3,and so on.

Each fiber termination should be labeled on the boot by a number that corresponds toits placement in the color code of the cable. Numbers should begin at 1 and ascend from there with duplicate numbers used for different types of fiber strands in one cable.For example, a composite fiber cable will have multiple strands designated with a 1 tocorrespond to the first MM fiber cable and the first SM fiber cable. Numbers will not refresh for different binder groups, only for different classifications of fiber.

The color sequence to be used is:

Blue-Orange-Green-Brown-Slate-White-Red-Black-Yellow-Violet-Rose-Aqua

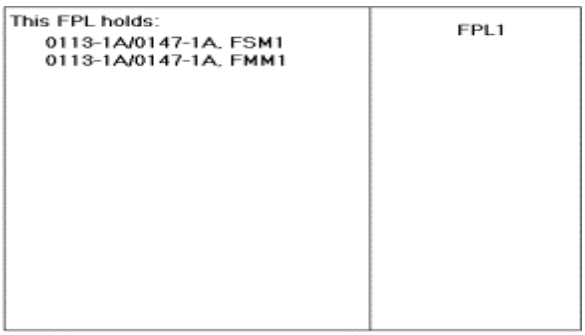
Fiber Panel

Outside

A fiber panel should be assigned an independent identifier and be labeled with it in the upper right corner of the front of the enclosure. Appropriate identifiers include FPL1, FPL2, and so on.

A fiber panel should have a list of all fiber cables that are held in the box itself. Oftentimes, this will just be one fiber cable but could be much more. This list should be preceded with an introduction of 'This FPL holds:' or the like to prevent confusion between the fiber name and the recorded name of the fiber panel. This list should bein the upper left corner of the fiber panel.

In the event that both ends of a particular fiber cable terminate in the same room, thename of that cable on the front of the fiber panel should be followed by an additional label in parentheses that specifies the rack and fiber panel numbers on both ends of that cable. For example, 0019-2A/0019-2A,FMM1 followed by (WFPL6/1FPL1) would communicate that one end of the cable terminates in a wall mounted fiber panel labeled FPL6 and a rack mounted fiber panel labeled FPL1 in rack 1. This additional label does not add to the cable name for record purposes but exists solely to assist technicians in the field:



Inside

Fibers should be installed in each module of a fiber panel from left to right and up to down accordingly as you look at the face of the bulkheads with the standard color code for fiber installation.

Each bulkhead will have an independent identifier. In a fiber panel that has been subdivided into modules, label the modules with numbers beginning with 1 and ascending. The individual bulkheads need not be labeled as they will be identified withnumbers that begin with 1 and will be read from left to right or up to down in accordance with the orientation of the module. In fiber panels that have not been subdivided, the individual bulkheads will need to be identified with a number. If the fiber panel does not come preprinted, the installer will be responsible for labeling the bulkheads.

A documentation page will be supplied inside the panel that should be marked with which fiber strand matches up to which bulkhead. The installer may create a simple spreadsheet similar to that pictured below. In this case, labeling should make clear the identity of each bulkhead and the fiber strand that is connected to it. In the case of horizontal fiber, the strand identifier will be followed by the room number of the cables remote end. This sheet should be stored in a clear plastic pouch inside the FPL. If the FPL does not provide such a pouch, the installer is responsible for providing one. Copies of this spreadsheet will be supplied to ODU IT Network Services with all other deliverables at the end of a project.

At no time should the labeling inside a fiber panel require a technician or engineer toopen the installer's side of the fiber panel to retrieve labeling information.

Grounding Busbars

Each grounding busbar in each Telecommunication Room will be labeled in the upper-left corner with the full name of the busbar.

Hand holes

Hand holes are to be labeled with their full name. Hand holes should be labeled underneath the cover and on an interior wall if possible. Purchasing of labels for useon external Communication Cabinets must be coordinated through ODU IT Network Services.

Horizontal Cable

Each end of the horizontal cable should be labeled on the outside jacket of the cablewithin 12 inches of the termination points with the name of the cable. Horizontal cablesdo not need building identifiers printed in the name on these labels. This label will follow the conventions outlined above with a typical label being T1-D-A01. This label shall be applied before the horizontal cable enters any bundle.

Horizontal Conduit

An installed horizontal conduit that directly connects the WAO with the TR without passing through the cable tray shall be labeled with the conduit’s full name and the name of the WAO it serves within 4 inches of the termination in the Telecommunications Room.

An installed horizontal conduit that directly connects the WAO with the TR without passing through the cable tray shall be labeled at the user end, inside the work area outlet box with the full name of the conduit

WAO feeding horizontal conduit that stubs out at the ceiling or extends only from the Work Area Outlet to the nearest cable tray shall be marked inside the WAO with bluepaint. Where it terminates in the ceiling or near the cable tray, this conduit shall be wrapped with blue electrical tape.

Maintenance Hole

Maintenance Holes are to be labeled with their full name. Maintenance hole identifiersshould be placed underneath the cover and on an interior wall if possible. Purchasingof labels for use on external Communication Cabinets must be coordinated through ODU IT Network Services.

Twisted Pair Patch Panels and Termination Blocks

Labeling of panels or punch blocks with letters will begin with A in each TR. Labeling of panels should begin again with the letter A for each new termination area and the labeling ofpanels on the wall should begin with A.

Where possible, individual ports on the panel should be numbered in ascending order.If not printed on the panel by the manufacturer, the installer is responsible for makingsure that each port is labeled with its own number. Since identification of individual panels for wall mounted 110 panels can be difficult, that the installer will be held

responsible for labeling all ports on wall mounted 110 blocks with the Panel identifierand the port identifier before adding additional labeling information.

<u>Horizontal terminations</u>

Each port on a UTP termination panel will utilize the factory labeled panels starting with A01 and continuing to A48, then starting with B and so on.

<u>Backbone terminations</u>

Where 4 pair UTP cable terminating in patch panels is being used as a backbone connection between TR’s, the patch

panel port where they terminate will be labeled with the termination position of the other end of the cable. For example, where 0132-1A/0132-1B,CUT1 connects two TR's each patch panel would be labeled with the termination position of the other room. In 0132-1A, the port where this line terminatesmay be labeled 1B-1A05. This points to Rack #1, Panel A, and port 5 in TR 1B.

For higher count UTP backbone cables terminating in wall mounted 110 blocks on both sides, the termination area should be labeled with the name of the backbone cable. This should be followed by the pair count in parentheses. Pair count should also be accessible through the supporting documentation. An appropriate label on afourth floor termination block would read, 0024-3B/0024-4A,CUT1 (100 pair) where the other end of the cable terminates in room 324 and the cable has 100 pairs.

For higher count UTP cables that terminate in a 110 block on one side and an RJ45 patch panel on the other, we default to the standard listed above for 4 pair UTP cables.This requires that the 110 blocks be split into logical ports for purposes of labeling. Each pair, or set of pairs, that connect to a port on the RJ45 patch panel will be considered a port and should be labeled as such on the wall mounted panel. Each panel on each side then will be labeled according to the port identifier for the other side. For example, where 0132-1A/0132-1A,CUT1 connects two termination areas within the same TR, the 110 block and the RJ45 patch panel would be labeled with the termination position of the other side. On the patch panel, each port would be labeled with a port identifier for the 110 block, *1A-WA14*. On the 110 block, the 'port',or series of pairs, would be labeled with the panel and port identifier for the 110 blockfollowed by the port identifier for the patch panel, *A14 / 1A-1A14*.

Rack or other Termination Area

Termination areas within a room should be labeled numerically beginning with 1 and ascending as more racks or cabinets are added to the room. The equipment definingthe termination area should be clearly labeled along the top crossbar.

For purposes of this labeling standard, a termination area is considered to be any structure capable of holding telecommunications terminations and electronic

hardware. This includes, but is not limited to, 7-ft free-standing racks, free-standing enclosures, 3-4 ft wall mounted fixed racks, wall-mounted enclosures, server desks and so on.

Telecommunications Bonding Backbone

Telecommunications bonding backbones will be labeled with the full name of the bonding backbone at each termination point.

In addition, the bonding backbone will be labeled with the full name of the bonding backbone at every point to which it is bonded in any other Telecommunications Roomsthrough which it passes.

Telecommunications Pull Boxes

All pull boxes installed to support telecommunications infrastructure will be identified as such. The letters ODU ITS will be painted on the front cover plate of the outlet box.

All conduits entering the pull box shall be labeled as addressed in the horizontal and backbone conduit sections in this standard.

Twisted Multi-Pair Backbone cable

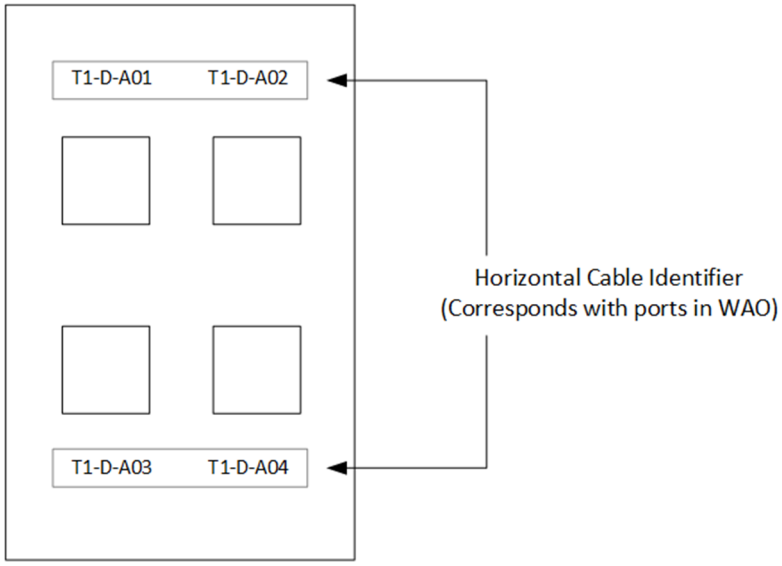
The twisted multi-pair cable should be labeled at both termination points on the outside jacket of the cable within 8 inches of the breakout point for the individual strands. Thislabel will contain the full name of the cable.

Work Area Outlets

Outlet box ports shall be labeled on the appropriate area with the name of the cable connected to them. For example, the Work Area Outletport connection should begin with the TR, connection type (D – Data, V – Voice, C – Coax), and port number last. T1-D-A36 meaning, Telecommunications Room 1, Data Port, Patch Panel A, Port 36.

Outlet boxes will be labeled numerically with the Work Area Outlet number at the topof the faceplate preceded by WAO. For each room, this number will begin at 1 and ascend numerically as new outlet boxes are added.

The interior of an outlet box should be labeled with the name of the horizontal conduitthat feeds it (see horizontal conduit section).

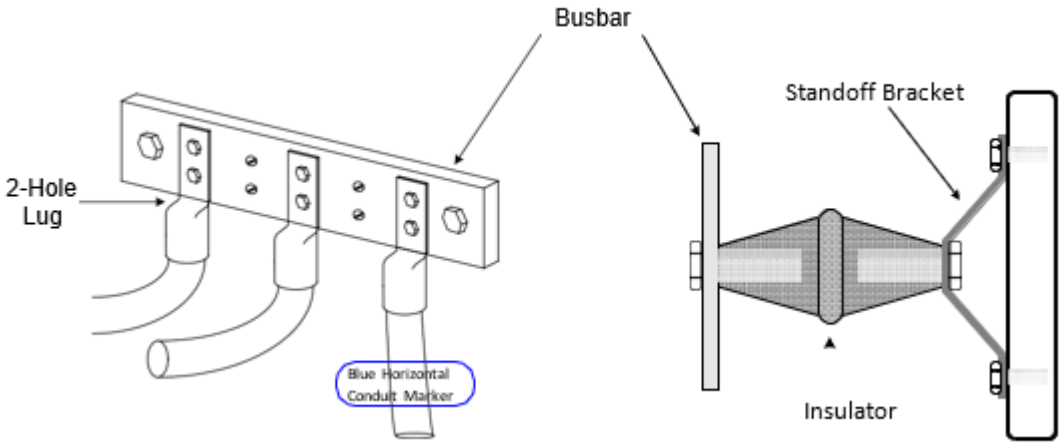


Supporting Documentation: All deliverables that are turned over to Old Dominion University will reference network-infrastructure equipment using this standard. At thatpoint it is the responsibility of ODU ITS Network Services to maintain all records and documentation ofnetwork infrastructure. As such, those procedures are open to more regular review, procedural change and will not be addressed here.

Conclusion: This document covers the most common labeling needs for the installation of network infrastructure across the Old Dominion University. There are a number of more specific situations covered in the ANSI/TIA/-606-B administration standard including a standard fare of abbreviations for descriptors. If you have any questions concerning these standards and their interpretation in reference to the Old Dominion University, contact ODU ITS Network Services.

Appendix #2 - Grounding and Bonding

Appendix 2 - Typical Grounding Busbars

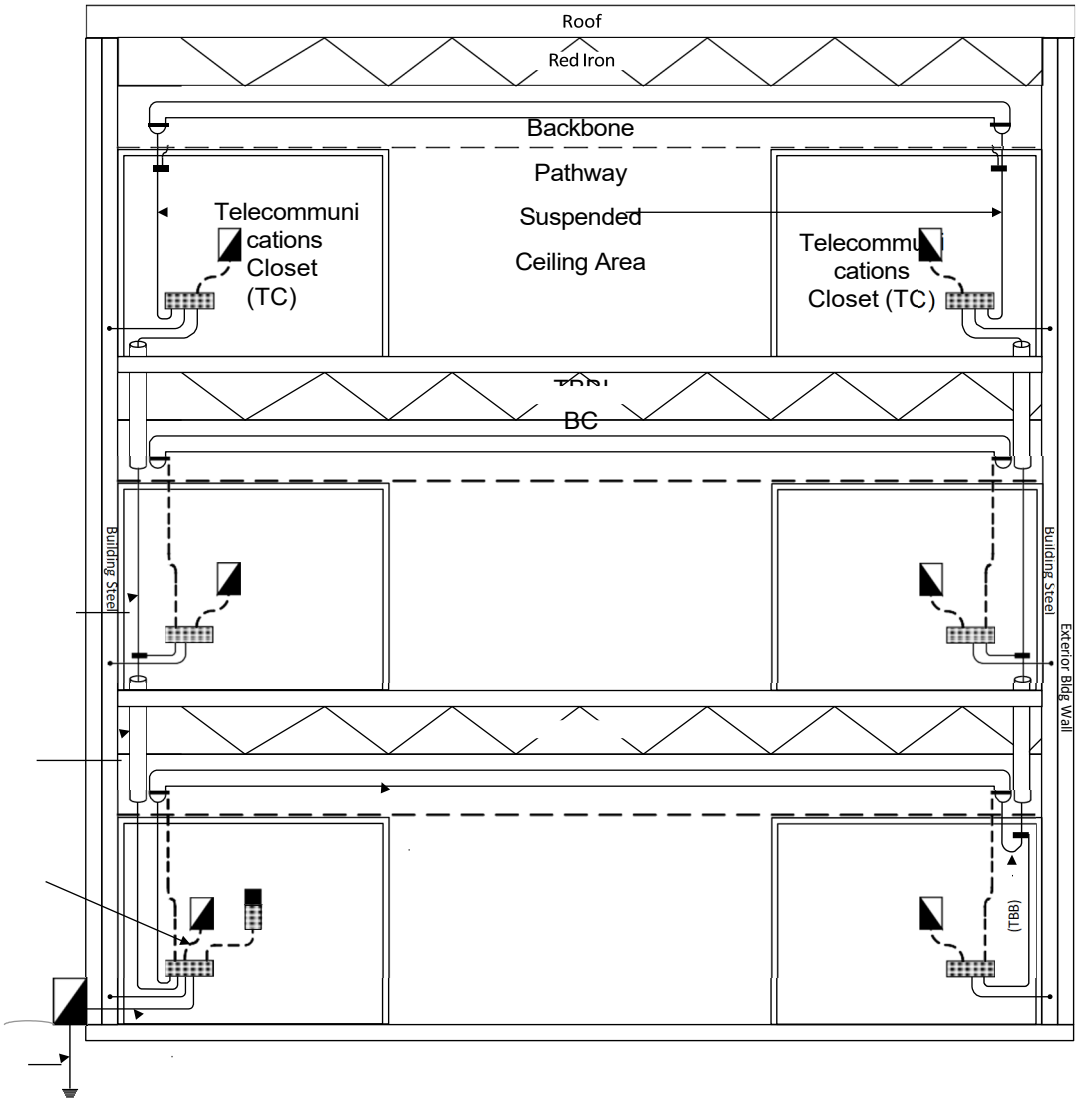


A Telecommunications Bonding Backbone (TBB) conductor is connected from the TMGB to the Telecommunications Grounding Busbar (TGB) in Telecommunications Closets within the building. The minimum dimensions of the TGB are 6 mm (0.25 in) thick, 50 mm (2 in) wide, and variable in length.

A TBB is a conductor that interconnects all the TGBs with the TMGB. The TBB is designed to interconnect busbars and is not intended to have equipment bonding conductors spliced on to it. The minimum TBB size shall be a 6 AWG and could be aslarge as a 3/0 AWG.

The busbar designated for protectors, the Telecommunications Main GroundingBusbar (TMGB), must safely carry lightning and power fault currents. The TMGB is directly bonded to the electrical service ground. It should be positioned adjacent to theprotectors and directly between the protectors and the approved building ground for protector operation. The minimum dimensions of the TMGB are 6 mm (0.25 in.) thick,100 mm (4 in.) wide, and variable in length.

Typical Telecommunications Grounding System:

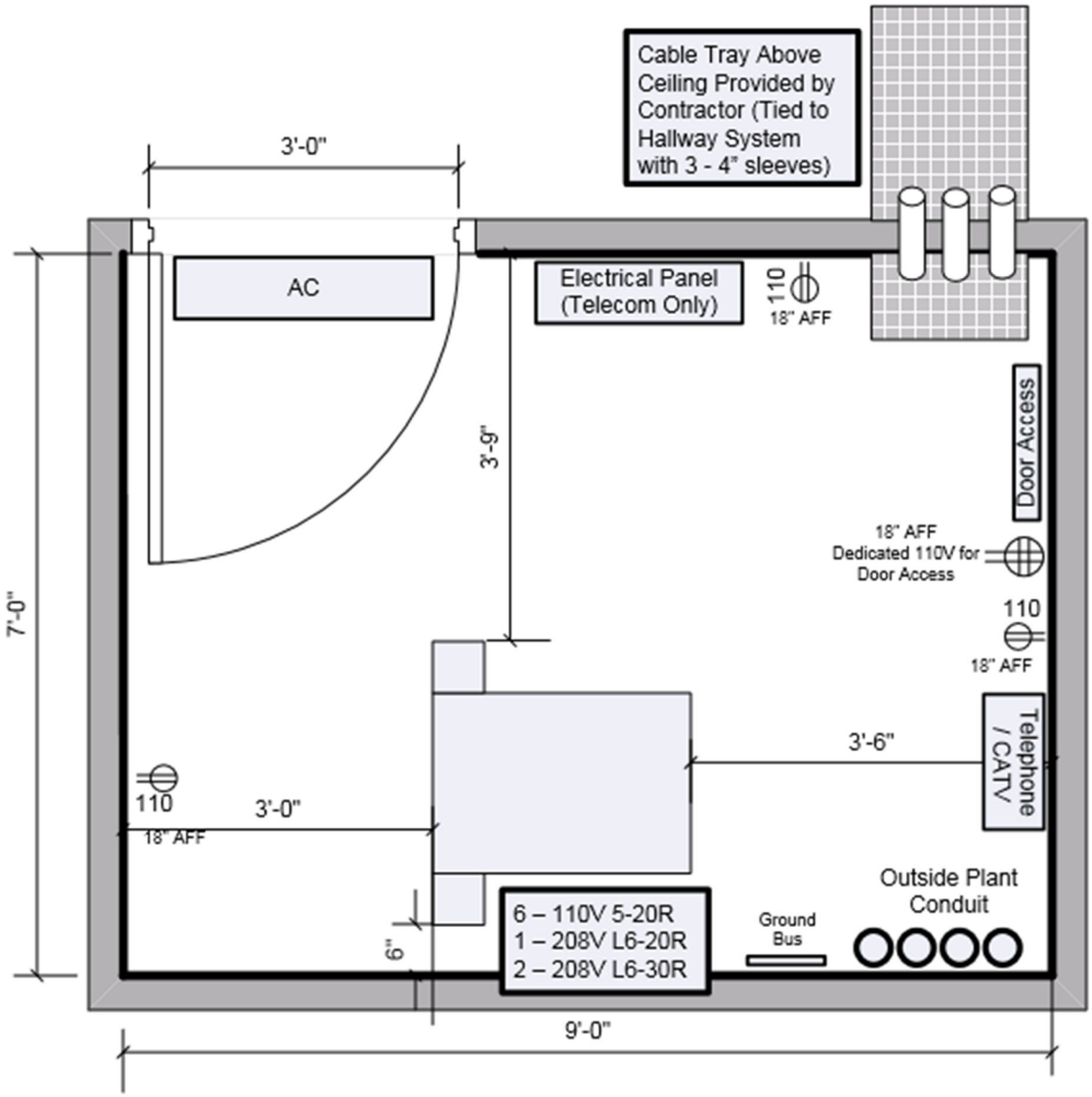


Glossary:

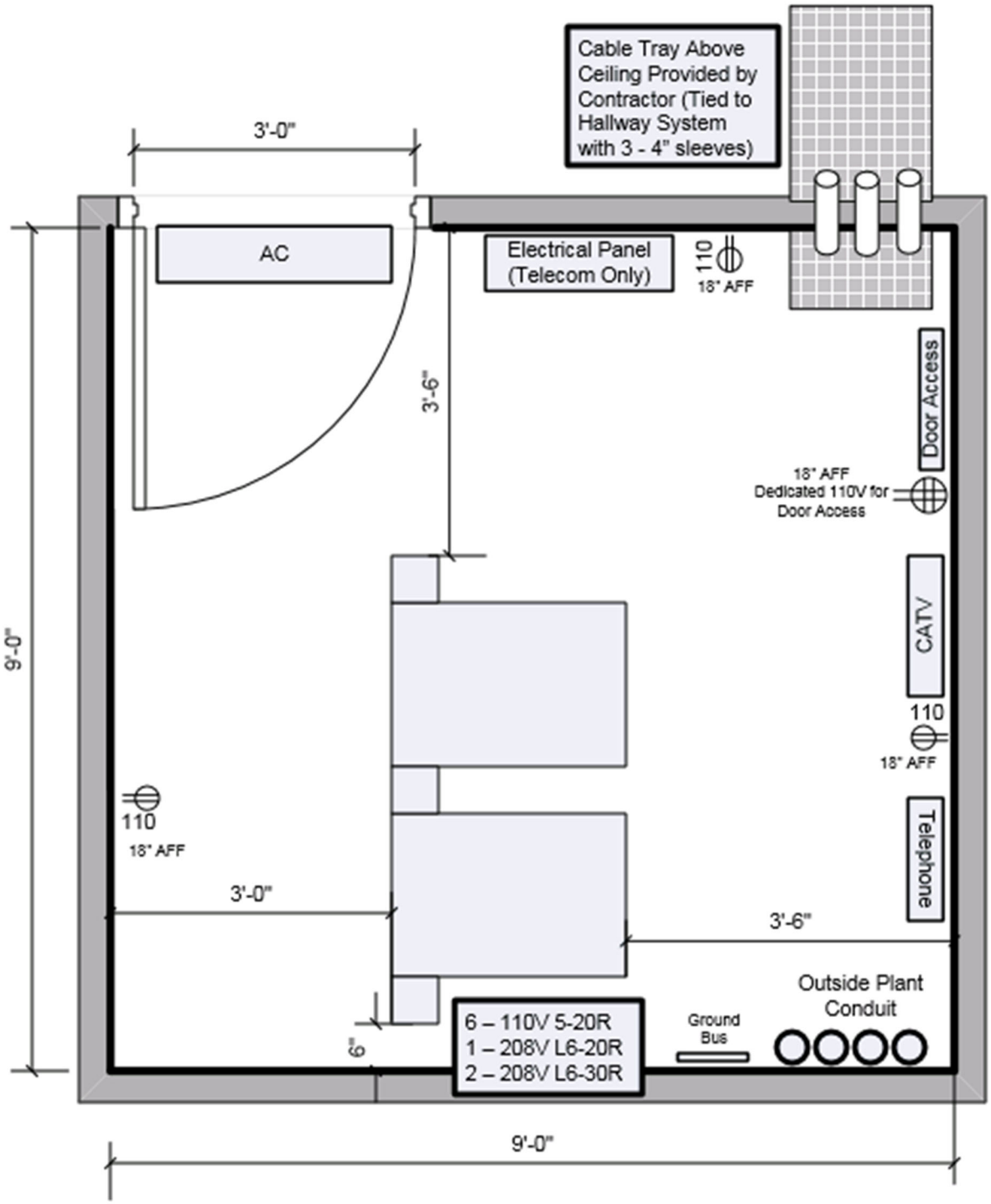
TBB - Telecommunications bonding backbone **TMGB** -
Telecommunications main grounding busbar**TGB** -
Telecommunications grounding busbar
TBBIBC - Telecommunications bonding backbone interconnecting bondingconductor

Appendix #3 -Telecommunications Room Design Examples

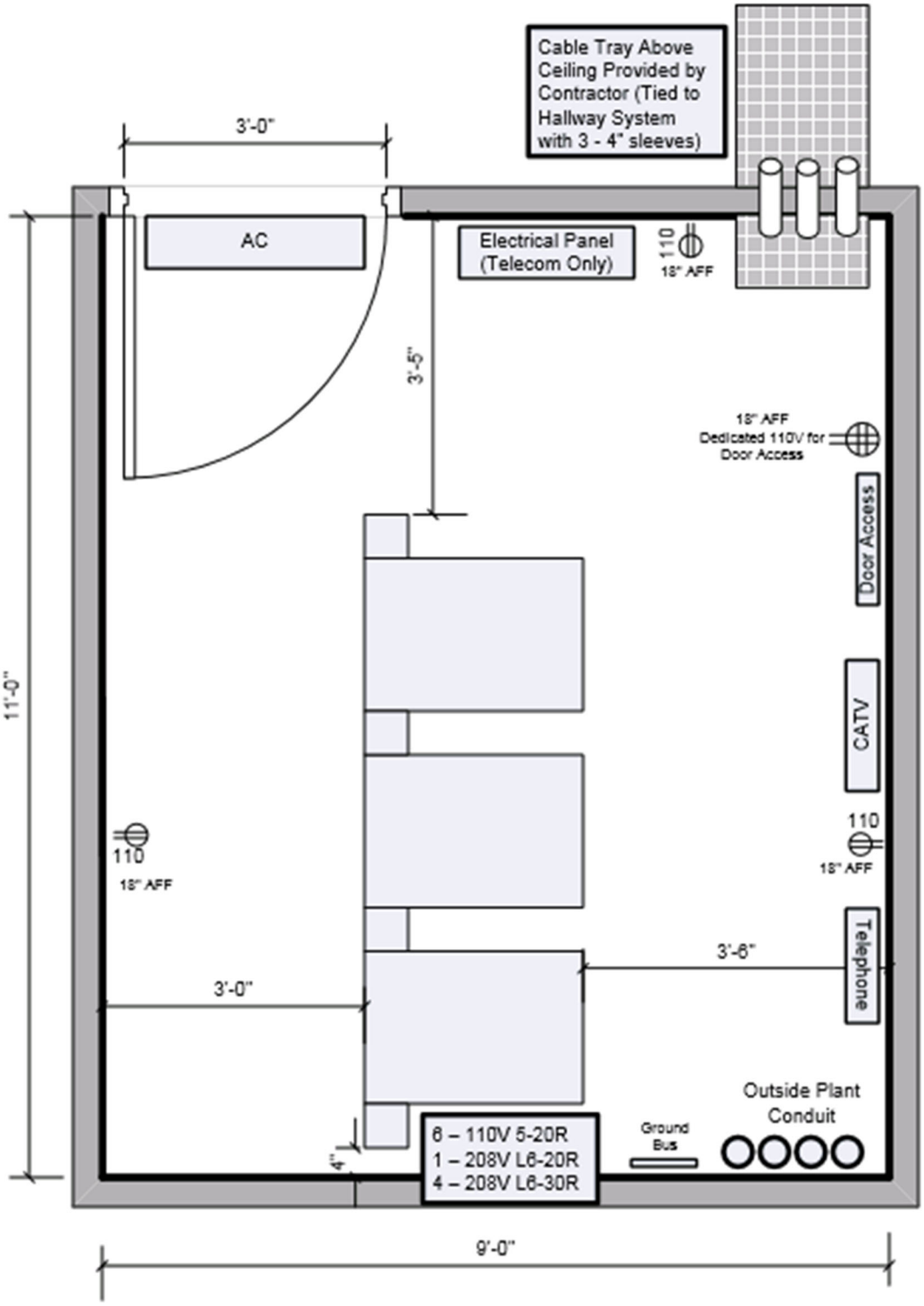
Typical 1 Equipment Rack Room



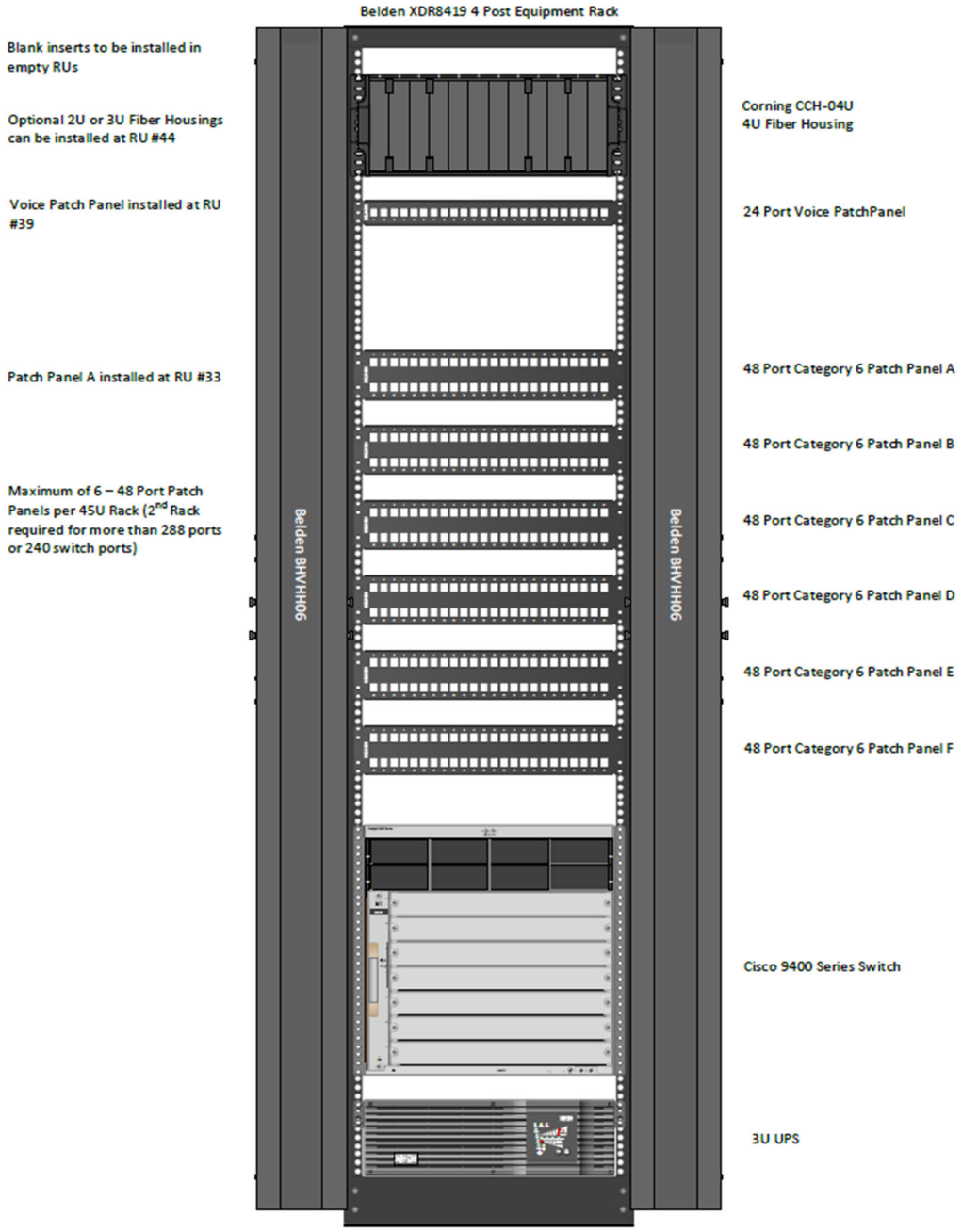
Typical 2 Equipment Rack Room



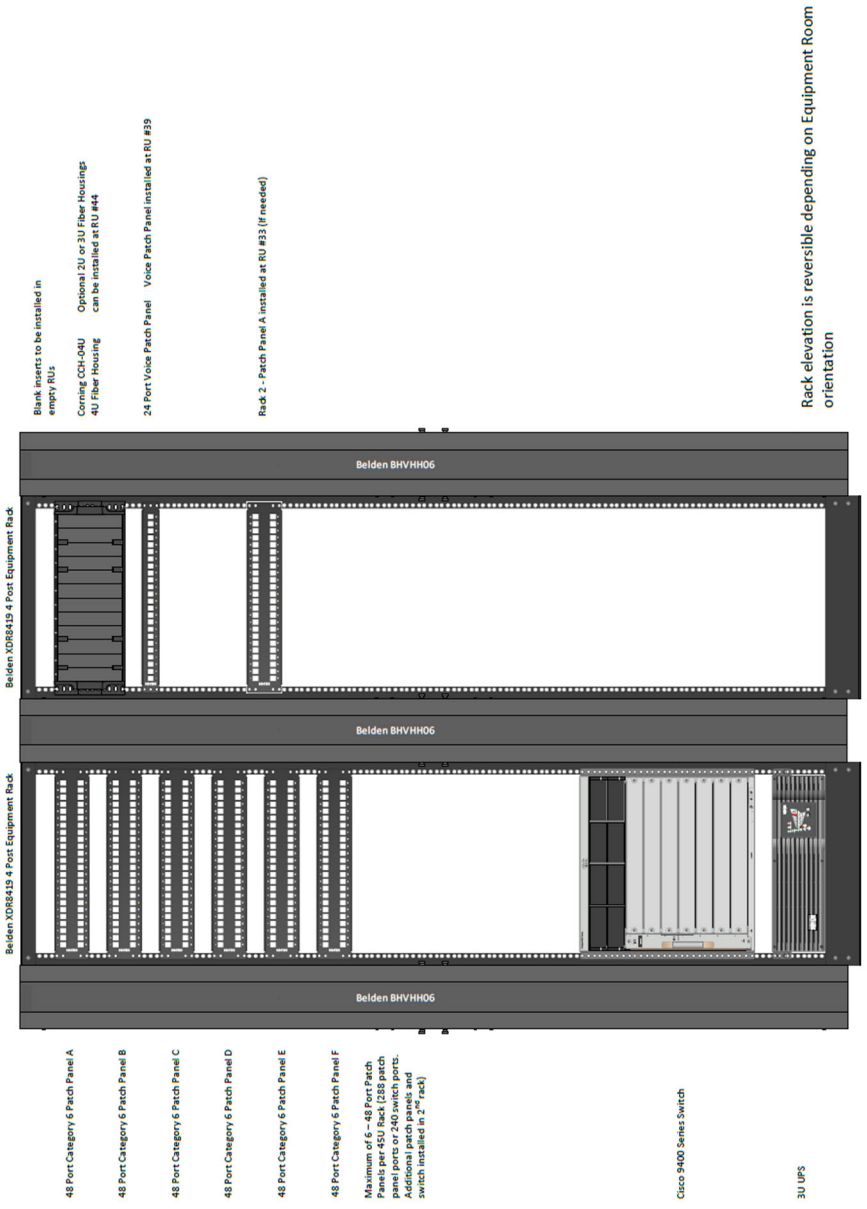
Typical 3 Equipment Rack Room



OLD DOMINION UNIVERSITY
Standard Single 45U Equipment Rack Elevation



OLD DOMINION UNIVERSITY
Standard Double 45U Equipment Rack Elevation

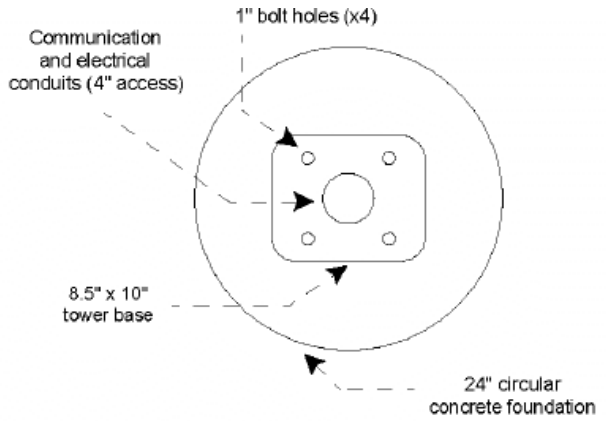


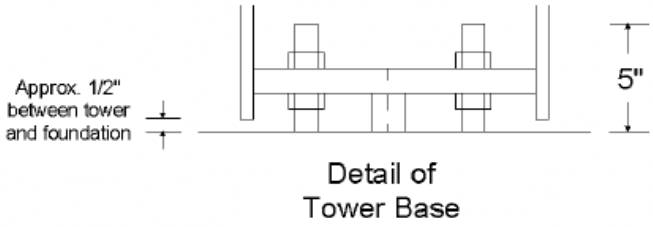
Appendix #4 – Blue Light Emergency Phone Tower Installation

ODU NST will coordinate installation of foundation pad for Talk-a-Phone tower units perthe manufacturer's directions provided at:
http://www.talkaphone.com/sites/default/files/ETP-MT-R%20Anchor%20Bolt%20Install_1.pdf

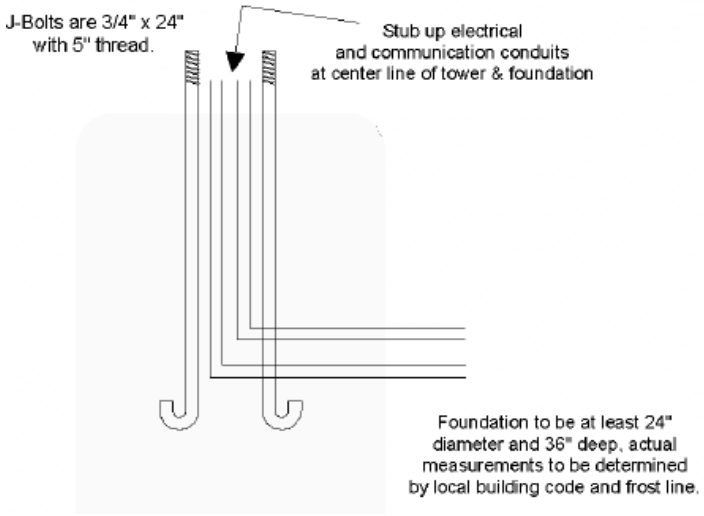
Project shall furnish a 1" conduit with a dedicated power circuit and a separate 1"conduit for data communications.

Details of Tower Base:





Detail of Tower Base



Appendix #5 – ODU NST, and Other ODU Department SpecificGuidelines

The Old Dominion University Telecommunication Standards shall be followed when designing an information transport system for any new construction and major renovation project. Procurement of the installation of these systems may vary slightly between ODU IT and ODU Housing or Athletics. Also, other ODU networking departments may have additional requirements and projects specific to those entities should be coordinated as noted below.

These guidelines are provided for informational purposes to assist with developing thescope of work for projects. The building design and drawings shall show all information transport systems work and then denote whether project furnished or "by others".

A. Housing Projects:

1. Follow ODU Telecom Standards.
2. Any additional requirements will be provided prior to bidding.

B. University Athletic Association Projects:

1. Follow ODU Telecom Standards.
2. Any additional requirements will be provided prior to bidding.

OLD DOMINION UNIVERSITY ELECTRONIC ACCESS CONTROL SYSTEM GUIDELINES	May, 5 2021 Ver: 2021050501

PURPOSE

The purpose of this document is to provide guidelines and direction for the selection and placement of electronic card access control devices. It is not intended to supersede any other door hardware or mechanical access control requirements.

1. Definitions:
    a. EAC – Electronic Access Control – the overall system
    b. CAC – Card Access Control – doors which are equipped with card readers for access.

2. Overview of Existing Electronic Access Control Environments
   Old Dominion University currently employs CBORD - CSGold CS Access system as its EAC system. As of Aug. 2014 all new EAC hardware shall be compatible and use the CBORD – CSGold - CS Access system. ODU uses the "CSGold Campus ID Card System" to manage the ODU ID card. This card is used to access doors on both system equipment with CAC.

3. General Guidelines
    a. Exterior doors shall be kept to a minimum.
    b. All devices shall fully and completely integrate with the ODU EAC system from CBORD.
    c. The contractor shall provide and install conduit, pull strings and junction boxes for each door as per EAC Conduit Diagrams provided by ODU.
    d. The contractor shall provide and install all electronic lock sets and power transfer devices and prep all doors requiring EAC for the specified equipment, such as drilling(preping) wood or medal doors for the AD300 lock set. See EAC Conduit Diagram – AD300.
    e. All products and materials shall be new and approved in the pre-installation submittals.
    f. All lock sets which require additional licenses from CBORD must be purchased from CBORD. The University does not want to encure additional fees.
    g. No offline locks, No push button combination locksets or similar types on exterior doors or interior doors.
    h. No magnetic locks.
    i. All electronic locks shall fail secure.
    j. All doors with electronic access shall have free egress at **ALL** times.
    k. No dogging options on eletricfied devices.
    l. EAC wiring will be installed by ODU are for following: Card reader, REX, DPS, MLR/Strike
    m. Auto operator wiring will be installed by Contractor(All wiring, including for Actuators). Auto operator is expected to be operational without ODU access control. ODU will interact with the contractor wires afterwards to make ODU access control work. (Contractor wires need to be accessible (should we make it a standard to make it wired only?) yes
    n. ODU will be the EAC vendor and will provide all CBORD Squadron EAC hardware and will activate the system.
    o. ODU will configure the system and provide all core licenses.
    p. Doors that require wires from Hinge/EPT to EAC hardware on the door is the responsibility of the contractor. I.E. AD300 on a door – (All prepping for the door handled by contractors)
    q. Cores- constution cores will be provided and maintained by contractor. Contractor will be responsibe for issues keys and maintaining log of issuance.
    r. Fire rating for doors need to be clearly started on the template given and prepped by vendor.
    s. Card readers: if there is a Box or flush mounted, if flush we need more space(¾ in hole minimum) for the MT readers
    t. Door Cameras- Need to add stuff here..

4. Minimum Electronic Access Control Requirements
    a. All exterior doors, regardless of whether they are electrified or not(Active leaf and inactive leaf), will be equipped with a prop sensor tied back to the CBORD EAC system.
    b. All exterior "Exit Only" doors will remain locked at all times and be equipped with a prop sensor(DPS) and request to exit device(REX) tied back to the CBORD EAC system.
    c. All exterior doors programmed to be unlocked at any time will be electrified to enable automated remote lock/unlock from the CBORD EAC.
    d. All electrified doors must be managed and wired as an individual device to the EAC.
    e. At least two exterior doors will be equipped with CAC to allow after hour access for authorized individuals. The number of exterior doors with CAC should be kept to a minimum. (should this include 2 auto operator doors as well?) john, should have minimum of 2 – needs to go in Door section.

f. If one door in a bank of doors is electrified all the door in that bank shall be electrified and be locked/unlocked at the same time using the EAC system. If the bank is used for afterhours access only one of the doors shall have CAC.
g. All ADA (auto operator) doors will be equipped with CAC. The auto operator system shall be tied in with the EAC to prevent the auto *operator* from engaging when the door is locked, the auto operator should be operational before odu ties into it. This will only for the exterior set of doors(if there is a vestibule), expect for residence halls. Also, if there is a vestibule (open area between an outter and inner set of doors) an ADA actuator to open the doors will be placed in the vestibule.
h. Class rooms, lecture halls and other teaching spaces which are equipped with EAC shall have locksets that enable the occupants to readily secure the door(s) from within the room, such as Function 40 (Privacy) and still provide free egress.(AD300, AD400, and LE locks)
i. Telecom/Data Closets shall be equipped with CAC with Function 70 capabilities. (AD300, AD400, and LE locks)
j. All EAC hardware should SFIC compatiable, Best 7 pin core.

5. Building System Hardware Specifications

The following hardware is the bases of the ODU access control system and should be used unless approved otherwise. These are commonly used and stocked by the University for campus maintenance.

a. Access Control System - CBord Squadron (Provided by ODU) – Add the new equipment here
    i. V-1000
    ii. V-100, V-200, V-300
    iii. RS485 PIM
    iv. RS485 Hub
b. DC Power Supplies (Provided by ODU)
    i. Altronix ALX1012ULXPD16 (12 Vdc)
    ii. Altronix ALX1024ULXPD16 (24 Vdc)
    iii. Altronix PD16WCB(16 port)
    iv. Ditek DTK-120HW – AC circuit surge suppression
    v. Altronix TROVE 2 V2 box(es)
c. Card Readers (Provided by ODU)
    i. All readers shall be multi-technology, 125 KHz proximity and 13.56 MHz smart card capable.
    ii. Schlage MT Series
        1. MT11, MT15, MT20 - USB
d. Electric Locks (Provided by Contractor)
    i. Schlage AD300 – ONLY purchased from CBORD – Wired
        1. Configuraiton Guide: https://us.allegion.com/content/dam/allegion-us-2/web-documents-2/DataSheet/Schlage_AD-300_Data_Sheet_104448.pdf
        2. Install Template: https://us.allegion.com/content/dam/allegion-us-2/web-documents-2/Template/Schlage_AD_Series_Combined_All_Templates_111677.pdf
    ii. Schlage AD400 – ONLY purchased from CBORD – Wireless (Typically not used)
    iii. Schlage LE locks - ONLY purchased from CBORD – Wireless (Used for Res Hall Interior Rooms)
        1. Data sheet:https://us.allegion.com/content/dam/allegion-us-2/web-documents-2/DataSheet/Schlage_LE_Series_Data_Sheet_111389.pdf
        2. Install template: https://us.allegion.com/content/dam/allegion-us-2/web-documents-2/Template/Schlage_LE_Series_Templates_111668.pdf
    iv. Function 40 – used on doors which are on an unlock schedule and require shelter-in-place capabilities, such as Class Rooms and lecture halls if equipped with EAC.
        1. Example: AD-300-MS(Mortise)-40-MT(Multi tech)-SPA- 626-BD-LH-09-663-10-072-1-3/4
    v. Function 70 – used on doors which do not require shelter-in-place capabilities or are not on an unlock schedule if equipped with EAC.
        1. Example: AD-300-CY(Cylindrical)-70-MT(Multi tech)-SPA- 626-BD-LH-09-663-10-072-1-3/4
        2. Need to verify.
    vi. Function 50 – used on residence rooms if equipped with EAC. Example:
        1. AD-300- CY(Cylindrical)-50-MT(Multi tech)-SPA- 626-BD-LH-09-663-10-072-1-¾
e. Electric Strikes
    i. Mortise & Cylindrical Locks: HES 4500, 5000,5200, 8000, 8300 and 8500 (Need to review this)
    ii. Rim Exit Device: HES 9400, 9500, 9600, 9700 (Need to review this)
f. Electric Latch Retraction Exit Devices / Panic Bars
    i. Stanley Precision Apex 2100 Series Rim Exit Devices
        1. Options
            a. MLR - Motorized Latch Retraction (powered from the EAC closet)
            b. TS - Touchbar Monitoring Switch
            c. LD – Less Dogging

2. ANSI Function: 03-Key Retracts Latchbolt
3. Trim: 1700C and 2000C

g. Power Transfer
   i. Electric Hinge – Command Access ETH6WH - 2 Wire (18 gauge) + 4 Wire (28 gauge), (minimum requirements: 2x18 AWG and 4x28 AWG)
   ii. EPT – Stanley EPT-12C, CEPT – 10 (minimum requirements: 2x18 AWG and 6x22 AWG)

h. Relays for ADA/Auto Operators – see Wiring Diagrams w/ Auto Op
   i. BEA Br3 Logic Module - Used to prevent the auto operator from engaging when the door is locked. The interior ADA push button/actuator should signal the EAC to unlock the door when pushed and then engage the auto operator.
   ii. Altronix RB1224 - Used to disable the exterior ADA push button/actuator when door is locked.

i. Access Control Cable – see door Wiring Diagrams
   i. Belden 6506FE Sheilded Plenum-CMP, 8-22 AWG – Card Reader
   ii. Belden 6302UE Nonshielded Plenum, 4-18 AWG – Lock & AD300 Power
   iii. Belden 6502FE Sheilded Plenum-CMP, 4-22 AWG – REX/PIR
   iv. Belden 6502FE Sheilded Plenum-CMP, 4-22 AWG – Door Contact & AD300 Data

j. DPS – Door Position Switch
   i. G.E - *1078/1076 Series*

k. PIR REX - Passive-Infrared Detector
   i. Kantech - T.REX-XL

l. Mortise Locks
   i. Typicaly not used. See section 5.d

m. Cylindrical Locks
   i. Typicaly not used. See section 5.d

n. Example of that is expected from vendor (Hardware schedule like this), ODU will provide a Template

Hardware Set # 1
Doors: 1133, 2115G, 2123
Fire Rated: 20 min
Door Handing: RHR

Qty	Unit	Item	Description	Catalog Number	CFCI	Finish	Manufacturer	Notes
3	ea	Door						
9	ea	Hinge						
3	ea	Exit Device	Rim Exit Device	*Von Duprin 98/99 series*	CFCI		Von Duprin	
3	ea	Power Transfer	EPT	CEPT-10	CFCI		Securitron	minimum requirements: 2x18 AWG and 6x22 AWG
3	ea	Lock\Trim	AD300 Trim	AD-300-993R-40-MT-(SPA)-(626)-BD-RHR-1-3/4	OFCI		Schlage	Need to know finish and lever style
3	ea	Cylinder	Cylinder	Included with Lock - BD	OFCI		Schlage	
3	ea	Core	EEL					Check with John Hasher
	ea	Backset & Latch	n/a					
	ea	Strike	Strike	should be Included with RIM Exit Device	CFCI		Von Duprin	
	ea	Reader	Multi-tech	Part of the Lock -MT	OFCI		Schlage	
	ea	Door Position Switch	DPS	Included with Lock	OFCI		Schlage	
	ea	Request to Exit (RX)	RX	Include with RIM Exit Device	CFCI		Von Duprin	
	ea	Door Closer						
	ea	Threshold						
	ea	Wall Stop						
	ea	Floorstop						

6. As-Built Documentation:
   The following documentation, hard and\or electronic copy (pdf), shall be provided whenever new devices are installed.
   a. Required Documents
      i. System Diagrams
      ii. Hardware Inventory
      iii. Manuals
      iv. Configuration/Programming

   All card reader access hardware must adhere to university standards and integrate with the CBORD - CSGold Access system.

END OF SECTION