Design and Installation Standards Policy

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| The vertical line in the left margin indicates a change from the previous revision. |
Introduction

Telecommunications: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.

The intent of this policy is to provide recommended practices for the design and installation of ETSU’s Telecommunications infrastructure that will support a wide variety of existing and future services, using industry accepted design and installation methods. ETSU attempts to define standards that will enable the design and implementation of structured cabling systems for commercial buildings and between buildings in a campus environment. ETSU recognizes and adopts for itself the telecommunications industry standards, codes and practices as defined in the agencies listed in Section 1. ETSU intends to build an ITS system that is vendor neutral and standards based.

This policy is intended to answer FAQ of ETSU ITS’ infrastructure practices and not to be a substitute for knowledge of industry accepted practices, standards and codes. This policy is NOT intended to be used in lieu of a construction specification document, but be an addition to the specifications.

This policy is to be followed by all projects involving Telecommunications including SBC and in house projects.

Communications technologies are complex. They shall be designed and installed by experienced professionals. Telecommunications shall be considered a fourth utility, to be designed, funded and installed with the same importance as Electrical, Plumbing and HVAC. The designer has the responsibility of providing a design using accepted engineering and architectural practices. ETSU ITS strongly recommends a Registered Communications Distribution Designer (RCDD) to be used as a consultant for the design of the telecommunications. In many cases the need will arise to consult with other engineers from other trades or areas of expertise.

ETSU ITS supports or aids in the delivery of telecommunications for a wide variety of services and spaces, on and off campus, the growing list, such as;

- Offices
- Research Laboratories
- Classrooms
- Recording Studios
- Computer Labs
- Health Care Facilities
- Museums
- Theaters
- Data Centers
- Physical Activity Centers
- Research Laboratories
- Residential Housing
- Sports Arenas and Stadiums
- Recording Studios
- Warehouses
- Fire Alarm / Mass Notifications
- Building Automation Systems
- 911 Police Dispatch
- Video Security/Access Security
- Forensics Labs
- Innovation Labs
- TV and Radio Studios
- Food Services,
- Restaurants Cafeterias and Vending
- Parking Garages
- Child and Adult Day Care
- Nursing Simulation Labs
- On-Line –eLearning
- Computer Labs
- K-12 School
- Digital Signage

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- On-Line –eLearning
- K-12 School
ETSU ITS will have final review, approval and be the acceptance authority for all telecommunications infrastructure, designs, installations, materials and methods, in all phases of the design and installation process.

ETSU Facilities Management and ITS intend to work in a “team” atmosphere with all parties. Our goal is to build a quality Telecommunications Infrastructure, by partnering with the design team, consultants and contractors. It is encouraged for all parties to ask questions and/or resolve conflicts in a professional, reasonable and timely matter.

**CAT5e and CAT6 Installations:**
Installers shall be certified by the manufacture of the system(s) they are installing and be able to certify the installation for the manufacturer’s warranty. Hubbell Premise Wiring will be the benchmarked used for equal or equivalent for material, methods and warranties for copper solutions. ETSU ITS will be the evaluator of authority in determining any possible substitutions.

**Fiber Optic, Coax, Audio Video and other low voltage installations:**
Installers must install the system(s) per Manufacturer’s specifications, this Policy’s methods, and Industry standards. Test per BICSI’s recommendations and methods. See Commissioning and Warranties for details on testing.

Installers must have:
- The necessary tools and calibrated test equipment
- Trained technicians to operate the equipment
- Have the ability to test, record and produce drawings
- Provide material that is new and free of defects, delivered to the job site in the original packing.
- It is recommended that a RCDD be assigned as a Project Manager

Installers to be professional:
- In their interactions with Faculty, Staff and Students.
- In their appearance. No objectionable graphics or language on clothing.
- Follow Campus rules as in the No Tobacco and Parking Policies.

This standard / policy will change to meet industry recognized standards. The designer, consultants and installers are responsible for inquiring about updates. The most recent edition of the Telecommunications Design and Installation Standards Policy is available [http://www.etsu.edu/its/](http://www.etsu.edu/its/) under “Policies” for any vendor (General, Electrical, HVAC, Security, Telecommunications and Fire Alarm Contractors) to download.
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1. **Design and Installation Codes and Standards**

The purpose of codes, in general, is for the practical safeguarding of persons and property from hazards and to ensure the quality of construction. Standards are requirements affecting the performance of a given system. As defined in the TIA Engineering Manual, a standard is “A document that establishes engineering and technical requirements for the processes, procedures, practices and methods that have been adopted by consensus. Standards may also be established for selection, application and design criteria for material.”

It is **expected** that the Telecommunications Infrastructure be designed and installed to the following codes, standards and practices (**current editions**):

Be aware that these codes and standards are updated regularly. However, these codes and standards do not necessarily coincide with each others’ revision dates. It is the responsibility of the designer, contractor and installer to be aware of any changes and be governed by these new issues when required.

- ANSI/TIA-569-C, Pathway and Spaces.
  - 568-C.1 Commercial Building Cabling
  - 568-C.2 Copper Cabling Components
  - 568-C.3 Fiber Cabling Components
  - 568-C.4 Coax Cabling Component
- ANSI/TIA- 606-B, Addendum 1, Administration Standard for Commercial Telecommunications Infrastructure.
- ANSI/TIA-607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- ANSI/TIA-942-A Telecommunications Infrastructure Standard for Data Centers
- ANSI/BICSI 002-2014 Data Center Design and Implementation Best Practices
- ANSI/TIA 1179, Healthcare Infrastructure Standard
- ANSI/EIA/ECA 310-E, Cabinets, Racks, Panels and associated Equipment
- ANSI/SCTE 74 2003, Specification for braided 75 ohm Flexible Coaxial Cable
- FCC Part 68, Connection of Terminal Equipment to the Telephone Network.
- FCC – CC Docket 88-57 (Min demarcation location and type)
- FCC Part 76, Cable Television Service.
- ADA of 2010 and Telecommunications Act of 1996, Physically Impaired and Accessibility.
- IEEE 802.3.xx, Physical and Data Link layer standards for LAN’s, includes Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet.
- IEEE 802.11. xx, Wireless LANs.
- IEEE 802.16, Broadband Wireless Metropolitan Area Networks
- (NFPA-70) NEC-2008. (National Electrical Code )
- NFPA-76, Recommended Practice for Fire Protection of Telecommunications Facilities.
- NFPA 99, Healthcare Facilities Code
- ETA Electronic Technician Assoc. Fiber Optics Installer
- FOA Fiber Optic Assoc. Certified Fiber Optics Technician
- I.B.C. International Building Code
- UL1069, Hospital Signaling and Nurse Call Equipment
- UL2560, Assisted and Independent Living Emergency Call Systems
- ANSI/SCTE 77 Underground Enclosure Integrity
- IEC-61300-3-35 Fiber Optic Connector Endface Visual and Automated Inspection
- ANSI/ESD S7.1-2005 Anti-Static Discharge Flooring
- ANSI/ESD S6.1-2009 Anti-Static Discharge Grounding

All applicable State, Municipal & Campus codes, standards and statutes.
1.1 ETSU ITS Requirements

The design team shall consult with ETSU ITS for specific needs and practices. These include implementation of Voice over Internet Protocol (VoIP), LAN Security Cameras, LAN equipment, Wireless LAN, Classroom setup and equipment, the use of CAT5E or CAT6, Fiber Optic type and count, CATV etc.

1.2 Standards Variance

If the need ever arises that a standard cannot be met, during the design or installation, a “Standards Variance Form” must be filled out and sent to the ETSU Project Coordinator who will deliver to ETSU ITS for approval or denial. A copy of this form can be found in Appendix C.

1.3 Equal or Equivalent / Submittals

Submittals play a critical role in construction. During construction, submittals confirm the contractor has met the designer’s and owner’s intent. Post construction, they serve as part of the as-built resource. Submittals shall be submitted in such a way as there is a clear indication of what is being submitted i.e. by circling (not highlighting), manufactures part numbers (not distributors’ numbers), in a legible manner. ETSU has standardized on a number of performance and warranties criteria relating to the campus network infrastructure. ETSU requires the use of the specified products to be used as a benchmark for equal or equivalent (terminology such as “similar” are not to be used). Submittals for any possible substitutions must be submitted to ETSU ITS before the bid process and be consistent with the language of the bid document. The submittals must include full specifications and warranties and verified with a recognized testing laboratory such as UL or ETL.

All communications submittals shall be reviewed and approved prior to their procurement and installation. Submittals shall be provided to ETSU in its entirely (including re-submittals) in both printed and PDF formats. No partial submittals accepted without prior permission.
1.4 Master Format 2004/2014

The Construction Specification shall follow the MasterFormat 2004/2011 numbers and titles. Most of the specifications for Telecommunications will be found in Section 27. There are instances where Telecommunications related work will fall into other sections. An example is to keep conduit and pull boxes requirements for Telecommunications in Section 27 and reference them in Section 26 to “see Section 27 05 33”. There are main sections, as in the following:

- 27 00 00 General Communications Requirements
- 27 20 00 Data Communications
- 27 30 00 Voice Communications
- 27 40 00 Audio – Video, MATV Communications
- 27 50 00 Monitoring Systems Communications

Each of these main sections will have many sub sections. The Construction Specifications must include all sections and sub sections that will have any active role in the project and only the specifications related to the project. Each section shall be formatted with:

- **Part 1 General**
  - Summary
  - Codes, Standards, Guidelines (this Standard)
  - Definitions (Warranties, Installers Certifications and Qualifications. Segregation of work; Electrical vs. Telecom, Telecom vs. Fire Alarm, Security AV etc.)
  - Submittals, product info and shop drawings

- **Part 2 Products**
  - List out specific products with manufacturer and part number

- **Part 3 Execution**
  - General installation instructions
  - Specific instructions per product
Examples of Specific Sub Sections to specified:

- 27 05 05 Selective Demolition for Communications
- 27 05 26 Grounding and Bonding
- 27 05 29 Hangers and Supports
- 27 05 33 Conduits and Backboxes
- 27 05 36 Cable trays
- 27 05 53 Identification
- 27 06 00 Schedules for Communications
- 27 08 00 Commissioning and Testing
- 27 11 00 Equipment Room
  - 27 11 13 Entrance Protection
  - 27 11 16 Racks and Frames
  - 27 11 19 Termination Blocks and Patch Panels
- 27 15 00 Horizontal Cabling
  - 27 15 00.19 Data Cabling
  - 27 15 43 Faceplates and Connectors

1.5 T-Drawings

Telecommunications drawings shall be identified as “T” series (Telecommunications) drawings in the approved construction drawings, separated from “E” (Electrical) drawings.

See the Appendix pages for examples of material and methods, the T-drawings should show the detail and elevations for the following:

- Floor layout, showing work outlets, cable path (j-hooks or cable tray, horizontal and riser), sleeves, conduits.
- Legends, use industry standard symbols and legends,
- Telecommunications room layout / elevations
- Equipment rack layout
- Detailed work area outlet with labeling
- Riser diagram and cabling for voice, data and CATV
- Outside plant, cabling, methods and paths, with footages and bends
- Schedule of jacks and rooms
- Pull Box detail
- Grounding and Bonding
- Multimedia Box detail and elevation
- Floor Box and Poke Through details
1.6 Bid Documents

Prior to bid, both the construction specifications (Division 27) and the T-Drawings must be approved by ETSU ITS by formally approving the CD Drawings. Allow time for corrections to be made and not delay the project schedule.

1.7 Special Note to Architect, Engineers and General Contractors

In the State of Tennessee’s Cabling Standards 5/4/2004, it states, “Telecommunications cabling infrastructure must be planned for and funded with the same level of importance and over similar time horizons as all other utilities.” “We are no longer in a world where telecommunications abilities are viewed as a luxury; they are now a necessity to conduct everyday business. The industry now views telecommunications “structured cabling” as the “Fourth Utility” along with Plumbing, Electrical, and HVAC.” In addition to the State’s views, the manufacturer requires the design and the installation of the pathways to meet their requirements to obtain the warranty.

The Telecommunications Contractor shall take charge of this fourth utility. The General Contractor is responsible for the installation for all work including the telecommunications work, which includes all pathways, spaces, conduits, trays, sleeves, etc. The Telecommunications Contractor shall be made available at all progress meetings with the owner once their works begins and be available to discuss the installation with the owner with reasonable notice. The Telecommunications Contractor must have the unrestricted means of requesting information, asking and answering questions. The Telecommunications Contractor, Electrical Contractor, General Contractor, Architect, Electrical Engineer, Mechanical Engineer, ETSU ITS and Facilities must work in a team environment. It will take all trades, designers, and engineers to build an industry standard telecommunication infrastructure. The Telecommunications Contractor along with the General Contractor must take full responsibility for the installation of the telecommunications infrastructure to obtain the manufacturer’s warranty.

It is highly recommended that the Telecommunications be designed by a RCDD. If not, the engineer shall consult with representatives of the manufacturer and have clear knowledge of the installation practices for the manufacture’s products as well as to industry standards.
2. **Telecommunications Spaces and Pathways**

2.1 **Entrance Facility (EF)**

- An EF is a space where telecommunications outside plant (OSP) terminates to the inside facilities. The outside plant will most likely be fiber optics LAN, CATV coax, UTP telephone and MaxCell innerduct. (27 11 13)
- The EF may be in its own space or share a space inside an Equipment Room (ER).
- OSP cables routed inside a building are influenced by fire codes. The designer should be aware of and adhere to local codes, standards and regulations that might be more stringent than ETSU’s recommendation.
- ETSU recommends that OSP cable be terminated or transitioned to listed cable as close as practical upon entry to the building. In no case must this termination or transition exceed 50 feet from point of entrance for exposed cable. The designer may extend the point of entry by enclosing the unlisted outside cables in a rigid or intermediate metal conduit that extends beyond the wall or floor of the building and is properly sealed and bonded to a grounding electrode. At no point shall this cable be exposed prior to the termination point.
- The space needed for the EF is determined by the amount of terminations and if it is shared or not in the same room as the ER.
- The Entrance Facility shall be defined in specifications and T drawings as “EF”.

2.2 **Equipment Room (ER) & Telecommunications Room (TR)**

2.2a **ER/TR Layout**

Ideally the ER/TR’s should be located in center of building and be stacked directly above and below each other floor to floor. ER/TR’s shall be located so that access is made directly from a public or common hallway. Access shall not interrupt normal business, workflow of occupants.

The ER/TR shall be rectangular in shape. Triangle, L-shape and curved walls are not acceptable. There shall be one ER per building and one TR per floor, vertically aligned. Designs other than this arrangement must be approved via the Standards Variance form in Appendix C.

When the designer does not know the specific equipment that will be housed in the ER/TR, the designer can take the following steps in determining the size of the ER. Deduct all of the core areas from the total square footage the room will serve. If core areas are not known, divide the total square footage by 20%.
- If the floor serving area is 5,000ft² or less, size the room 10’ X 8’
• If the floor serving area is 5,000ft² to 8,000ft², size the room 10’ X 9’
• If the floor serving area is 8,000ft² to 10,000ft², size the room 10’ X 11’
• If the floor serving area is 10,000ft² to 20,000ft², size the room 10’ X 15’
• It is not recommended by ETSU ITS to house other services in the Telecommunications Rooms, due to network security. If other services such as Fire Alarm panels or CBord panels have to be housed in an ER or TR, (see Appendix C, Standards Variance Form) increase the size of the room 20%.
• NOTE: Designer must consult with ETSU Facilities Management and ITS before initial space planning for the ER/TR. Special conditions exist, as dictated by industry standards that can greatly increase the needed space requirements of these rooms based on use and construction types. (Medical, Classrooms, Labs, Law Enforcement, etc.).

Equipment not related to the support of the ER/TR (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, pass through, or enter the ER/TR. The ceiling must be free and clear of any obstructions including architectural / structural members not directly related to the ER/TR.

Ceiling heights in an ER/TR is recommended to be 10’ maximum. No acoustical / false ceilings lay in tile, or suspended ceiling grid are permitted in the ER/TR or any other areas designed or designated for the distribution of communications cabling or equipment. All ceilings in the ER/TR shall be constructed of solid gypsum or other approved material. Walls shall extend from floor to ceiling. Conduits and sleeves must enter below ceiling and above ladder tray.

Doors shall be a minimum of 36” wide and 7’6” tall. Doors must swing out of room or increase room size 3’. Doors shall be secured with Onity card reader locks.

Floors are to meet ESD standards (electrostatic discharge), developed by the ESD Assoc.(ANSI/ESD S7.1-2005 Flooring and ANSI/ESD S6.1.2009 Grounding) to prevent static damage to equipment. Light in color to enhance lighting and be either VCT or treated / painted concrete to prevent dust. A Rack Base Insulator Kit must be installed at the base of each rack to isolate the racks from the floor.

There should not be any windows in an ER/TR. If there is, they must be sealed to prevent opening and equipped with blinds.

There will be a minimum of two network racks with vertical wire management per ER/TR, each rack has a footprint of 2’X 2’ and shall be
bolted and bonded together. One rack is for cabling and the other for equipment. There shall be a minimum of 3 ft. clearance around all sides of the connected racks, measured from equipment mounted on wall, not the wall itself (see Appendix B). Install appropriate 24-port or 48-port patch panels in the cabling rack and fiber optic patch panel in the equipment rack. There shall be horizontal wire management for patch panels, one installed above and the other underneath the patch panel. Provide and install rear cable management bar for strain relief at each patch panel. Cables shall be dressed and terminated evenly 50/50 split left and right in groups of 48 or 24 depending on the numbers of ports of the patch panel. Racks shall be labeled top and bottom, front and back, to TIA-606B standards. When determining the port quantities add 25% for future growth.

A minimum of 18” wide ladder tray shall be installed around room and to each rack.

All walls shall be covered with ¾” AC grade plywood (“C” side facing the wall), covered on all 6 sides with two coats of fire retardant, light colored paint. See Appendix A for paint part number. Plywood shall be above electrical outlets (17” above finished floor typical) and extend to above ladder tray.

Terminate traditional phone on plywood with 110 blocks, with the copper UTP riser/backbone cables. VoIP, terminate on the network patch panels. In many cases, VoIP cabling will be traditional data cabling, with the designation determined by ITS (not the installer) after installation.

2.2b ER/TR HVAC

Today’s network equipment consumes more power and generates more heat than yesterday’s equipment. It is safe to say tomorrow’s equipment will also increase power and heat from today’s equipment. It is important to design for future growth of added equipment and network equipment upgrades. Design for a minimum of 5,000 BTU’s from equipment, for up to 144 data outlets, add 1,000 BTU’s for every 48 additional outlets served. HVAC shall be provided on a 24 hours-per-day, 365 days-per year basis. A stand-alone unit should be considered. When building is being backed up by generated power, it is required that the ER/TR’s HVAC be tied into the back up power, to keep the life safety network and telephones working during a power outage.

- The temperature and humidity shall be controlled to provide continuous operating ranges of 68° F to 77° F with 40% to 55% relative humidity.
• The ambient temperature and humidity shall be measured at a distance of 5 ft. above floor level, after equipment is in operation, at any point along an equipment aisle centerline.

• When a UPS system is installed in the ER, the engineer will need to factor in the units BTU’s.

• The ER/TR shall have positive air pressure with at least one air change per hour.

• When split systems are specified for the ER/TR, those systems shall be provided with a manufacturer-specified auto restart function to ensure the unit comes back on fully functional automatically after a power failure. Manual restart after a power interruption is not acceptable.

2.2c ER/TR Power Requirements

• It is highly recommended that the electrical feed to the ER/TR be backed up by a generator, including all convenience outlets.

• When generator power is provided to the building: All power, including power to all mechanical systems, in the ER/TR shall be installed to the building’s generator. All electrical outlets hooked to the generator must be red in color with red faceplates. Circuit ID to be labeled on faceplate.

• Outlets and faceplates with a generator feed shall be red.

• A separate supply circuit serving the ER/TR shall be provided and terminated in its own electrical panel inside the ER/TR.

• A minimum of two dedicated nonswitched 3-wire, NEMA 20 amp, 120Vac duplex electrical receptacle for equipment power, each on separate branch circuits. These outlets shall be mounted to the equipment rack vertical wire manager at 3’6” AFF. (Not the cabling rack). All electrical circuits installed on the equipment rack shall be installed from ceiling space down to elevation specified.

• Separate quad 120Vac convenience outlets for tools, test equipment etc., placed at maximum of 6’ (wall space) intervals around perimeter of room and below the plywood.

• Grounding and bonding shall be in accordance with ANSI/TIA-607-B standard.

• Follow manufactures recommendations for power needs of a UPS system.

2.2d ER/TR Lighting

• Provide a minimum of 500 lux (50 foot-candles) measured 3’ above finish floor.

• Locate light(s) 8.5’ above finished floor.

• Power for lighting should not come from the power panel located inside the ER.
• At least one light to be powered from generator.
• The walls and ceiling of the ER/TR shall be painted in light colored paint to enhance lighting.
• Coordinate the lighting layout with equipment layout, especially ladder trays.

2.3 Telecommunications Enclosures (TE)

A TE should serve an area not greater than 3600ft² and only to be used if a TR is not available or impractical. ETSU ITS will determine the size and if a TE is to be used. The TE is not to be installed in furniture systems. The TE should be accessible and controlled against unauthorized access.

If active equipment is to be housed in the TE:

• A minimum of one dedicated 120V, 20 amp, nonswitched, duplex electrical outlet receptacle should be provided.
• Sufficient number of air changes. Refer to equipment manufacturer for Standards.
• Must be bonded and grounded per ANSI J-STD-607-A.
• Doors hinged or removable to open at least 90°.
• Light measured within the TE should be a minimum of 500 lux (50 foot-candles).
• TE’s must not be used in lieu of a TR on a given floor.

2.4 Telecommunications Pathways

When designing a telecommunications pathway system, it is important to consider the design’s ability to:

• Accommodate cabling changes
• Minimize occupant disruption when pathways are accessed
• Facilitate the ongoing maintenance of cabling

The designer should locate telecommunications pathways away from sources of Electromagnetic Interference (EMI), including:

• Electrical power cables and transformers
• Radio frequency (RF) sources
• Motors and generators
• Induction Heaters
• Arc welders
• X-Ray equipment
• Photocopy equipment
The designer should plan for a pathway capacity that accommodates a minimum of three cables per every WAO. Although a minimum of only two cables is required, additional capacity would facilitate additions and changes to user needs and as applications evolve.

2.4a Conduits and Sleeves

- Vertically aligned TR’s with connecting sleeves are the most common type of backbone pathway.
- There shall be a minimum of three 4” conduit sleeves between each TR. (one filled with 2 3X3 MaxCell, each with their own color ID).
- No more than two 90° bends or a total of 180°
- Be less than 100’ in distance
- If over 100’ and or more than 180°, install a 31” wide X 60” length X 8” deep Pull Box (PB).
- The PB needs to be located in an accessible area.
- A PB is not to be used in lieu of a bend. Conduits are to enter and exit the PB in an aligned fashion.
- Empty conduits over 1” shall have a minimum 3/8” nylon rope pull line rated for 200lb. test. Conduits 1” and less shall have a polyline (Greenlee 430) installed.
- If more than 1 conduit in a room, install different colored polyline or rope.
- Conduits in the EF/ER/TR shall extend at least 3” and no more than 4” from floor, wall or ceiling.
- Adhere to the BICSI TDMM for conduit fill capacity.
- All WAO are to be fed within a minimum of 1” metal conduit. Consult ETSU ITS on conduit sizing prior to design installation.
- All conduits must be installed per NEC 2008 and be terminated into a box or bushing prior to cabling.
- When determining the size conduit sleeve from corridor to office or room, add up all the WAO and times by three to get the number of cables and design for 40% fill and 25% growth. Minimum conduit sleeve (only 1 WAO) is 1”. Multiple conduit sleeves are acceptable.
- All conduits shall be labeled, to/from.
- Conduit interior shall be fire stopped with Hilti CP-618. Exterior, around conduit, fire stop with Hilti CP-601S.
- Conduits shall be inspected by ETSU ITS prior to installation of cables.
2.4b Cable Management Systems

Ladder tray or baskets for backbone and horizontal cabling shall be sized appropriately (allow 25% growth) and have a 2” minimum depth. All ER/TR’s shall have ladder tray with a minimum width of 18”, around perimeter of room, with branches off to each network rack and bonded to an approved ground. All CAT6 installations shall be installed in ladder tray or basket. Ladder tray shall be located a minimum of 3” above ceiling tile and have a minimum of 12” of unobstructed access above tray. When designing the layout of the ladder tray, the designer should ensure that other building components (e.g., lighting fixtures, structural supports, air ducts) do not restrict access to the ladder tray. Wire basket must be cut using cutting tool for wire basket and not bolt cutters, see Appendix A.

2.4c J-Hooks

J-Hooks are to be used in CAT5E installations. Use appropriate size J-Hooks with a maximum of 40 CAT5E cables in any J-Hook, regardless of the J-Hook’s manufacturer’s specifications. When there are more than 40 CAT5E cables, ladder tray, wire basket or multiple J-Hook paths are required. Non-Metallic J-Hooks for CAT6 is limited to maximum of 8 cables. All cables (CAT5E, CAT6, Coax) must be secured every 4’-5’, anchor J-hooks to studs

2.5 Outside Plant (OSP)

Before designing any OSP, the designer and or consultants will need to meet with ETSU ITS for system requirements and methods. All OSP at ETSU is underground and in conduit. No aerial and no direct bury. The contractor shall be responsible with all conditions, duties and liabilities as respects to utility and underground locating prior to any work and all associated / required permissions for work and consulting with all parties of vested interest throughout the design and construction process. Underground requirements:

- 4” PVC Schedule 40 conduit for most applications.
- 4” PVC Schedule 80 conduit under parking lots, streets and driveways.
- A minimum of 24” from top of conduit to finished grade.
- Minimum of 12” of well tamped earth or minimum of 3” concrete separation from electrical power, 24” from steam lines.
- Minimum of three 4” conduits from Handholes (HH) to HH.
- Minimum of three 4” conduits from HH to Building. ETSU ITS will determine if more are required.
- At least one of the 4” conduits is to have two 3X3 MaxCell MXD detectable installed. Each MaxCell is to have different color ID markings. MaxCell must be installed to manufacturer’s instruction including the use of ball
bearing swivels and the MaxCell’s pull tapes must remain free floating throughout installation. (Plastic flexible inner duct not allowed).

- Install cables in the center cell of the MaxCell first.
- All conduits (including when filled with MaxCell) are to have a pull rope (no strings) installed.
- Conduits entering the buildings must be sloped away from building.
- HH’s are to be open bottom (on top of 4” of rock), with a minimum size of 30” X 48”, cover labeled “Communications”. Cover to have pull slot with center pin.
- HH’s are to be installed at a maximum distance of 150’ intervals for straight runs. This distance could be shorter after calculating bends and cable pulling tensions.
- No 90° bends in conduit. Communications sweeps are to be used.
- No “elbows or LB’s” (Smart LB allowed, see appendix H), terminate conduit in an appropriate sized pull box (PB).
- When tying into an existing HH, first consult with ETSU ITS to determine if a HH needs to be replaced with a larger size.
- When entering a HH, with conduit, enter minimum of 24” below finished grade, do not drill or punch holes in sides of HH higher than 24”. Do not stub up in center area of HH, see Appendix F. A HH is not to be used in lieu of a bend, see Appendix F & F1.
- HH’s are not to be installed in streets or parking lots. If one has to be installed in traffic areas, it must meet AASHTO H20 standards.
- Conduits are to be free of debris and water. Seal conduits with pliable / non-hardening duct seal to keep out rodents and moisture (Ideal 31-605 or Gardner Bender GB-DS-110N or equivalent).
- Cabling is to be neat and professional inside HH & PB’s. Route and secure cables around edges to free up room for future cabling.
- All cables are to be labeled inside HH or PB. Consult ETSU ITS.
- All cables (ISP & OSP) shall be permanently labeled within 1” of the end of the cable at the point of termination.
- Every other HH is to have a 25’ maintenance loop for fiber optics. Secure loop to side of HH.
- Install “Caution Fiber Optics” detectable Orange tape, along the cable pathway in one continuous piece, 12” below the final grade.
- When splicing is necessary, use approved splicing methods and enclosures. All coax connectors are to be enclosed with heat shrink, with at least 2” of shrink tube covering outer jacket. Use flame spread head to avoid scorching and melting center dielectric. Consult with ETSU ITS before any splicing is designed or requested.
- Before backfill, all underground installations must pass ETSU ITS inspections.
3. **Horizontal Cabling**

3.1a 100 ohm UTP CAT5e / CAT6

Prior to design, the designer and or consultant must meet with ETSU ITS to determine applications, methods and material. No surface mount raceway, (i.e. Hubbell, Wiremold, Panduit, conduit) allowed without prior authorization from ETSU Facilities Project Manager and ETSU ITS CIO. See Appendix C

The maximum cable distance from the ER/TR to the WAO is 90m (295’). When deductions are made for mandatory minimum slack, the cable distance is approximately 85m (281’).

- Cable slack in the ER/TR, minimum of 3m (10’). Above WAO, 1m (3.28’), and at the WAO for termination 8”. Cable slack should not be stored in bundled loops. Cable loops have a degrading effect on cabling performance. Cable slack should be stored in an extended loop or in a figure-eight configuration.
- All UTP terminations shall be done to TIA-568-C.2 Section 5.7.5 as T-568A scheme for pin/pair assignments.
- J-Hooks are allowed for CAT5E cabling, with 40 cable limit and non-metallic J-Hooks for CAT6 with an 8 cable limit.
- No splices in telecommunications copper cabling.
- Flexible metallic conduit or plastic tubing not allowed. Short lengths of smooth flexible Non-Metallic Conduit is allowed when the size is increased 1 trade size, with prior ITS approval.
- No vinyl cable ties are permitted in EF/ER/TR/TE. Contractor shall provide and install approved Velcro strips for securing cables in the EF/ER/TR/TE.
Installers are responsible when pulling cables through conduit or sleeves that are installed by themselves or others. Installations that do not meet standards or codes (Section 1), shall be redone at the discretion and direction of ITS. This includes,

- Fill percent
- Conduit size,
- Number of bends between pull points,
- Improper pull box and or size,
- Conduit ends not terminated properly with bushings or connectors.
- Installers are responsible of maintaining proper clearances above ceiling tile and away from EMI sources.
- Installers shall not use other trade’s pathways or allow them to use theirs.

Before any terminations and installation of equipment, the EF/ER/TR must be in its finished stage. Free of dust and debris with all walls and ceiling painted to finish coat and floors installed or treated. This will need to be coordinated with the building / project schedule for Fire Alarm, Elevator, Building Automation Systems and Access Controls testing, inspections and certifications. General Contractor is responsible for dust, debris and moisture. After terminations and equipment are installed, the EF/ER/TR’s door must be kept closed and locked at all times. If dust and debris occurs after terminations, the terminations will have to be re-terminated and tested.

All work is subject to inspection and review at anytime by qualified ETSU personnel.

All rough in work will be inspected by ETSU personnel before finished walls and ceilings are installed.

Final walk through inspections must be done prior to turning in final documentation and test results. The preliminary documentations will be made available for review during this walk through inspection. Cables with visible defects, kinks, twists, crushed, cuts or smashed will be replaced regardless if they pass tests.

Installer must take reasonable steps to protect their installation in a construction environment. Free of dirt, defects and debris.

### 3.1b Coaxial Cable

All CATV installations shall comply with FCC Part 76 signal leakage requirements.
Coax must be installed free of kinks, dents or any physical damage.

There shall not be more than two CATV amplifiers in cascade in a building. Design the CATV system to a minimum of 750MHZ.

Design for range of 3dBmV to 10dBmV signal at the CATV outlet. No more than 17dBmV signal on an F-fitting.

All CATV drops are to be home run from TR to outlet, no series wiring.

As part of the submittal process, CATV termination tools and test equipment (field strength meter, TDR) must be listed and approved.

3.1c Work Area Outlets (WAO)

Angled 4 port, electrical ivory faceplates are the standard faceplate used in Administration, Classroom, Mechanical and Building Automation spaces. 1 or 2 port flat faceplates are used in student rooms. Angled faceplates are only to be used in the vertical position. The use of other type or color faceplates will be determined on a case by case basis and shall have prior approval from ITS. ETSU has standardized on the colors of the jacks. CAT5e data jacks are to be blue. CAT6 data jacks are to be orange. Special circuits are to be yellow. Existing legacy phone jacks are white. On new installations, all drops are to be considered data unless noted otherwise. Outlet box, 4”X4”X3” deep.

3.1d Office Space

Each office space is to have a minimum of two WAO’s, one with 2 data cables fed within a 1” conduit, a second blank outlet on opposite wall for future or additional cabling. Cable offices by, routing cable to center of office before installing to WAO so the cables can be used in either WAO. Department Heads that will actually occupy the space will need to be consulted with to insure their needs are met. Network printers and fax machines locations often get overlooked.

3.1e Modular Furniture

Telecommunications and Power distribution planning should be coordinated to avoid conflicting pathway assignments. Untried distribution or terminations strategies should be avoided. Permanent cables shall be installed only in or on permanent walls. All modular furniture shall be fed from a “Consolidation Point” (CP). No direct horizontal cabling. Horizontal cables do not terminate in modular
furniture. Locate CP in an accessible area free from workstations and heavy file cabinets. Cabling from CP to modular furniture shall be through a service pole or through the wall if not blocked from furniture. Do not block access to horizontal cabling pathways or outlets. No cabling or WAO allowed behind modular furniture. Label “Consolidation Point” with adhesive label on ceiling grid where the CP is installed. Designer must calculate the maximum cables capacity allowed in the modular furniture’s raceway and feed with multiple service poles if necessary.

3.1f Multi Media Classroom / Labs

The designer will need to consult with ETSU ITS’ Special Project Manager for design specifications for Classrooms and Computer Labs.

With the introduction of digital audio\visual and sun setting analog, all classrooms will be compliant with High-bandwidth Digital Content Protection (HDCP) using High-Definition Multi Interface (HDMI) components. Components will be controlled by a Crestron processor\switcher and use Crestron’s proprietary cable DM-CBL-8G as the backbone for transmitting digital audio\visual signaling and control

Multi Media design, installation, cabling, materials and methods, shall be done to the standards of ANSI/InfoComm Audiovisual Standards, and Accredited Standards Developer (ASD). Multi Media requirements include:

- Lectern with dedicated power
- Five networking drops
- Projectors or large displays with dedicated power
- Zoned fluorescent lighting
- Zoned canned dimmable LED type lights
- Dimmable track lighting for Instructor
- Crestron Control Systems
- Digital Components
- White Boards/ Smart Boards / Screens
- Document Cameras
• Overhead speakers and projectors, secured to ceiling with safety wire
• A chase to house an 8” X 8” electrical box fed with 2” conduit for signal and 2” conduit for data, extended 4” above chase wall.
• Multi Media wall plates, connectors and cables.
• Blackout Shades

**ITV/ distance learning/ e-learning.**

**Special room lighting, sound and carpet considerations**

• Ideally ITV room should be sound reinforced with carpet and acoustical panels.
• Dedicated power for lectern equipment, projector and displays
• Zoned lighting Fluorescent Lighting
• Zoned canned LED type lights
• Dimmable track light for instructor
• Blackout Shades

**Computer Labs:**

• Raceway to house both electrical and data separately, utilizing Hubbell plates and connectors installed with T-Series Panduit, elevation dependent upon computer-lab table model.

### 3.1g Residence Life (Housing)

Each student bedroom is to have two data cables and one CATV outlet. The data and CATV WAO’s shall be in separate outlets. Each living room shall have a minimum of one CATV outlet. See Appendix A for data/phone and CATV faceplates and jacks.

When there is more than one CATV drop in a Housing unit, residential wiring scheme is permitted for CATV. Run one CATV drop to unit and split signal to other outlets in unit through ¾” conduits. Locate in wall box near electrical panel secure splitter to back of box and bond to electrical panel with #14 AWG green insulated wire.

The main entrances to a housing building shall be equipped with an outside weatherproof wall or pedestal mounted Emergency Phone. Locate phone near card reader door access.
3.1h Conference Rooms

Each conference room shall have a minimum of two WAO on opposite walls consisting of two data and one CATV cable. One of these two can be installed in same faceplate as the multi media. A floor box consisting of a duplex electrical outlet, 6 communications (combination data, voice, audio, video). Wall plate, HDMI, VGA, 3.5mm audio, data, CATV. Locate all wall WAO’s near electrical outlets. Cabling from wall plate to floor box, shall be housed into either 2(two) 3/4:” or 1 (one) 1 1/2” conduit for the HDMI, VGA, 3.5mm cables. One separate 3/4” conduit for data and voice. Table shall have HDMI, VGA, 3.5mm audio, 2 duplex electric, data and voice. It is recommended that the conference room table have cable management and cutouts or “pop-up” surface boxes for electrical, data and USB charging to eliminate cables routed over the top and through seating areas.

- All floor boxes and poke throughs must be recessed. Hubbell System One.

See Appendix A for complete assembly part numbers.

3.1i Break Rooms, Lobby / Others

As a general rule, each break room area should have one wall mounted WAO (ADA compliant). The Department Head should be consulted with for specific needs in their space.

Lobbies and corridors shall have wall mounted courtesy phones. Locate courtesy phones near elevators and or near main entrances /exits.
3.1j Wireless LAN (WLAN)

All buildings on ETSU’s campus will have access throughout the building to ITS’ WLAN. WLAN is not intended to replace wired data WAO’s, but is to provide flexibility and mobility. No one should take an exam or test using wireless connections. Even the strongest wireless connections may have brief interruptions of service due to outside interference. A RF survey must be done prior to design and installation of renovated buildings to ensure radio-frequency integrity, optimum location for coverage, and to identify possible interference problems. This survey should be done after 100% Design and Development and before 100% Construction Documents.

Cabling for Wireless:

**Horizontal cables shall not directly terminate to equipment.**

**Suspended / False Ceilings**

Access points located in areas with a suspended or false ceiling will have the outlet terminated in a single gang work area outlet (WAO) on the nearest wall or column, within 15 feet of the proposed access point location. If the distance from WAO and access point is greater than 15 feet, install ¼” conduit to directly above access point. Use appropriate ceiling grid clips to secure access point to ceiling grid, depending upon if tile is flush or recessed. Patch cable must be installed to standards and be secured every 4’ to 5’ and kept away from florescent light ballast and other EMI sources.
High Ceilings

In locations where the ceiling height is 12’ or greater, the access point will be mounted on wall at a height of 9 feet. Extend a \( \frac{3}{4} '' \) conduit from above to a single gang WAO. An Oberon 1029-00 or equivalent will be installed around the WAO. Use a 1 foot patch cable to connect access point.

Solid Ceilings

In new construction, conduit will be installed in areas with solid ceilings. Terminate conduit in a recessed single gang WAO. The access point will mount directly to the WAO and flush with ceiling. Use a 1 foot patch cable to connect access point. Solid ceilings in existing buildings will be addresses on building by building bases. Access above the ceiling or attaching to the ceiling may not be an option. Consult with ITS regarding solid ceiling in existing buildings to determine access or workaround.

Open Ceiling

For open ceilings of 12 feet or less, conduit will be installed and terminated on the nearest wall if within 15 feet from RF prediction, into a shallow single gang WAO. The height of the Oberon mount will be 9 feet above finished floor. Use a 1 foot patch cable to connect access point.

If the nearest wall or column is greater than 15 feet, the conduit and WAO will terminate at the access point prediction; location. The height of the WAO should be level with metallic structures, which may require the conduits to stub down, but still have the access point mount horizontally. The access point will be mounted directly to the WAO. Use a 1 foot patch cable to connect access point.
3.1k Security Cameras

Deployment of Security Cameras must follow ETSU’s FP-34 Security Camera Policy, including but not limited to appropriation, use and feasibility. ETSU has established the Axis cameras as the model source. Camera placement on new or renovated buildings to be coordinated with Public Safety and ITS prior to final design. During construction, a site visit needs to be arranged with ITS for the exact location and height. This visit shall occur after wall studs are installed and before drywall installation or external facade. Provisions in design shall be made for the pathways and power requirements. Install and design per manufacture’s specifications.

There are three main types of installations for cameras:

1. **Exterior Camera**, requires an inside WAO, ¾” sleeve to the outside. Install per camera installation instructions.
2. **Ceiling Grid Mount** interior camera. Install 1 port surface box at nearest wall, above ceiling. Patch cable from WAO to camera location, 15’ maximum, secure patch cable every 4’-5’. If over 15’, install ½” conduit from directly above ceiling camera to the nearest wall. Terminate horizontal cabling at the end of conduit at camera location.
3. **Dome Wall Mount** interior camera. Install recessed WAO center 4” below ceiling.
3.11 Emergency Phones

Emergency Phone’s type and location will need to be coordinated with ETSU’s Health and Safety Department in the design phase and specified in the construction documents. Install as per the manufactures specifications, including grounding with 5/8”, 10’ ground rod and bonding the electrical ground with the telecommunications cable’s sheath and protector. Button height to be 48”. 
3.1m Elevator and Area of Refuge Phones

Elevator phone cable shall be CAT5e or CAT6 (same as rest of building’s cabling) and be protected in ½” EMT conduit from elevator control panel to the TR. No more than two 90° bends between pull boxes. Terminate inside control room inside a minimum 4X4 electrical box outside of the equipment panel with a single port surface box. (Demarcation Point) Installation, testing and labeling shall be consistent with material and methods found in this standard.

Area of Refuge phone cable shall be CAT5 or CAT6 (same as rest of building’s cabling) and be protected in ½” EMT conduit from phone to TR. No more than two 90° bends between pull boxes. Mount so that the red help button is 48” above finished floor. Terminate cable inside housing with a 1 port surface mount outlet box.
3.1n Building Access / C-Bord / Security

Indicate on the T-Series drawings the placement of the C-Bord equipment and network outlet. Cabling within the TR shall comply with the ETSU ITS Telecommunications Standards. Building Access, C-Bord and Security shall provide their own pathways and not use other trades pathways.

3.1o Building Automation Systems / BAS

BAS can consist of:
- HVAC and Electrical monitoring
- Electronic Access Control (EAC)
- Electronic Safety and Security (ESS)

Or any system that:
- Monitors
- Controls
- Operates
- Manages building services
**Cabling connecting** BAS to the ETSU ITS network must follow the standards spelled out in ANSI/TIA/EIA 862 and adhere to the methods and materials of this standard. All cabling (fiber and copper) to be connected to ETSU’s network must be certified and follow the standards and test methods spelled out in this standard.

**Network connectivity** to the ETSU ITS network must meet the following criteria:

- Ethernet 10/100 auto negotiate
- 1 MAC address per port (per drop)
- DHCP for IP addressing – reservations may be requested if a persistent address is required.
- Network devices that extend or share connectivity such as switches and routers are prohibited.
- Special configurations such as Vendor Class Options and PXE will be considered on a case by case basis and may be granted if they do not interfere with other services.
- Special needs such as Firewall exemptions, VPN or DNS requests, will have to get permissions and authorizations through ETSU ITS Networking Director.

**VPN**

**Firewall, Static IP, DNS,**

### 3.1p Fire Alarm Communications

Cabling connecting the Fire Alarm System to the ETSU fiber optic network must follow the standards spelled out in this document. Fiber optic cabling shall terminate in a wall mounted patch panel (see Appendix- A) using a red patch cable to connect to the ETSU fiber patch panel (demarcation point). It is up to the contractor to determine what
connector is required for this patch. Fire Alarms that use phone lines for telecommunications must follow codes and methods of the Authority Having Jurisdiction and installed per BICSI, NFPA and ANSI/TIA standards. All Fire Alarm cabling must be physically protected. Coordinate Fire Marshall Inspections with ETSU Health and Safety, Project Manager and ITS. Contractor is not to independently schedule such inspections.

3.1q Digital Signage

Digital signage in a building shall consist of 1 data and 1 coax in a WAO, next to an electrical outlet. Outlets shall be located at a height so it will be behind the flat screen monitor/TV.
4. **Backbone Cabling Inside Plant (ISP)**

The recommended backbone pathway, connecting Telecomm Rooms together, is to align them vertically. This provides the most flexibility, protection of critical services and reduces costs of extending 4’ conduits, bonding/ground wire, installing large pull boxes or ladder tray. When the rooms are vertically aligned, connect by installing a minimum of three 4” sleeves, following BICSI standards. Install proper fire stop to make sure the conduits are able to be re-entered. See Appendix J. When the Telecomm Rooms are not vertically aligned, connect rooms by either installing a minimum of two 4” conduits with one of them filled with 2 3X3 MaxCell or installing a separate ladder tray above horizontal cabling paths. When installing conduit backbone paths, follow the standards as to length and degrees of bends and placing proper sized pull boxes. In addition, install proper sized grounding/ bonding conductor in separate conduit. Install proper fire stop to make sure the conduits are able to be re-entered. See Appendix J. When installing a separate ladder tray for backbone cabling, in addition to installing above horizontal cable path, clearly label tray at every support, “Telecommunications Backbone Cables Only” with machine originated label, with large font size.

4.1a **Fiber Optics**

The fiber optic riser backbone cable connecting 2 TR’s shall be a minimum of 12 single mode (OS2) and 12 50 micron multi mode fiber optic cables (OM3). Plastic inner duct is not allowed. Fibers are to be either in conduit or use Corning non-metallic armored cables. See Appendix A for part numbers and colors. Test per BICSI’s recommendations & methods and Chapter 5, Commissioning, Warranties and Documentation.

4.1b **UTP Copper Cables**

The requirement to install copper backbone cables will be a decision of ETSU ITS. The most likely purpose of copper backbone is for life safety, Fire Alarm, Elevator Phones, Emergency Phones, etc. When installed it must be protected (conduit). The type and cable pair count will be determined on a case by case basis. Follow standards for bonding/grounding, labeling, and testing.

4.1c **Coax CATV Cables**

Coax CATV backbone cabling under 300’ between TR’s is to install RG11 riser rated cable. For installations over 300’, install .500 PIII Plenum hardline coax. See Appendix A. There shall be no noticeable defects, dents, twists, kinks or splices in the cable. Terminate TDR length and label.
5. **Commissioning, Warranties and Documentation**

5.1a **Inspections and Walk Through**

- All work is subject to inspection and review at anytime by qualified ETSU personnel.
- All rough in work will be inspected by ETSU personnel before finished walls and ceilings are installed.
- Final walk through inspections must be done prior to turning in final documentation and test results. The preliminary documentations will be made available for review during this walk through inspection.
- Cables with visible defects, kinks, twists, crushed, cuts or smashed will be replaced regardless if they pass tests.

Installer must take reasonable steps to protect their installation in a construction environment. Free of dirt, defects and debris.

5.1b **Commissioning**

ETSU ITS requires the newly installed infrastructure to be tested and certified. Follow the Standards of ANSI/TIA -568-C.1,2,3,4 for testing criteria of the permanent link. See Appendix D for approved test equipment to obtain a manufacture warranty.

Testing shall commence only after all materials are permanently installed, adjusted, bonded and labeled. Installer must retest and save both the original and retested results when any of the above occurs.

Testing shall commence only in a clean environment, free of moisture, dirt, dust and debris. Terminations exposed to such environments after testing will require retesting.

In addition to the cabling being commissioned and certified, the electrical grounding and bonding systems must also be tested and certified.

- The electrical contractor is responsible for testing the Alternating Current (AC) Grounding Electrode System.
- The telecommunications installer is responsible for testing the Equipment Grounding (Bonding) System.
- Refer to the BICSI TDMM latest edition, for approved test equipment and acceptable results.
5.1c Warranties

ETSU ITS requires all copper installations to have a 25-year warranty. This warranty shall include all types of telecommunications services such as Power over Ethernet (PoE) Voice over IP (VoIP), LAN Security Cameras, Wireless LAN and any future services that meet CAT5E or CAT6 ANSI/TIA/EIA and or IEEE specifications. As part of the equal and equivalent in section 1.3, ETSU ITS has benched marked the Hubbell’s MISSION CRITICAL® Warranty and System Performance Guarantee Program in determining equal or equivalent. As stated in the Introduction, installers must be certified by the manufacture of the systems they are installing. Follow the instructions of Appendix D. For further information on the warranty program go to: http://www.hubbell-premise.com/MissionCritical.asp

5.1d Test Results

Follow the manufacturer’s warranty submittals and submit a copy of all results (including CATV, Fiber Optics and Grounding/Bonding) to ETSU ITS before final certification.

Test results shall be provided in the following Sections, Format and Order*:  
Section 1: Cover sheet clearly indicating project name / number and date of testing.
Section 2: Summary sheet with a single table indicating all ID’s in order, total cable quantity and a pass or fail result for each.
Section 3: Individual sheets for each individual twisted pair cable or optical fiber strand pair in order showing all applicable test results per TIA standards.

Note: Test results submitted in any other format will be rejected.

- All UTP cable test results must be submitted in their original format from tester. UTP testing and results shall conform to TIA-568C.2 Section 6 for the permanent link.
- CATV signal loss and attenuation, length, signal leakage report and document on spreadsheet.

* UTP cables terminated on a patch panel shall be in order by room number starting with port 1 with lowest room number. Fiber Optics in order of standard color code, single mode first, multi-mode second, CATV in order of room number.
Fiber testing:

**OPTICAL FIBER TESTING PARAMETERS**

<table>
<thead>
<tr>
<th>Optical Fiber Type</th>
<th>Testing Method per TIA-568-C.0 (Section 6 and Annex E)</th>
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</thead>
<tbody>
<tr>
<td>Singlemode OSP</td>
<td>Tier 1 and Tier 2 testing required:</td>
</tr>
<tr>
<td></td>
<td>- Tier 1: Attenuation measurement for permanent link</td>
</tr>
<tr>
<td></td>
<td>measured with optical loss test set (OLTS) using</td>
</tr>
<tr>
<td></td>
<td>methods specified by TIA-526-7, method A.1.</td>
</tr>
<tr>
<td></td>
<td>- Tier 2: Additional attenuation measurement with</td>
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<tr>
<td></td>
<td>optical time domain reflectometer (OTDR) using</td>
</tr>
<tr>
<td></td>
<td>methods specified by TIA-526-7, method B.</td>
</tr>
<tr>
<td>Singlemode ISP</td>
<td>Tier 1 testing required (Tier 2 optional unless</td>
</tr>
<tr>
<td></td>
<td>specified):</td>
</tr>
<tr>
<td></td>
<td>- Tier 1: Attenuation measurement for permanent link</td>
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<td></td>
<td>measured with optical loss test set (OLTS) using</td>
</tr>
<tr>
<td></td>
<td>methods specified by TIA-526-7, method A.1.</td>
</tr>
<tr>
<td>Multimode ISP and OSP</td>
<td>Tier 1 testing required (Tier 2 optional unless</td>
</tr>
<tr>
<td></td>
<td>specified):</td>
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<tr>
<td></td>
<td>- Tier 1: Attenuation measurement for permanent link</td>
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<td></td>
<td>measured with optical loss test set (OLTS) using</td>
</tr>
<tr>
<td></td>
<td>methods specified by TIA-526-14-A, method B.</td>
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**OPTICAL FIBER ATTENUATION (LINK LOSS) BUDGETS**

<table>
<thead>
<tr>
<th>Optical Fiber Type or Connection Type</th>
<th>Allowable loss per kilometer at wavelength</th>
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</thead>
<tbody>
<tr>
<td>Singlemode indoor / (outdoor)</td>
<td>1.0dB @ 1310nm / (0.5dB @ 1310nm)</td>
</tr>
<tr>
<td></td>
<td>1.0dB @ 1550nm / (0.5dB @ 1550nm)</td>
</tr>
<tr>
<td>Multimode ISP and OSP</td>
<td>3.5dB @ 850nm</td>
</tr>
<tr>
<td></td>
<td>1.5dB @ 1300nm</td>
</tr>
<tr>
<td>Connector loss (per mated pair)</td>
<td>0.75dB</td>
</tr>
<tr>
<td>Splice (per each)</td>
<td>0.3dB</td>
</tr>
</tbody>
</table>

Note: Optical fiber splices shall be measured in accordance with ANSI/TIA-568-B for field testing.

Document; results, test procedure and methods, wavelengths, equipment used, calibration dates of test equipment and test personnel.

Tests must pass manufactures specifications as well as industry standards. Cables with visible defects and deformations such as, kinks, twists or crushed will fail and needs to be replaced regardless of test results.

Note. The contractor shall ensure the proper usage of optical fiber patch cords during testing, having the correct core to cladding offset (i.e. 50/125 um vs. 62.5/125 um) patch cable for the cable under test. Test results shall show calculated loss budget for each fiber length and type. The use of mode-conditioned launch cables and fiber mandrels shall be employed where applicable.

5.1e Administration / Labeling

It has become more important to accurately document every outlet and every port, so the information can assist in a 911 data base.

All WAO’s, patch panels, 110 blocks, conduits, trays, backbone cables, grounding and racks shall be labeled according to ANSI/TIA 606-B, Class 3 standards, with specific labeling scheme of ETSU ITS. All labeling
material, methods and scheme shall be submitted during the required submittal process. All labels shall be printed or generated by a mechanical device. See Appendix M and M2 for examples. Labeling is to include:

- Identifiers required in class 3 administration
- “Caution Fiber Optic” adhesive marker every HH. Label to include SM & MM fiber count and “to and from”.
- “Caution Fiber Optic” adhesive marker every 50’ of exposed fiber in building (including in ladder tray). Label to include SM & MM fiber count and “to and from”.
- OSP UTP cables shall be labeled with permanent and neat penmanship in every HH and EF with “to and from” and cable pair count.
- OSP CATV coax cables shall be labeled with permanent and neat penmanship in every HH and EF with “to and from”.

6. Firestopping

Telecommunication’s conduits and sleeves are meant to be re-entered numerous times over the life of the building. Firestopping methods must meet the requirements of the Authority Having Jurisdiction (AHJ) and also be flexible enough for future moves, adds and changes for telecommunications.

Firestopping around the conduits shall be elastomeric (permanent). Firestopping inside the conduit shall be pliable putty (removable). Conduits must be available for re-entry for future cabling without “digging out” hardened fire stop.

In lieu of conduit sleeves, other firestop assemblies are approved as long as they meet the Fire Rating of floor/wall and are made to be re-entered. Such as Hilti CP-653.

All rated penetrations shall be labeled at each accessible entry and exit (both sides of wall for wall penetrations or on wall near floor for floor penetrations).

Firestopping shall be accomplished by listed and approved methods and materials. (UL 1479 / ASTM E814) See Appendix J.

Contractors are responsible for obtaining, (prior to their procurement, fabrication and installation), official documentation from the AHJ that all materials intended for firestop thru-penetrations are approved.
Appendix A
Material and Parts List

The following materials are to be used unless a timely submitted substitute is approved by ETSU ITS.

CABLES

**CAT5E Cable.**
Mohawk MegaLAN M56167B
Hubbell Speedgain C5EPRRB
CommScope Ultra II 55N4R, Blue
Indoor/Outdoor, Mohawk M58932,
Outdoor Only, Belden 7997A, CommScope 5NF4

**CAT6e+ Cable.**
Mohawk AdvanceNet M57202
Hubbell Nextspeed C6RRB
CommScope Ultra Media 75N4, Blue
Indoor/Outdoor, Mohawk M58772
Outdoor Only, Belden OSPU6U, CommScope 6NF4+

**Fiber Optic OSP Cable.** (Check with ITS on which one to use)
   Corning Freedm One Cable / CommScope Short runs 24 strands or less
24) OS2 Corning 024E8F-31131-29, CommScope Z-024-DS-8W-FSUBK
24) 50/125um OM3 Corning 024T8F-31180-29, CommScope Z-024-DS-5L-FSUBK
12) 62.5um OM1 Corning 012K8F-31130-29, CommScope Z-012-DS-6F-FSUBK
   Corning Altos / CommScope -Longer pulls and or high fiber counts
   XXX = fiber count (048, 084, 144 etc.)
   Single mode Corning OS2 XXXEU4-T4101D20, CommScope D-XXX-LN-8W-F12NS
50/125um OM3 Corning XXXTU4-T4180D20, CommScope D-XXX-LN-5L-F12NS
12) 62.5um OM1 Corning XXXKU4-T4130D20, CommScope D-XXX-LN-6F-F12NS

**Fiber Optic Riser Cable.**
   Corning MIC DX / CommScope Armored Cable
12) (yellow) OS2 012E81-33131-D1,CommScope R-XXX-DZ-8W-FSUYL
12) 50um(aqua) OM3 Corning 012T81-33180-D1, CommScope R-XXX-DZ-5L-FSUAQ
6) 62.5 um (orange) OM1 Corning 006K81-31130-D1,
   CommScope R-XXX-DZ-6F-FSUOR
   (Non-armored MIC is accepted when installed in dedicated conduit)

**Coax Horizontal.** Thor Digital RG6-60R Black, Belden 7915A (plenum, CommScope 2275V)

**Riser Coax.** Belden 9011 RG11 (under 300’) or CommScope PIII 500 Plenum (over 300’)

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Design and Installation Standards Policy Rev. 3.5
**OSP Coax, Flooded.** CommScope, .PIII 500 JCASS, (under 500’), PIII 750JCASS (over 500’)

**OSP Phone CAT3.** BSW (Buried Service Wire), Essex or General Cable PE89

**Inner Duct.** MaxCell 3X3, Detectable, color ID, MXD3456

**CONNECTORS**

**CAT5E Jacks.** Hubbell Speedgain, Blue, HXJ5EB

**CAT5E Phone Jacks.** Hubbell Speedgain, White, HXJ5EW

**Cat5e Special Circuit Jacks.** Hubbell, Speedgain, Yellow, HXJ5EY

**CAT6 Jacks.** Hubbell, Nextspeed, Orange, HXJ6OR

**Coax RG6 F-Fittings.** Belden / CommScope-Thomas and Betts FSNS6U (plenum FSNS6PL), Thor Digital T&B SNS1P6 blue

**Coax RG11 Fitting.** Belden Thomas and Betts 716SNS1P11H,

**Coax .500 Fitting.** Gilbert GRS-500-CH-DU-03-T

**Coax .750 Fitting.** Gilbert GRS-750-CH-DU-03-T

**Coax F-81 Jack**
- Student Rooms, (Stainless Steel), Allen Tel, ATBK-81, Pico WP-81SS
- Office/Classroom, only if CATV is in the same WAO as a data drop, Hubbell, SFFEX. Stand alone CATV, Allen Tel, CT-103F or Pico WP-81V

**Fiber Optic Connectors.** Hubbell Proclick SC or Corning Uni-Cam SC
- **Single Mode**, Hubbell FCSC900KSM or Corning 95-200-41, blue
- **Single Mode APC**, Hubbell FCSC900KASM, or Corning 95-200-44 green
- **50um Multi Mode**, Hubbell FCS900K50M or Corning 95-050-41, black
- **62.5um Multi Mode**, Hubbell FCS900K62M or Corning 95-000-41, beige
- **SC Bulkheads Duplex** Use Hubbell in Hubbell Housings and Corning in Corning Housings. Hubbell FSPSCD series, Corning CCH series.

**CROSS CONNECTS**

**CAT5E Patch Panel.** 48 port, Hubbell Speedgain, Black, HP5E48

**CAT5E Patch Panel.** 24 port, Hubbell Speedgain, Black, HP5E24

**CAT6 Patch Panel.** 48 port, Hubbell, Nextspeed, Black, HP648A
**CAT6 Patch Panel.** 24 port, Hubbell, Nextspeed, Black HP624A

**110 Blocks, Backbone.** 5 pair, Hubbell, 110BLK50FTK5

**110 Blocks, Horizontal.** 4 pair, Hubbell, 110BLK50FTK4

**Fiber Optic Connector Housing.** Hubbell FCR series or Corning, “CCH” series

**Fiber Optic Wall Mount.** (Fire Alarm), Hubbell FCW4SP or Corning Wall Panel WCH-02P

**UTP Protectors (CAT3)** Circa 1880 series, 110 block, 5 pin modules 4B1S-300. CAT5e, Linx CAT5e-75

**CABLE MANAGEMENT**

**Network Rack** with 6” Z-Channels, Black, Hubbell Nextframe CS-1976

**Rack Base Insulator Kit.** Chatsworth Products, 10605-019

**Horizontal Management.** Hubbell, HM24C, or HM14C. Check with ITS

**Rear Cable Management Bar.** Hubbell ECMBR3

**Cable Management Rings.** Hubbell, MCCPSR4

**Cable Management Troughs.** (110 blocks), Hubbell, 110TRA

**Ladder Tray. (for ER/TR)** Hubbell Next Frame, 18”, “HL” Series, or Cooper B-Line SB17U18B

**Ladder Tray. (for corridors),** Hubbell, “HPW” Series, or Cope I-Beam System

**Wire Basket,** Hubbell Pre-Galvanized, HBT series (size dependant)

**Wire Basket Cutting Tool.** Hubbell HBTCUTTOOL (Do Not Use Bolt Cutters)

**J-Hooks.** (up to 40 cables, CAT5e only), Cooper B-Line / BCH32, Erico CAT425 Adjustable Cable Support

| **J-Hooks.** (up to 8 cables), Panduit J-Pro JP75W-L20 (the only J-hook approved for CAT6)

**Equipment Shelf.** Hubbell, MCCCCS19P
**Work Area Outlet (WAO)**

(Coordinate faceplate color with electrical faceplates)

**Office/Classroom Faceplate**, 4 port, Hubbell AFP14EI (Electrical Ivory)

**Office/Classroom Faceplate**, 6 port, Hubbell, IFP16EI (requires 2 gang box, with plaster ring)

**Office/Classroom Faceplate**, 9 port, Hubbell, IFP212EI (requires 2 gang box)

**Student Room Faceplate**, 1 port, Hellerman Tyton FPSINGLESS, 2 port FPDUALSS

**Student Room CATV Faceplate**, with F-81, (Stainless Steel), Allen Tel, ATBK-81, Pico WP-81SS

**HON Furniture Faceplate**, 2 port, Hubbell FP2BK (black), FP2GY (gray)

**Blank Faceplate inserts**, Hubbell, Electrical Ivory SFBE10

**Blank Faceplate inserts**, Hubbell, Black, SFBB10

**Blank Faceplate inserts**, Hubbell, Gray, SFBG10

**Floor Box Assembly**, In slab concrete, Hubbell System One, Recessed, www.hubbell-wiring.com/Press/pdfs/WLBD001.pdf


### Miscellaneous

**Firestop** Hilti “Moldable Pliable Putty” CP-618. *Tube putty and caulk that cures to an elastomeric solid is not approved in conduit.* Hilti FS-ONE around the conduit. Hilti CP-653 Sleeve.

**Fire Retardant Paint**, Benjamin Moore P59-220 (white), or Sherwin Williams MIL-PRF-24596B (white 27880) up to 2 oz. of tint allowed per gallon. Or approved replacement from State Fire Marshall.

**Telecommunications Grounding Busbar**

TMGB Hubbell HBBB14416H, (EF & ER)

TGB Hubbell HBBB14210A, (TR)

**Rack Equipment**, Hubbell HBBBHR19KT

See Appendix E-2 for more Bonding and grounding part numbers

**Rack Base Insulator Kit**, Chatsworth CPI 10605-019
**Power strip.** (for network rack), surge protected, Hubbell MCCPSS19TS

**Emergency Phone.** Gai-Tronics, Red 234 Stanchion w/strobe, 397-001 Phone

**Outdoor Courtesy Phone.** Gai-Tronics Red 236 Enclosure, 398-001 Phone.

**Handhole (HH) Pull Box.** Quazite “PG” style, 30X48 PB, 36X60, Splice Box. Lids are to be identified with “Communications” and have pull slots center pins.

**Splice Enclosures.**
For Copper Preformed Line Products, Coyote Series
For Fiber Optics, Corning SCF family

**Duct Seal.** Ideal 31-605 or Gardner Bender GB-DS-110N

**Smart Conduit Body LB.** Conduit Specialties Inc.PVC 4” KBLB401, Aluminum, 4” KBLB400

**CATV Amplifier.** Blonder Tongue BIDA 750-30 or BIDA 750-50 (Check with ITS)

**CATV Splitters.** vertical ports, Blonder Tongue SCV-X or Pico TSV-XSB (X= number of ports)

**Raceway for Shared Power and Communications, Dual Channel** Hubbell PW2ABC7 PB2IND2G In-Line Box KP8 Plate with BR106C 106 frame or Panduit Twin-70 “Pan-Net” office white, T702BIW8 Base with T702CIW8 Cover, Device Bracket T70DB-X

**Metallic Raceway.** Wiremold V2000BC, Base and Cover, or Hubbell HBL2000BCIV Base and Cover

**Detectable Warning Tape.** C.H. Hansen 16626

**Network Cabinets** For inside Telecom Room, Hubbell HSQ3636 or HSQ4836, with fan kit HWKF120 and ground kit REKEGS. For outside the Telecom Room 24 drops or less Hubbell RE4X
Appendix B

- 10’X 8’ is the minimum size room. The square footage of service area, number of drops and equipment mounted on walls could require a 10’X 9’ or 10’X 11’ room.
- Must have a minimum of 3’ of clear work space around all sides of racks. Measure a minimum of 5’ from front of rack to rear of room. Do not mount equipment on walls directly in front or rear of racks unless increase size of room to maintain the 3’ clearance.
- 36” door must swing out or increase room size 3’. Door is secured with an Onity card reader system.
- The amount of sleeves needed is dependent on number of drops and 25% growth, 40% fill.
- Sprinklers must have wire cage and be located away from tray and sleeves.
- Equipment not related to the support of the ER/TR shall not be installed or pass through the room.
- No vinyl cable ties, use approved Velcro strips.
- AC Grade plywood, on all 4 walls. Plywood to be fire retardant or have all sides covered with two coats of fire retardant paint.
Appendix C - Standards Variance Form
ETSU Telecommunications Standards Variance Request Form

Complete this form and submit to the ETSU Project Coordinator. ETSU ITS will review the request and either accepts, modifies or denies the variance and will notify the ETSU Project Coordinator.

Project Name: _________________________ Date: __________________
Requester: ___________________________ ________________
Company: ____________________________________________
Title: _______________________________________________
ETSU Project Coordinator: ________________________________

Reason for Variance:
________________________________________________________________
________________________________________________________________
________________________________________________________________

Is the variance requested due to (check all that applies?)

Cost____ Amount $_______
Schedule Impact_____ Days impacted ______

Suggested Remedy(s):
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

To be completed by ETSU ITS

Comments and or suggestions:
________________________________________________________________
________________________________________________________________
________________________________________________________________

This request has been (circle):     Approved         Modified       Denied

Signature _______________________________ Date: __________________
Appendix D

Registration for Installation Warranty

1. Complete the Structured Cabling System Registration Request form.
   - Complete the Certified Installation Company Information section with your company’s information and the names of those who designed the system.
   - Enter the manufacturer and type of cable used under the Warranty Information section. Approved cable manufacturers include Hubbell, Belden, Berk-Tek, CommScope, General Cable, Hitachi, Mohawk and Superior Essex. Check off the appropriate recitals (double click and select “Checked”).
   - Complete the Project Information section with the project name, end user company or organization name, project address, project contact person and his/her phone number and email address. Please note that End Users may refuse to sign warranty documents when this information is incorrect or incomplete, which results in delays in processing.
   - Complete the Products Installed: Part Number and Description section on the second page. Be sure to include the cable manufacturer(s) under Cable Installed.

2. Complete both the Horizontal Schematic and Backbone Schematic forms.

3. Submit Test Results using the following instructions:
   - Test results are to be copied onto a CD/DVD. Send the original raw data tester file(s) only. Do not convert the test results into another format. PDFs, etc. will not be accepted. This is applicable for copper cabling from a Level II compliant Category 5 tester, Level IIe compliant Category 5e tester or Level III compliant Category 6 tester.
     - Approved Testers:
       - Fluke OmniScanners
       - Fluke: DTX 1800 and 4000 Series
       - Fluke: DSP 4000 Series
       - Ideal/LANTEK Series
       - Agilent Wirescope Series
       - It is recommended that test results software be kept current. Download the most recent software version via the field tester manufacturer’s website.
   - Include all optical fiber test results (if applicable) from a power meter with an accuracy of ±.5 dB or better on the CD/DVD in its original tester format. Do not convert the test results into another format. Test results for Backbone cables should also include the allowable attenuation values calculated using the link attenuation equation.
   - Provide floor plans or as-built drawings on the CD/DVD, showing the location of all telecommunications rooms, equipment rooms, workstation locations and connecting pathways. Any file type is acceptable (i.e. PDF, DWG, JPG, etc.). Please do not submit large original floor plans/drawings.

4. Mail all documentation to:
   Mission Critical Coordinator, Hubbell Premise Wiring, 40 Waterview Drive,
   Shelton, CT 06484

Warranty requests sent via email or fax will not be accepted.
Appendix E
Bonding and Grounding

TMGB – Telecommunications Main Grounding Busbar
TGB – Telecommunications Grounding Busbar
EF – Entrance Facility
Appendix E-1

Bonding and Grounding
Appendix E-2

Bonding and Grounding

Bonding part numbers only, see appendix A for 18” ladder rack, cabinets and network racks

All part numbers are Hubbell

| A | HGRKTD9D: Ladder Jumper  |
| B | HGBTEB1210: Ladder Bracket |
| B | HGBTEB1224B: Busbar for DataCenter |
| B | HGBTEB1416H: Busbar for Entrance |
| D | HGRKTD144DA: 12’ Conductor |
| D | HGRKTD360: 30’ Conductor |
| D | HGRKTD600: 50’ Conductor |
| H | HBBVR76KT: 76” RGB Busbar |
| I | HBBHR19KT: 19” RGB Busbar |
| J | HBBVR36KT: 36” RGB Busbar |
| K | HGRKTD60DA: 60” Ladder to Busbar |
| C | HBBVR76KT: 76” RGB Busbar |
| C | HBBHR19KT: 19” RGB Busbar |
| C | HBBVR36KT: 36” RGB Busbar |
| C | HGRKTD60DA: 60” Ladder to Busbar |
Appendix F

Pull Box (PB) / Hand Hole (HH)
### Appendix F-1

**OSP Pull Box (PB) / Hand Hole (HH)**

<table>
<thead>
<tr>
<th>Application Tiers</th>
<th>Vertical</th>
<th>Loading Requirements</th>
<th>Lateral</th>
<th>Loading Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TIER 5’</strong> Sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic</td>
<td>Design Load 22.2 kN, Test Load 33.3 kN</td>
<td>5,000 lbs.</td>
<td>Design Load 28.7 kPa, Test Load 43.1 kPa</td>
<td>900 lbs./sq. ft.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>TIER 8’</strong> Sidewalk applications with a safety factor for non-deliberate vehicular traffic</td>
<td>Design Load 35.6 kN, Test Load 53.4 kN</td>
<td>8,000 lbs.</td>
<td>Design Load 28.7 kPa, Test Load 43.1 kPa</td>
<td>900 lbs./sq. ft.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TIER 15’</strong> Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic</td>
<td>Design Load 66.7 kN, Test Load 100.1 kN</td>
<td>15,000 lbs.</td>
<td>Design Load 38.3 kPa, Test Load 57.5 kPa</td>
<td>1,200 lbs./sq. ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tier 22’</strong> Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic</td>
<td>Design Load 100.1 kN, Test Load 150.1 kN</td>
<td>22,500 lbs.</td>
<td>Design Load 36.3 kPa, Test Load 57.5 kPa</td>
<td>1,200 lbs./sq. ft.</td>
</tr>
</tbody>
</table>

When a PB or HH is required in a street or parking lot, use traffic rated boxes and lids.

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**AASHTO H-20**

Deliberate vehicular traffic applications ONLY. Quazite does not currently offer any enclosures for this application tier.

Certified precast concrete, cast iron or other AASHTO recognized materials.*

*There are no AASHTO design or test provisions for polymer composites. Therefore there is no recognized method of testing for qualification. Applying other material testing methods to polymer composites is not recognized by AASHTO. **BUYER BEWARE!**
Appendix F-2
Pull Box (PB) / Hand Hole (HH)
### Appendix G

#### SYMBOL LEGEND

<table>
<thead>
<tr>
<th>DEVICE SYMBOL</th>
<th>DESCRIPTIVE TEXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲</td>
<td>COMMUNICATIONS WALL OUTLET AT 18&quot; AFF, UNO. FOR ADDITIONAL INFORMATION, REFER TO DRAWINGS, SPECIFICATIONS AND OR DETAILS.</td>
</tr>
<tr>
<td>W</td>
<td>WALL PHONE AT 48&quot; UNO</td>
</tr>
<tr>
<td>EP</td>
<td>EMERGENCY PHONE (CONDUIT ENTRY FROM BOTTOM) SEE APPENDIX 17 FOR PATHWAY TYPES</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS WORK AREA ROUGH-IN, BOX AT 18&quot; AFF, UNO TYPE A OR TYPE B AS NEEDED. SEE APPENDIX 17</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS FLOOR OUTLET (RECEDED)</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS FLOOR OUTLET ROUGH-IN (RECEDED)</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS OUTLET - CEILING MOUNTED.</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS OUTLET BOX ROUGH-IN - CEILING MOUNTED.</td>
</tr>
<tr>
<td>▲</td>
<td>FURNITURE SYSTEM COMMUNICATIONS OUTLET - MOUNTED PER MANUFACTURERS REQUIREMENTS, UNO</td>
</tr>
<tr>
<td>▲</td>
<td>WIRELESS ACCESS POINT OUTLET</td>
</tr>
<tr>
<td>▲</td>
<td>WIRELESS ACCESS POINT AND PATCHBOARD (PROVIDED BY OTHERS)</td>
</tr>
<tr>
<td>▲</td>
<td>COMMUNICATIONS OUTLET FOR W.A.P. INSTALL AT LOCATION SPECIFIED</td>
</tr>
<tr>
<td>▲</td>
<td>TELEVISION OUTLET / DIGITALS CABLE OUTLET</td>
</tr>
<tr>
<td>▲</td>
<td>MULTIMEDIA OUTLET</td>
</tr>
<tr>
<td>▲</td>
<td>MULTIMEDIA FLOORBOX - POLE THRU FROM CEILING BELOW</td>
</tr>
<tr>
<td>▲</td>
<td>MULTIMEDIA FLOORBOX - CASI IN SUB</td>
</tr>
<tr>
<td>▲</td>
<td>CARD READER</td>
</tr>
<tr>
<td>▲</td>
<td>SURFACE MOUNT RACEWAY - REFER TO DRAWINGS FOR REQUIREMENTS</td>
</tr>
<tr>
<td>▲</td>
<td>VERTICAL SERVICE FLOOR</td>
</tr>
<tr>
<td>▲</td>
<td>POWER/VOICE DATA</td>
</tr>
<tr>
<td>▲</td>
<td>VIDEO CAMERA, MOUNTING HEIGHT AS SPECIFIED</td>
</tr>
<tr>
<td>▲</td>
<td>1&quot; EMT COMMUNICATIONS CONDUIT FROM WALL OUTLET BOX EXTENDED TO ACCESSIBLE CEILING SPACE (UNO). EXTEND CONDUIT TO CABLE TRAY OR HOOK PATHWAY AS SPECIFIED. PROVIDE 4&quot; SQUARE BOX WITH SINGLE-GANG DEVICE RING. UNO PROVIDE BRUSHING ON OUTER END OF CONDUIT. SEE APPENDIX 17</td>
</tr>
<tr>
<td>▲</td>
<td>1&quot; EMT COMMUNICATIONS CONDUIT FROM WALL OUTLET BOX INDIVIDUAL CONTINUOUS TO LOCATION SPECIFIED. PROVIDE 4&quot; SQUARE BOX WITH SINGLE-GANG DEVICE RING. UNO PROVIDE BRUSHING ON OUTER END OF CONDUIT. SEE APPENDIX 17</td>
</tr>
</tbody>
</table>

* FOR INFORMATIONAL PURPOSES ONLY

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**NOTE:** NOT ALL ABBREVIATIONS, SYMBOLS, DETAILS, OUTLET TYPES, DESIGNS AND DIAGRAMS ARE NECESSARILY USED WITHIN THIS PROJECT OR SET OF DOCUMENTS. SEE DRAWINGS AND SPECIFICATIONS FOR DETAILS ON OUTLETS AND CABLE MEDIA TYPES.
### Appendix G-1

Multi-Media Symbol Legend

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Device Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Speaker</td>
<td>HF-High Frequency M-Monitor</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>LAR-Line Array P-Powered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LCR-LCR Bar S-Subwoofer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LR-LR Bar ST-Stereo</td>
</tr>
<tr>
<td>M</td>
<td>Video Display</td>
<td>M-Mirror TV</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>TV-Television</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VM-Video Monitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP-Weatherproof TV</td>
</tr>
<tr>
<td>M</td>
<td>Video Projector</td>
<td>LCD-Liquid Crystal Display</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>DLP-Digital Light Processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LED-Light Emitting Dode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LCOS-Liquid Crystal On Silicon</td>
</tr>
<tr>
<td>M</td>
<td>Video Projector</td>
<td>F-Fixed PD-Pull Down</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>M-Motorized PU-Pull Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-Rear MLB-Mobile</td>
</tr>
<tr>
<td>M</td>
<td>Video Camera</td>
<td>D-Document IP-IP Cam</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>PT-Pan/Tilt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PTZ-Pan/Tilt/Zoom</td>
</tr>
<tr>
<td>M</td>
<td>Remote AV Source</td>
<td>A-Audio Source AV-Audio Video Source V-Video Source</td>
</tr>
<tr>
<td>DO</td>
<td>White Board</td>
<td>A-Active I-Interactive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OVLY-Overlay PAS-Passive</td>
</tr>
<tr>
<td>M</td>
<td>Microphone</td>
<td>B-Boundary CLP-Clip SGN-Shotgun</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>GNK-Gooseneck ST-Stereo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HH-Handheld WLS-Wireless</td>
</tr>
<tr>
<td>J</td>
<td>Junction Box</td>
<td>AV-Audio Video D-Data</td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td>J-Junction Box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP-Weather Proof</td>
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</table>

(ANSI-J-STD-710 is available online, free download pdf.)

Appendix H
Smart Conduit Body – Telecommunications LB
Appendix I

Telecommunications Enclosures

Size and type dependant on serving area and use.
Appendix J

Fire Stop

**FS-ONE Caulk**
Outside/Around Conduit
Permanent

**CP-618 Putty**
Inside Conduit
Removable

OR

**Re-Entry Sleeve CP-653**

**Firestop Labels**
Appendix K

Network Racks

Example of horizontal cables routed left and right.
Example
Example of rack layouts. Copper and fiber counts and type may differ.
## APENDIX L
### SCHEDULE

<table>
<thead>
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<th>Telecom Rm</th>
<th>Panel</th>
<th>Port</th>
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</tr>
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<td>17</td>
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</table>

Room 101 has 3 drops, fed from TR 115

TR115 is 1 of 2 TR on 1st floor

Room 151 is fed from TR 163

TR 163 is 2 of 2 TR's on 1st floor

### Telecommunications T-Series Room Schedule

Telecom Room, Port Number, Room Number, Jack Number

T-Drawings shall list every room and include information shown above for every data and VoIP jack.
APPENDIX M
LABELS / PATCH PANEL / FACEPLATE
Appendix M - 2
Other Labels and Information

**Faceplate Labels**
- Label Type: Banner Landscape
- Font Size: 14pt Bold
- Tape Size: 3/8" or 1/2" Single Line

**Access Point Labels**
- Label Type: Banner Landscape
- Font Size: 28pt Bold
- Tape Size: 1/2" Single Line

**Patch Panel Port Labels**
- Label Type: Patch Panel
- Font Size: 14pt Bold
- Tape Size: 1/2" Two Lines
- Spacing: 0.5" Cat 5, 0.6" Cat 6
- # of Ports: Remember to Set

**Wire Wrap Labels**
- Label Type: Wire
- Font Size: 14pt Bold
- Tape Size: 3/4" up to Two Lines
- Size: 1.2" (10-4AWG)

**Patch Panel and Rack Labels**
- Label Type: Banner Landscape
- Font Size: 28pt Bold
- Tape Size: 1/2" Single Line

---

**Fiber Cable Label**

[Image of fiber cable label]

**Detectable underground warning tape**

[Image of detectable underground warning tape]
Appendix N
Risers & Sleeves

Indicate where the penetrations are for floors and walls. Indicate on drawings, length, degrees of bends, location and size of pull boxes for every conduit / riser.
Appendix O
Multi Media Classroom
Appendix O-1
Multi Media and Conference Room / Floor boxes assemblies

2X2 USB Work Surface Pop-Up Box/ Flush Mount Boxes