

BALTIMORE COUNTY GOVERNMENT



Office of Information Technology

Telecommunications Cabling Standards

As prepared by BALTIMORE COUNTY GOVERNMENT Network Operations

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1.0 Revision Notes

Current revision is 1.07

Revisions made to revision 1.06:

6.0.1 Optical Fiber - General
Added color code scheme

7.0.2.1 Card Access
Complete revision

7.0.2.2 CCTV
Complete revision

7.0.7 Inside Plant – Locations and Quantities
Eliminated

7.0.8 Paging System Integration Requirements
Complete revision

Appendix A
Eliminated

Appendix B
Eliminated

2.0 Introduction and Purpose

2.0.1 Introduction

The specifications set forth in this document are designed to be the minimum standard of OIT structured wiring systems. They are to be viewed as general requirements and specifications to allow for adjustment in today's ever growing and changing telecommunications industry. These specifications may be reviewed and modified by OIT Network Operations (OIT) to accommodate specific space requirements as well as any functional or special design needs.

Wiring specifications, as well as those specifications designed to support wiring, are constantly changing as per the dynamic changes of industry and networking standards evolve. All contractors will be required to receive approval from OIT before commencing an installation to ensure that all current media types, media support systems and installation standards are being followed. The designated specifications for material and products, space requirements associated with the Telecommunications Facilities are, however, to be considered standards in choosing material and products to be installed.

The Contractor shall be required to install, test and document all structured wiring systems specified in this document keeping in mind that these specifications and standards are not to be used for assimilating a final bid but as general guide. Final specifications will be a collaborative effort between the installation contractor, architect/designer, the facility occupants, and OIT. Detailed specifications will be defined for any given project based on the purpose of the space, and will be a culmination of the collaborative effort of the involved parties with final approval received from OIT.

2.0.2 Purpose

The purpose of this document is to create a starting point for collaboration between the interested parties to ensure that all industry specifications and standards and the creation of a specific bid document of high quality which will contain accepted industry standards and specifications.

The network cabling standards in this document are adapted from relevant industry standards and practices and are based on current practices for new cabling installations. These standards provide the following benefits for the Government:

- Support for best practices.
- Provide multi-vendor equipment and services
- Improved management of building space resources
- Reduced costs for network wiring installation, support, and management
- Reduced training requirements for support personnel

- Consistency of wiring at different locations
- Improved reliability of network cabling infrastructure
- Improved trouble-shooting and fault isolation
- Improved ability to manage system moves, adds and changes

3.0 Contact Information

Office of Information Technology - Network Operations (OIT)
Customer Service
Attention: Manager of OIT NSU Infrastructure
400 Washington Ave
Towson, Maryland 21204
(410) 887-8200

4.0 Codes, Standards and Regulations

4.0.1 Overview

Federal, state, and local codes, rules, regulations, and ordinances will govern the work, and is part of the specifications outlined here on. If the contractor notes an item(s) in the drawings or the specifications, representing code violations, the contractor shall promptly call them to the attention of the BALTIMORE COUNTY GOVERNMENT in writing. Written notice shall be sent to: ATTN: Manager of OIT. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications located herein shall apply.

The design, manufacture, test, and installation of telecommunications cabling networks at the BALTIMORE COUNTY GOVERNMENT shall be completed per manufacturer's requirements and in accordance with NFPA-70, state codes, local codes, requirements of authorities having jurisdiction, and include but are not limited to the following agencies, standards, and publications:

4.0.2 Agencies

ANSI American National Standards Institute

BICSI Building Industry Consulting Service International

EIA Electronic Industries Association

FCC Federal Communications Commission

FOTP Fiber Optic Testing Procedures

IEEE Institute of Electrical and Electronic Engineers, Inc

NBC National Building Code

NFPA National Fire Protection Agency

NEC National Electrical Code

TIA Telecommunications Industry Association

UL Underwriters Laboratories

4.0.3 Applicable Standards

ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling.

ANSI/TIA/EIA-568-B.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements

ANSI/TIA/EIA-568-B.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components

ANSI/TIA/EIA-568-B.3 -- Optical Fiber Cabling Components Standard

ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI/TIA/EIA-607(A) -- Commercial Building Grounding and Bonding Requirements for Telecommunications

ANSI/TIA/EIA-526-7 -- Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

ANSI/TIA/EIA-526-14A -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant

ANSI/TIA/EIA-758(A) -- Customer-Owned Outside Plant Telecommunications Cabling Standard

4.0.4 Applicable Publications

BICSI -- Telecommunications Distribution Methods Manual

BICSI -- Cabling Installation Manual

BICSI -- LAN Design Manual

BICSI – Customer-Owned Outside Plant Design Manual

5.0 Telecommunications Facilities

5.0.1 Definition

Telecommunications facilities are spaces and secured rooms housing telecommunications and network equipment consisting but not limited to Data, Voice, Cable Television (CATV), Closed Circuit Television (CCTV) components, Secure Card Access and their associated wiring. Secured rooms have stringent requirements due to the expense and complexity of the equipment housed in them supporting the Government's telecommunications and network infrastructure. The types of telecommunications facilities are as follows:

Main Distribution Frame (MDF): is a signal distribution frame used for connecting subscriber equipment and cables (inside plant) to carrier equipment and cables (outside plant).

Intermediate Distribution Frame (IDF) is a distribution frame which cross-connects the user cables and equipment to individual user line circuits, and which serves as a distribution point for multi-pair cables connected to the main distribution frame (MDF) to individual cables connecting to equipment in areas remote from these frames.

Telecommunications Room (TR): provides for demarcation between the per floor horizontal customer service cabling and the buildings video, data and voice backbone cabling. Additionally this room contains the electronic equipment that provides transition between the data, voice and video building backbone and the end user's telecommunications equipment. This securable room is to be dedicated to this purpose with no other building services sharing the space.

Telecommunications Rooms are allocated to each floor of a building and house the communications equipment and related wiring that serves that specific floor. Several telecommunications rooms may be located on a single floor in order to maintain the cable length limitations specified within particular standards.

5.0.2 Requirements

5.0.2.1 General

All work associated with Telecommunications and Equipment Rooms shall comply with the National Electrical Code, state and local building codes. The guidelines developed by ANSI/TIA/EIA and BICSI shall be followed in both design and construction.

To facilitate the proper installation, routing and placement of cables in Telecommunications Rooms shall be located to assure compliance with TIA/EIA

distance limitations, and stacked one above the other whenever possible. The total distance of the cable path between the telecommunication outlet and its termination in the Telecommunications Room shall be less than 90 meters.

No plumbing, HVAC, or electrical conduit shall pass through or above the Telecommunications Room, except for sprinkler systems. Sprinkler heads shall be caged and of high-temp head type.

Doors and Locks for Telecommunications and Equipment Rooms – A windowless, solid core door measuring 36” wide by 80” tall and swinging open out of the room is the minimum requirement. Locks shall be cored with a Telecommunications Room standard as provided by the BALTIMORE COUNTY GOVERNMENT Lock Shop. Keys for Equipment Rooms will be available from OIT Project Managers as needed.

Telecommunications and Equipment Rooms - Shall be secured to ensure all areas in which Office of Information Technology resources are stored remain protected from environmental concerns hazards and theft. The security of the Telecommunications and Equipment Rooms is to be coordinated with OIT.

Floors – Floors shall be vinyl composition tile or sealed concrete. Carpet is prohibited.

Conduits and Sleeves – Due to the need for facilitating frequent additions, moves and changes to the telecommunications systems, communications conduits are generously sized.

- Conduits entering the building are 4" diameter PVC pipes with some type of sub-space partitioning.
- Conduits between building telecom rooms are also 4" diameter PVC pipes.
- Conduits outer diameter will be located within 4” of room walls.
- Conduits servicing end user spaces are 1" diameter PVC pipes. Exceptions are made for outlets for wall phones, payphones, etc. outlets where only one cable is needed. This conduit may be 3/4".
- The use of Flexible conduit is discouraged. If it is the only solution, increase its size over rigid conduit by one trade size.
- Conduits between floors interconnecting telecom rooms are stubbed 2" into the rooms.
- The 1" conduits servicing end users information outlets are usually stubbed to above the ceiling, and then to the nearest corridor/hallway telecommunications horizontal pathway leading to the telecommunications room.
- Minimum radii for conduit bends shall be as follows:
 - Internal diameter of less than 2" – bending radii is 6 times the internal diameter.
 - Internal diameter of 2" or more – bending radii is 10 times the internal diameter.
- All sleeves must be fire sealed. Initial sealing of the sleeve penetration is to be completed by the sleeve installer.

- All sleeves will be reamed and grommets placed prior to cable installation to prevent cable damage.

Building Riser - The building backbone riser system connects Telecommunications Rooms to one another; to the Main Service Entrance Room and to the Equipment Room. OIT specifies separate cable systems to provide data, video and voice needs. Riser (plenum) rated multi-pair twisted pair copper cables, coax, and both single mode and multi-mode fiber cables along with their termination systems are specified.

Ceilings – There will be no suspended ceilings in the Telecommunications Room. Suspended ceilings in existing Telecommunications Rooms shall be removed whenever large cable projects require the installation of new cable trays, or overhead conduits and sleeves are to be installed.

Cable Trays – Basket tray (or approved ladder rack) of 12" width shall be installed on three (3) walls at a height of 7' whenever possible with minimum clearance of 4" from ceiling. Basket tray spanning the width of the room shall be installed on top of the telecommunications racks. Radius drop-outs are to be used where the cable exits the tray to a lower elevation.

Walls – Interior walls in the room should be covered, floor to ceiling, with fire rated $\frac{3}{4}$ " plywood and painted with 2 coats of fire retardant paint preferred black or a neutral color. Paint should be or equal to: Flame Control Coatings, LLC. Flame Control NO. 20-20A. Fire Hazard Classification, ATSM E-84 (NFPA 255) Class "A"

Fire Wall Identification – Fire walls should be painted with 2 coats of fire retardant paint preferred black or a neutral color and marked for easy identification.

Lighting – Lighting should be maintained at 50 lumens, measured at 3 feet above floor level. Light switches shall be located immediately inside the door. Fluorescent lighting is specifically prohibited.

Cable Entrance - Riser or distribution cables entering/exiting the Telecommunications Room shall be via four-inch (4") conduits, sleeved cores or cable tray. An additional one conduit, sleeved core or cable tray, over and above the current requirement shall be included in the design for future growth.

5.0.2.2 Room Sizing

Entrance Facility (EF) –

Minimum size for small buildings - serving size of <5,000 sq. ft.: 4' X 5'.

Minimum size for large buildings - serving area of <50,000 sq. ft.: 6' X 8'

Minimum ceiling height is 9' 6"

EF cannot have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab

Equipment Room (ER) – Shall not be less than the following size, depending on the total building area being served. ER cannot have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab.

- < 1,000 sq. ft.: (3' X 4')
- < 5,000 sq. ft.: (6' X 6')
- < 8,000 sq. ft.: (6' X 10')
- < 10,000 sq. ft.: (8' X 10')
- < 20,000 sq. ft.: (10' X 15')
- < 30,000 sq. ft.: (15' X 15')
- < 40,000 sq. ft.: (17' X 17')
- < 50,000 sq. ft.: (19' X 19')

Telecommunications Room (TR) – Shall not be less than the following size, depending on the total building area being served. TR cannot have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab

- < 5,000 sq. ft.: (4.5' X 4.5')
- > 5,000 < 8000 sq. ft.: (10' X 7')
- < 8,000 sq. ft.: (10' X 9')
- <10,000 sq. ft.: (10' X 11')

5.0.2.3 Environmental Control

HVAC should maintain an ambient temperature range of 68° to 75°F (20° to 24°C) while also maintaining ambient relative humidity levels between 45% and 55% with the full complement of equipment in the room. OIT shall provide the HVAC contractor with equipment BTU information.

5.0.2.4 Electrical

For Telecommunications Rooms (TR), all convenience electrical outlets shall be installed to a side wall in order that power cables can be run along the telecommunications racks. This will minimize the possibility of tripping hazards. There should be, at a minimum, one duplex convenience outlet every six feet along the walls immediately to the left and right of the door for general purpose use. All outlets will be backed up via the building wide UPS or on emergency generator if there is no building UPS.

At a minimum, one 240 volt 30 AMP dedicated circuit with a NEMA L6-30R receptacle and one 240 volt 20 AMP dedicated circuit with a NEMA L6-20R receptacle will be installed at a height of 7 feet (on or near the basket tray). At a minimum, there must be four 120 volt 20 AMP dedicated outlets with each pair on a dedicated circuit with emergency generator back-up. These outlets to be located at a height of 7 feet (near the basket trays). Final design and layout approval on number, type, and location of outlets shall be provided by OIT.

All telecommunications circuits are to be clearly labeled on circuit breaker panels.

A grounding bar measuring 12" long by 2" wide by ¼" thick with pre-drilled ¼" holes shall be installed. The ground bar shall be connected to the main building ground using #2 or greater AWG copper wire.

All cable trays and racks are to be grounded to the main building ground using #2 or greater AWG copper wire. Rack-mounted electrical outlets must be grounded to the

rack ground in addition to any other NEC, State, or local building code grounding requirements.

UPS installation of appropriate size will be installed in every Telecommunications Room and where applicable in Equipment Rooms having rack mounted equipment/hardware. OIT will determine appropriate UPS devices.

5.0.2.5 Termination Hardware

The design layout for the placement of racks, rack hardware, and wall fields within the Telecommunications and Equipment Rooms shall be approved by OIT.

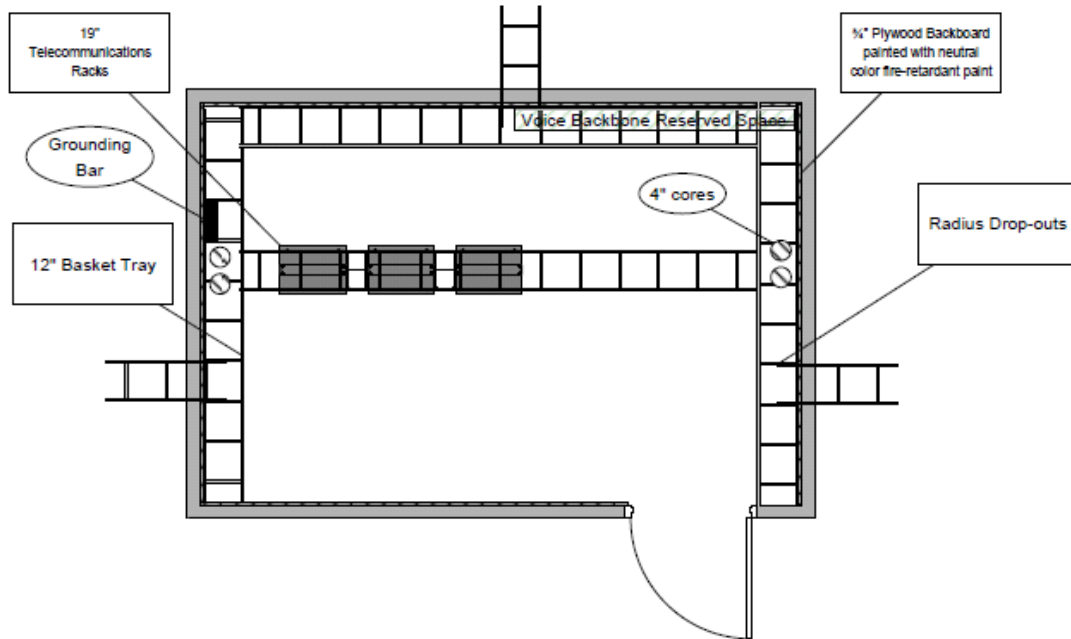
Equipment Racks - Heavy duty aluminum 7' floor mount racks with cable management channels on both sides and mounting rails for 19" equipment are required. All racks are to be properly anchored with space allocated between racks for installation of vertical cable managers.

Rack Mounted Hardware - For Telecommunications and Equipment Rooms a minimum of six (6) rack mount spaces (6 rack "Units" or 6 "U") are reserved at the top of each rack for fiber enclosures.

Wire Managers - Vertical wire managers will run the entire length of a rack and shall be mounted on both sides of each rack. Horizontal wire managers will be mounted below the spaces left for the fiber enclosure to contain patch cabling which must run from one side of the rack to the opposite side. A 2RU horizontal wire manager per 48-port patch panel is required.

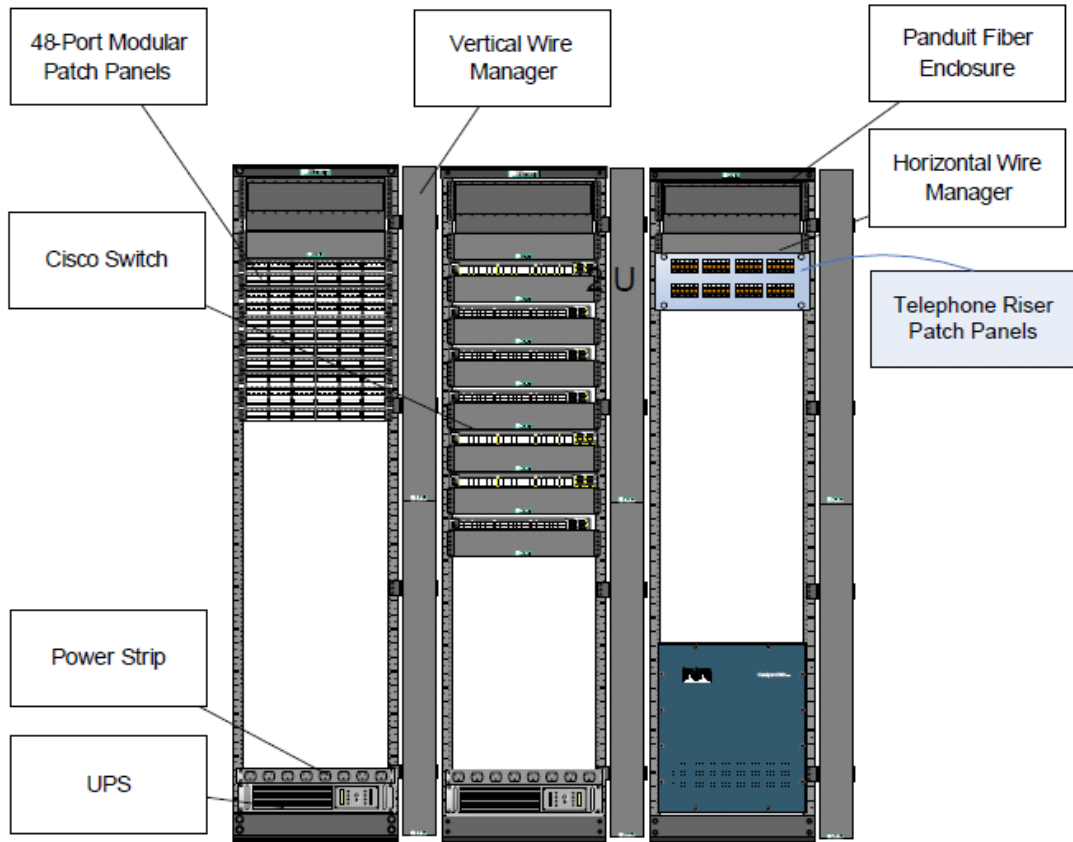
Wall Mounted Hardware – in the Entrance Facility 100 pair or 300 pair 110 system kits shall be fastened to the plywood backboard and D-rings or jumper troughs utilized for wire management.

5.0.2.6 Sample Telecommunications Room



Layout

5.0.2.7 Sample Rack



Elevation

5.2.0.8 Additional Requirements

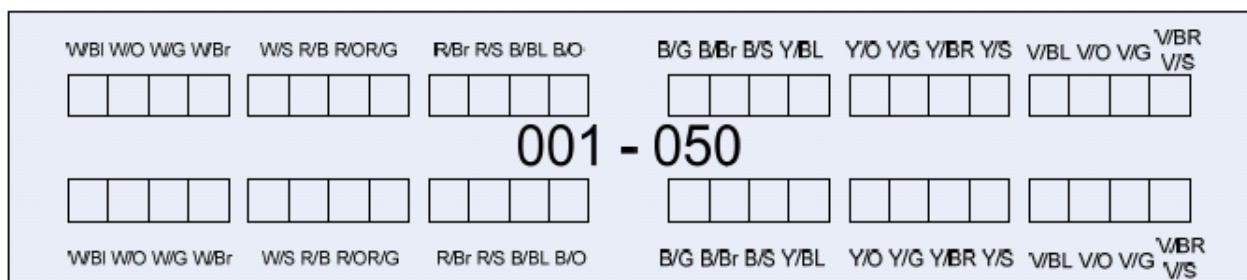
Riser and distribution cables leaving the Equipment Rooms to building and Telecommunications Room spaces shall be via four-inch (4") conduit, sleeved cores with basket cable tray for horizontal runs. At least one additional conduit, sleeved core or cable tray with sufficient available space must be included in the design to provide for future growth. Conduit numbers and size to be determined by building square footage. All conduits will be sealed with appropriate fire-stopping materials.

The Entrance Facility located usually in a mechanical closet must have sufficient conduit runs between the Entrance Facility and all Telecommunications and Equipment Rooms. Conduit number and size to be determined by building square footage. One additional core/conduit must be provided for future growth.

At a minimum, a 6-strand multi-mode fiber of size 62.5/125, or 50/125 micron shall be installed between the Equipment Rooms to each Telecommunications Room. The final design to be approved by OIT.

At a minimum, a 6-strand, single-mode fiber of size 9/125 micron shall be installed between the Equipment Rooms to each Telecommunications Room. The final design to be approved by OIT.

At a minimum, vertical/horizontal copper backbone cabling consisting of 25- pair unshielded twisted-pair shall be installed from the Main cross-connect field to each Horizontal cross-connect field. This cable shall be terminated in the Main cross-connect and Equipment Rooms using a 100 pair 110 system kit. Wire management to be provided using D-rings or jumper troughs. In the Telecommunications Rooms the riser cable shall be terminated on the Patch Panel in accordance with the drawing below. The jacks shall be black in color.



5.2.0.9 Labeling

All Telecommunications Facilities to include equipment, racks, cabling, patch cables, terminating panels, and grounding bus bars shall be properly labeled. Refer to Appendix A for labeling conventions.

6.0 Optical Fiber

6.0.1 General

All new cable plants to be connected to or disconnected from the OIT campus telephone network, local area network, wide area network, video network, cable television network, and fiber optic network will be performed by OIT or personnel designated by OIT.

Optical fiber cable jackets shall adhere to the following color codes:

Single mode :	YELLOW
Multi-Mode 50/125 :	AQUA
Multi-Mode 62.5/125 :	ORANGE

6.0.2 Minimum Fiber Qualities

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be a matched clad design.

The multi-mode fiber strands utilized in the cable specified shall conform to ANSI/TIA/EIA-568-B, IEEE and TIA-492AAAC-A specifications.

The single-mode fiber strands utilized in the cable specified shall conform to ANSI/TIA/EIA-568-B and IEEE specifications.

6.0.3 Minimum Requirements for OSP Fiber Optic Cable

Optical fiber cables shall be of loose buffer tube configuration.

The fibers shall not adhere to the inside of the buffer tube.

All optical fibers and buffer tubes shall be color coded per EIA/TIA-598. In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.

Each buffer tube and the cable core interstices shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional non-toxic solvents.

All fibers in the cable must be useable fibers and meet required specifications. The cable provided will be new, unused, and of current design and manufacture. Outer jacket shall be fungus resistant, UV inhibited, water resistant, and shall have a non-wicking rip cord for easy removal. The outer jacket or sheath shall be free of holes, splits or blisters. Outer cable jacket will be marked with "*Manufacturer's Name* Optical Cable", Sequential foot or meter markings, and year of manufacture. The height of the markings shall be approximately 2.5mm. The cable jacket shall contain no metal elements and shall be of a consistent thickness.

6.0.4 Fiber Physical Performance

The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with FOTP-82, "Fluid Penetration Test for Filled Fiber Optic Cable."

All cables will have tensile strength of greater than or equal to 2700N (Newtons) short term and 600N long term without exhibiting an average increase in attenuation greater 0.20 dB (multi-mode) and 0.10 dB (single mode). Minimum bend radius for all cables will be less than or equal to 20 times the outside diameter under installation tensile load and 10 times the outside diameter under long term tensile load.

6.0.5 Optical Fiber Cable Installation

Aerial installation of fiber optic cable is prohibited unless written approval is received from OIT Management.

6.0.5.1 General

Cable runs will be installed in one continuous length from bulkhead connector to bulkhead connector, including service loops, repairs, and without splices unless required by standard.

All cable shall be installed in one inch inner duct (or multi-cell Maxcell preferred) when transitioning into conduit. A pull string shall be run in addition to the cable in order to provide access for future growth.

All fiber cable installations are to be 100 percent terminated. Plastic dust caps will be installed on all unused fiber terminations.

Terminated fiber strands will be installed in rack-mounted optical fiber distribution shelves. A Corning or approved equivalent distribution shelf will be used in all applications.

Cable installation shall not exceed manufacturer specifications for tensile load; bend radius, and vertical rise. All pulled cables shall be monitored for tension and torsion during installation and shall not exceed manufacturer specifications.

A minimum of three (3) with a diameter of an inch and a quarter (1¼) corrugated inner-ducts will be placed inside each conduit of four (4) inch diameter. All optical fiber cable installations shall be placed in inner-duct up to the point the cable enters a terminating enclosure.

Lubricants may be used to facilitate pulling of cables but the lubricant must not be harmful to the cable, the raceway or personnel.

Fiber patch cables secured by strap or other fasteners shall not be pulled so tight that the outside cable sheathing is indented or crushed. J-Type Polywater is preferred.

6.0.6 Outside Plant (Infrastructure Cables)

When installing fiber optic cable (FOC) in manholes between buildings, there shall be a minimum of two (2) complete loops in each manhole. FOC shall be pulled in an inner-duct inside the manhole to prevent damage to the cable. No splicing is allowed in fiber cables between buildings.

All inner-ducts shall be spliced according to manufacturers approved methods.

Sump pumps may be installed in manholes where flooding is a consistent problem.

6.0.7 Inside Plant (Riser Cables)

Fiber optic cable shall be tight-buffer tube construction, all dielectric, with no metallic components of any kind.

At a minimum, a 6-strand multi-mode fiber of size 62.5/125, or 50/125 micron shall be installed. Final strand counts to be approved by OIT.

At a minimum, a 6-strand, single-mode fiber of size 9/125 micron shall be installed. Final strand counts to be approved by OIT.

Each buffer tube within a cable must be color coded with none of the same colors appearing in one cable. Each fiber within a buffer tube must be color coded with none of the same colors appearing in the same buffer tube.

The outer cable sheath construction will be of NEC Rated OFNP

(PLENUM) Jacket – Flame retardant material.

Multi-mode fiber size will be 62.5/125, or 50/125 micron. All Multi-mode cables are not to exceed 1 dB plus .0013 dB per foot end to end attenuation at 850nm.

Single-mode fiber size will be 9/125 micron. All Single-mode cables are not to exceed 1 dB plus .0008 dB per foot end to end attenuation at 1310nm.

The AVERAGE/MAXIMUM fiber splice loss for single-mode fusion splices will be 0.05/0.3 dB and 0.10/0.3 dB for mechanical splices.

The AVERAGE/MAXIMUM fiber splice loss for multi-mode fusion splices will be 0.05/0.3 dB and 0.10/0.3 dB for mechanical splices.

Individual mated connector pair loss will be less than or equal to 0.20 dB.

All fiber strands are to be terminated in accordance with industry standard color codes.

Multi-mode fiber patch cables will be terminated with 'LC' connectors on one end and as required on the other end.

Single-mode fiber patch cables will be terminated with "LC" connectors on one end and as required on the other end.

Bulkhead distribution cabinets and cable must be labeled in accordance with OIT labeling conventions. Reference: Appendix A for labeling conventions.

A minimum of ten meters (33 feet) of extra cable shall be coiled and fastened to the telecommunications room plywood backboard as a service loop at each end of the cable.

Pull string shall be installed in all conduit which do not contain inner ducts simultaneously with the pulling in of cable.

7.0 Inside Plant

7.0.1 General

All telecommunications wiring shall be designed or approved by OIT.

All telecommunications wiring shall be run using suspension hooks, conduits or approved cable tray. At no time is cable to be attached to the ceiling grid support system.

7.0.2 Card Access & CCTV

7.0.2.1 Card Access

Each electronic card access application is unique which requires extensive design and integration work by OIT staff. Please refer these needs and requirements directly to OIT as soon as possible so that the appropriate solution can be specified for budgetary and planning purposes.

All cabling for Card Access electronics shall have YELLOW cable jackets.

7.0.2.2 CCTV

Each CCTV application is unique which requires extensive design and integration work by OIT staff. Please refer these needs and requirements directly to OIT as soon as possible so that the appropriate solution can be specified for budgetary and planning purposes.

All cabling for CCTV electronics shall have YELLOW cable jackets.

7.0.3 Backbone Cabling

All optical fiber and copper backbone cable designs, materials and sizes shall be approved by OIT prior to installation.

Solid copper, 24 AWG, 100 balanced twisted-pair (UTP) Category 6 cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2 up to 16 MHz shall be installed.

Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2002).

Reference Appendix A for approved labeling conventions for backbone cabling.

7.0.4 Horizontal Cabling

All voice and data cabling shall be continuous (no splicing) from the nearest telecommunications room to the telecommunications outlet.

Reference Appendix A for approved labeling conventions for horizontal cabling.

Horizontal cabling will be 100 percent terminated in the telecommunications closet to an approved 19 inch rack mountable, 48-port 8-pin modular to insulation displacement connector (IDC) meeting Category 6 performance standards, and pinned to T568B standards. IDC color codes shall mimic telecommunications outlet jack color standards.

Solid copper, 24 AWG, 100 balanced twisted-pair (UTP) Category 6 green cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2 shall be installed.

RG6 coaxial cable is to be used for all TV locations.

7.0.5 Copper Patch Cables

Baltimore County Government OIT will be responsible for provision and installation of patch cables.

7.0.6 Telecommunications Outlets

Telecommunications outlets shall consist of a single-gang mounting plate with four (4) openings. Unless otherwise indicated, each modular jack must be a GREEN-colored RJ45 (8P8C) and conform to the ANSI/TIA/EIA 568B cabling standard. Blank inserts shall be placed in any unused openings.

7.0.6.1 Installation

Telecommunications outlets shall be installed at locations and in the quantities specified by OIT on the electrical/mechanical drawings supplied by Baltimore County Property Management. Unless otherwise indicated, outlets shall be installed at 23-inches from center above the floor.

7.0.8 Paging System Integration Requirements

7.0.8.1 General

Paging systems that require integration with Baltimore County VoIP telephone system must provide a 600 ohm interface. Paging system amplifiers must be located in the

facility's network data room. Should the selected paging system vendor require additional consultation on this matter, please have them contact OIT.

8.0 Documentation and Submittals

8.0.1 General

Submit to OIT shop drawings, product data (including cut sheets and catalog information), and samples required by the contract documents. Submit shop drawings, product data, and samples with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors.

The Contractor shall provide a complete location table and spreadsheet indicating each wall jack location including the following information: jack numbers, room number, and wall orientation per jack number (North, South, East, or West, or Power Pole if applicable), landmark orientation and distance. The contractor shall be responsible for appending new installations to this documentation so that a complete, consolidated inventory of all installations and work completed by the contractor is maintained at all times.

By submitting shop drawings, product data, and samples, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings, product data, and samples conform to the requirements of the work and of the contract documents.

OIT approval of shop drawings, product data, and samples submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed OIT in writing of such deviation at time of submittal, and OIT has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by OIT in writing.

OIT approval of shop drawings, product data, and samples shall not relieve the contractor of responsibility for errors or omissions in such shop drawings, product data, and samples.

OIT review and approval, or other appropriate action upon shop drawings, product data, and samples, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. OIT review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the contractor. The review shall not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures.

OIT approval of a specific item shall not indicate approval of an assembly of which the item is a component.

Perform no portion of the work requiring submittal and review of shop drawings, product data, or samples, until OIT has approved the respective submittal.

Submit shop drawings, product data, and samples as a complete set within thirty (30) days of award of contract.

General: Submit the following:

- Bill of materials, noting long lead time items
- Optical loss budget calculations for each optical fiber run
- Project schedule including all major work components that materially affect any other work on the project

Shop drawings: Submit the following:

- Backbone (riser) diagrams
- System block diagram, indicating interconnection between system components and subsystems
- Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor
- Fabrication drawings for custom-built equipment
- One set shall be laminated and placed in appropriate Telecommunications and Equipment Rooms.

Product Data -- Provide catalog cut sheets and information for the following:

- Wire, cable, and optical fiber
- Outlets, jacks, faceplates, and connectors
- All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings
- Terminal blocks and patch panels
- Enclosures, racks, and equipment housings
- Over-voltage protectors
- Splice housings

Samples-- Submit the following:

Submit project record drawings at conclusion of the project and include:

- Approved shop drawings
- Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications rooms, and backbone (riser) cable runs
- Telecommunications and Equipment room termination detail sheets.
- Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
- Labeling and administration documentation.
- Warranty documents for equipment.
- Copper certification test results in PDF file format.
- Optical fiber power meter/light source test results.

8.0.2 Contractor Certification

1) The installing contractor shall submit proof of having installed at least six (6) similar Data and Voice Structured Cabling and Outlet Systems. These systems shall have been in service for a minimum of three (3) years. These systems must have been within a fifty (50) mile radius of the project location.

Included with this proof shall be the customer name, customer contact and telephone number, and, if applicable, the architect and electrical engineer on the project. The Architect and Owner retain the right to reject any installing contractor who, in their sole judgment, has not met the above criteria or has received a less than favorable reference from any of the submitted references OR from any other customer for which the installing contractor has performed similar installations, whether or not such customer has been listed on the submittal.

2) In order to assure full compliance with all codes and regulations, the installing contractor must have on its regular staff a Master Electrician licensed within the jurisdiction in which the installation occurs. Proof of such licensing must be included with the original submittal.

3) The Contractor shall make application for all necessary permits, licenses and inspections as required by the Authority Having Jurisdiction, and shall pay all fees and charges appurtenant thereto.

4) The installing contractor must hold a current certification from manufacturer of the Cabling System being proposed for installation. Proof of such certification must be included with the original submittal.

5) Work will be supervised by a registered communications distribution designer (RCDD) during all phases of the installation.

The contractor shall not subcontract installation of voice/data/video cabling, termination or testing without the written consent of BALTIMORE COUNTY GOVERNMENT.

The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.

Upon request by OIT, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.

Material shall be new, and conform to grade, quality, and standards specified.

Materials of the same type shall be a product of the same manufacturer throughout.

Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the BALTIMORE COUNTY GOVERNMENT and OIT.

Quality Assurance inspections will be coordinated with OIT Project managers.

8.0.3 Warranty

Unless otherwise specified, unconditionally guarantee in writing the materials and equipment, for a period equal to the manufacturer's warranty and workmanship for a period of not less than two (2) years from date of acceptance by OIT.

8.0.4 Delivery, Storage and Handling

Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with OIT for temporary secure storage of equipment and materials during project timeframes. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

8.0.5 Sequence and Scheduling

Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, owner acceptance, and demolition completion.

8.0.6 Use of The Site

Use of the site shall be at OIT direction in matters which the Government of

Baltimore County deems it necessary to place restriction.

Access to building wherein the work is performed shall be as directed by OIT.

The selected contractor temporarily will occupy the premises during the entire period of construction for conducting his or her normal business operations. Selected contractor will cooperate with the BALTIMORE COUNTY GOVERNMENT and OIT to minimize conflict and to facilitate non-disturbance of the BALTIMORE COUNTY GOVERNMENT operations.

Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the BALTIMORE COUNTY GOVERNMENT to include OIT operations.

All contractors will adhere to the BALTIMORE COUNTY GOVERNMENT's Contractor Badge Program and will wear assigned contractor's badge on person in a clearly visible location following the Contractor Badge Program standards as administered and provided by Facilities Planning & Construction.

All contractors shall, when pulling cables in any BALTIMORE COUNTY GOVERNMENT building or related off-site areas provide proper safeguards at the reel location. This can be done with personnel or appropriate safety barricades.

8.0.7 Continuity Of Services

Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Government's representative(s). The work shall be arranged to minimize down time.

Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

8.0.8 Deliverables

Submit project record drawings at conclusion of the project to include:

- Approved shop drawings
- Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications rooms, and backbone (riser) cable runs
- Telecommunications and Equipment Room termination detail sheets.
- Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
- Labeling and administration documentation.
- Warranty documents for equipment.

- Copper certification test results delivered in PDF file format.
- Optical fiber power meter/light source test results.

9.0 Protection, Grounding and Bonding

9.0.1 Lightning Protection

NEC article 250 “Grounding” and 800 “Communication Circuits” cover general requirements for grounding, bonding, and protecting electrical and communication circuits.

Building entrance protection for copper cabling shall be installed.

9.0.2 Grounding

Grounding shall conform to ANSI/TIA/EIA 607(A) - Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum.

Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.

Connect cabinets, racks, and frames to single-point ground which is connected to building ground system or to telecommunications room grounding bar via #6 AWG green insulated copper grounding conductor.

9.0.3 Bonding

Bonding shall be of low impedance to assure electrical continuity between bonded elements.

All conduits terminating to cable trays, wire ways and racks shall be mechanically fastened. When connected to a cable tray or rack it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or telecommunications room grounding bar using #6 AWG copper.

10.0 Inspection and Testing

10.0.1 Permits and Inspection of Work

The installation company shall be responsible for securing any necessary permits and inspections related to this work in accordance with local law.

10.0.2 Testing

10.0.2.1 Fiber Optic Cabling

Individual fiber strands shall be tested bi-directionally using optical time domain reflectometer (OTDR) and optical loss test sets (OLTS). An initial acceptance test is to be conducted on the reel with a second test completed after installation.

OTDR tests for multi-mode fiber shall be conducted bi-directionally at 850 and 1300 nm and tests for single-mode fiber shall be conducted bi-directionally at 1550 nm. Installation reports shall include the installed lengths for all fibers.

Cables will be rejected for broken strands or OTDR/OLTS tests that reveal a single fiber strand or an entire cable is out of manufacturer specifications. A rejected cable shall be replaced at contractor expense. The OTDR and OLTS printouts must be delivered to the Government within 10 business days of cable installation.

10.0.2.2 Category 3 UTP Cabling

Testing shall conform to ANSI/TIA/EIA-568-B.1 standard.

Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct any reversed or grounded pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

If copper cables contain more than the following quantity of bad pairs, or if outer sheath damage is cause of bad pairs, remove and replace the entire cable:

CABLE SIZE	MAXIMUM BAD PAIRS
<100	1
101 to 300	1 – 3
301 to 600	3 – 6
>601	6

These figures apply only to voice riser cables.

10.0.2.3 Category 6 UTP Cabling

Testing shall conform to ANSI/TIA/EIA-568-B.1 standard.

If horizontal cable contains bad conductors or damaged outer jacketing, remove and replace cables.

11.0 Fire-Stopping

11.0.1 General

Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids (hereinafter referenced as cavities) at communications penetrations. Fire-stopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables. Under no circumstances will non-approved filler material be allowed.

New and existing raceways, cable trays, and cables for power, data, and telecommunications systems penetrating non-rated and fire-rated floors, walls, and other partitions of building construction shall be fire-stopped where they penetrate new or existing building construction.

Fire-stopping shall be accomplished by using a combination of materials and devices, including penetrating raceway, cable tray, or cables, required to make up complete fire-stop.

Verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed.

The following agencies and their codes, standards, and regulations shall govern all fire-stopping work performed at the BALTIMORE COUNTY GOVERNMENT. These codes, standards, and regulations have been approved by the BALTIMORE COUNTY GOVERNMENT Fire Marshall's Office.

11.0.2 Applicable Standards

ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire-stops.

UL 1479, Fire Tests of Through-Penetration Fire-stops

UL Fire Resistance Directory: Through Penetration Fire-stop Devices (XHCR) and Through Penetration Fire-stop Systems (XNEZ).

ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers)

2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(B), Spread of Fire and Products of Combustion

NFPA 1 Uniform Fire Code: Referenced in 101 and has been adopted by the BALTIMORE COUNTY GOVERNMENT as our Fire Prevention Code (MAPP 06.02.02).

ANSI/NECA/BICSI-568, Standard for Installing Commercial Building Telecommunications Cabling, Section 5, Clause 5.1 through 5.2.3, Fire-stopping

2000 edition of the BICSI Telecommunications Distribution Methods Manual, Chapter 15, Fire-stopping

Factory Mutual Approval Guide

ULC List of Equipment and Materials, VOL. II

11.0.3 Installation

Select appropriate type or types of through penetration fire-stop devices or systems appropriate for each type of communications.

Selected systems shall not be less than the hourly time delay ratings indicated for each respective fire-rated floor, wall, or other partition of building construction.

Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

Coordinate each fire-stop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, fire-stop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

Use materials that have no irritating or objectionable odors when fire-stopping is required in existing buildings and areas that are occupied.

Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of fire-stopping. Remove combustible installation aids after fire-stopping material has cured.

All fire-stops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.

Additional requirements for existing penetrations are as follows:

- Existing raceways, cable trays, and cabling whether contained in the preceding structures or penetrate any existing building construction shall be fire-stopped to the extent necessary to fill cavities that may exist between existing building

construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

- Assemblies consisting of individual steel hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling.

If required by inspecting authorities:

- Expose and remove fire-stopping to the extent directed by inspecting authority to permit his or her inspection.
- Reinstall new fire stopping and restore work where removed for inspection.

Appendix A - Labeling Standards and Conventions

Labels will be used on all fiber optic and copper cabling to include Outside Plant cable, risers, horizontal (station) and fiber and copper patch cables. The labeling scheme shall be TIA/EIA-606A compliant or better. Labeling shall also extend to racks, cabinets, and patch panels used for terminations. Label materials shall meet all applicable fire codes and be resistant to the environment and have life span equal to or greater than the product to which they are applied. All labels shall be machine printed unless otherwise approved by OIT in writing.

Fiber Optic Cable

OSP Cable

Outside Plant (OSP) shall be labeled at each end of the fiber optic cable shall be specifying the far end building name, building number, single-mode or multimode, and the strand count. The cable shall be also be labeled at entrance and exit points of the tunnel system or if it enters a conduit. The label shall be placed between 12 inches and 36 inches from the conduit or at the closet point that it is clearly visible. The cable shall be labeled along its length at 200-foot intervals or the closet point that maintains clear visibility. The labels in the tunnel system shall specify the building name, and number of both ends of the cable and specify either single-mode or multi-mode and the strand count. Termination panels at both ends shall be labeled with the far end building name, building number, single-mode or multi-mode, and the strand count. Termination panels shall use both machine printed labels and manufactures color coding on ferrules to denote single-mode fiber or multimode fiber. Ferrule colors shall be yellow for single-mode and black or no color for multimode. Each separate 6 or 12 strand panel insert shall have a factory panel label and each strands terminations shall have a factory label or installers machine printed label with the strand number for that cable. If there is a factory supplied label for the door or cover it shall be used to indicate cable numbers and strand number.

Riser Cable

Each riser cable originating in a fiber Entrance Facility and interconnecting an Equipment or Telecommunications Room shall be labeled on both ends of the cable with the far end Entrance Facility or Equipment or Telecommunication Room number, strand count, and specify either single-mode or multi-mode. On some occasions a small building or facility may be fed from a primary building and treated as an Equipment Room to the primary building. In those instances the riser cable (may require an OSP rated cable) shall be labeled the same as the feeder cable in the above paragraph. Termination panels will be labeled using factory supplied labels or approved machine printed labels and specify far end Entrance Facility or Equipment or Telecommunications Room number, single mode or multi-mode, and the strand count.

Each separate 6 or 12 strand panel insert must be factory labeled as to panel number. Each strand must be either factory numbered or installer applied machine printed label.

Horizontal Cable (station)

In most cases fiber cable to the desk top will be duplex multi-mode or single mode cable. The cable shall be labeled on each end behind the faceplate or patch panel with the far end room or Equipment or Telecommunications Room number and the cable number. The cable number shall match the number on the patch panel and on the faceplate. The faceplate shall specify the Equipment or Telecommunications Room number on the upper left corner of the plate and the cable number either directly below or next to the jack and specify as to single mode or multi-mode. The Equipment or Telecommunications Room patch panel shall include the room number below the cable number.

Copper Cable

OSP or Feeder Cable:

Outside Plant (OSP) cable shall be labeled on each end with the far end building name, building number, and the pair count. A label shall be applied at a point with 12 to 36 inches or nearest location to maintain visibility of the point it leaves the tunnel and enters a conduit. The label shall contain the building name and number and pair count of the building it is entering. The cable shall also be labeled along its length in the tunnel at 200 foot intervals at a location that maintains clear visibility and at every turn. The label shall contain the building name and number at each end and the pair count. The protector blocks at each end shall be labeled with the cable number and far end building name and number and pair count. The cable number will be supplied by OIT.

Riser Cable

Riser cables shall be labeled on each specifying the far end Entrance Facility or Equipment or Telecommunications Room number and the pair count. Terminations panels shall specify the far end Entrance Facility or Equipment or Telecommunications Room number. The point that individual pairs are terminated will be labeled as to actual pair at every 5th pair point.

Telecommunications Outlets

Faceplates shall be marked with an ultra-fine tip black permanent sharpie and covered with a machine printed label, such as a P Touch type label, over the handwritten sharpie identification (this procedure must be done so that identification remains if the machine printed label falls off. Mark the new location with the Equipment or Telecommunications Room number on the upper left corner of the face plate and the cable number immediately below (preferred) or next to the jack. In the telecomm room after the first

panel has been filled (1-48) the other panel must be labeled in continuous sequencing (49-96) etc. Other cable contractors have installed cables at these campuses or buildings. Locate all of the other Equipment or Telecommunications Room locations at this site to determine the correct labeling sequence to be used for the new Equipment or Telecommunications Room. Samples of faceplate labels are included within this document.

Examples:

Fiber labeling

Each panel will be labeled with its own designation and the destination panel(s).

Panel designation should include the following where applicable:

- Building name
- Floor/room number
- Room name (i.e., MDF/IDF) and type

Label the front of each Fiber optic distribution box with FD-sequence number

Example:

FD1

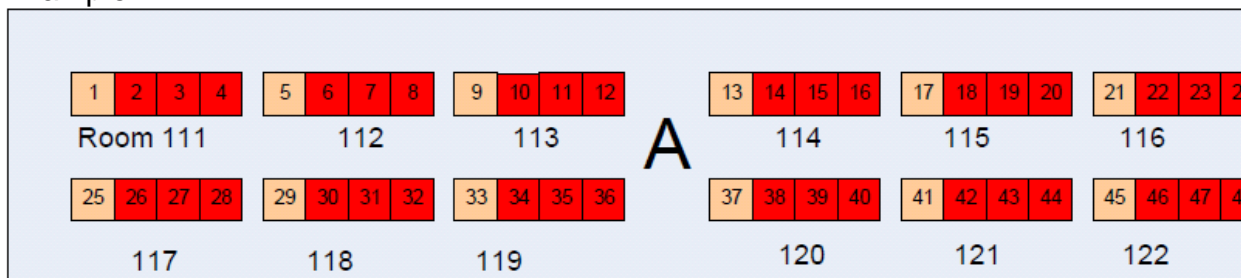
Copper labeling

Patch panel.

Each panel will have an alphanumeric designation

Each jack number on the patch panel will be determined by room number along with the panel and port designation as shown below.

Example:

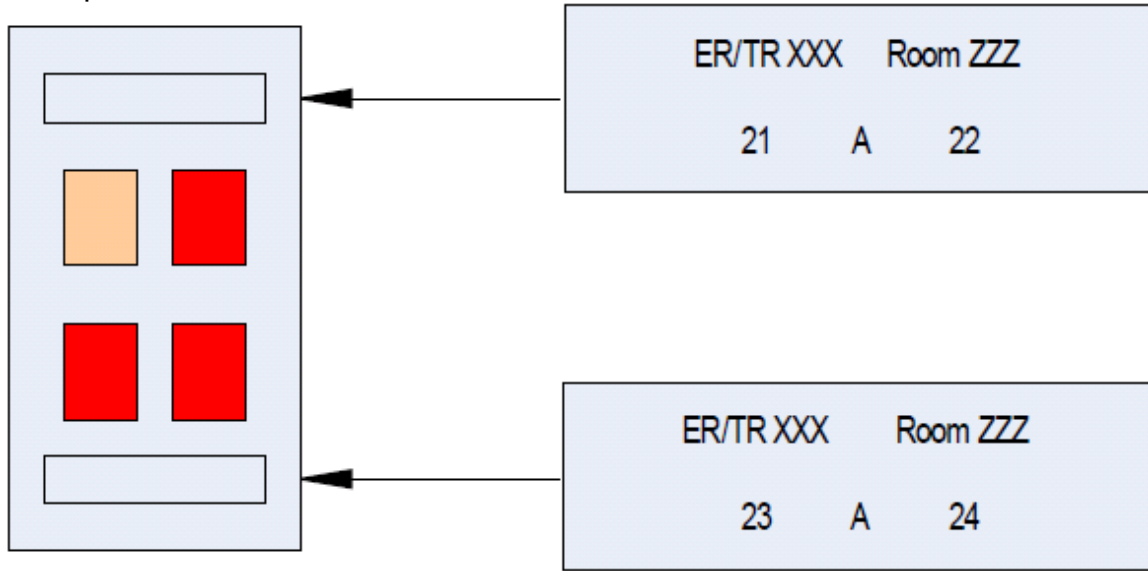


Faceplate at each office

ER/TR room # as well as the room number of the communication outlet on the first line of the supplied label

First jack # followed by the panel letter followed by second jack #

Example:



Rack labels

Label the top of each rack with the rack number.

Example:

Rack 1