Collier County Information Technology Construction Standards Version 5.00 2/24/2014

Revision History

Date	Initials	Change
09/30/201	SC	Updating fonts and table of contents
12/21/09	JD	Document Updated
9/17/2007	INJ	Document updated
08/5/2008	INJ	Document Updated Section G-5 Cabinet connections
02/14/2014	MMF	Combined Vertical and Fiber Construction Standards.

Audience: General (vendors, other department Project Managers)

Purpose: Outline IT's requirements for new construction and remodels

Prerequisites: None

Policy

Policy – Collier County Information Technology Construction Standards

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Vertical Construction Standards

Fiber Construction Standard

1. Site Design

a. **Entrance Conduit**
   i. Single Building Sites - Building will have two sets of two inch conduit from the Main Distribution Frame (MDF) to the right of way. Each set will follow a different physical path.

b. **Multi Building Sites**
   i. One building will be designated as the Site MDF and the entrance conduit will be installed as described above.
   ii. Intra Building Connectivity - All Building MDF's will be connected to the Site MDF with two, two inch conduits.
   iii. Conduit between Communications Rooms - Each Communications Room will be connected to the building MDF with two, two inch conduit.

c. **Physical Security**
   i. Card Key - All buildings will have at least one exterior door equipped with Card Access Locks (see Facilities Management for details.) where available.

2. Communication Rooms

a. Exclusive Use - All Communications Rooms are for the sole use of CCIT. No other building facility equipment will be housed in any Communications Room including, but not limited to, fire alarm systems, monitoring systems, security systems, janitorial services, supply storage, departmental storage, electrical, HVAC, etc. or any other equipment. Exception to these restrictions for low voltage building automation systems will be considered on a case by case basis.

b. **Room Specifications**
   i. **Flooring**
      1. Size **-** Minimum of 60 square feet (6' x 10') for single rack applications. An additional 2' of width is required for each additional rack.
      2. Floor Surface - Light colored sealed epoxy. Computer Rooms will have site specific floor surface requirements. VCT installation will be completed at least two weeks before the rack installation.
      3. Floor loading – Distributed floor loading of 200 lb/ft^2 minimum or as required by applicable codes whichever is greater. The concentrated loading in Communications Rooms must be 2000 lb/ft^2 over the area supporting the communications equipment.
   ii. Ceiling Height - Minimum clear height 8 feet above finished floor without obstructions.
   iii. **Doors**
      1. 36" wide and 80" tall with a 180^0 outward swing
      2. The door should have no center posts or doorsills.
   iv. **Lighting**

1. Specify to have lights mounted at ceiling height with a minimum of 540 lumens measured three feet above the floor. Special consideration will be made regarding the placement of lighting fixtures to avoid equipment racks and loaded cable trays from blocking much of the lighting.
2. CCIT will have final approval over placement of the lights.
3. Illumination shall not be controlled by automatic means only per NFPA 70 Article 110-26-(3)(d).

v. **Systems Power**
1. Power Outlets for Communications Rack to be approved by CCIT.
2. Power Outlets for Communications Rack shall be a quad-receptacle on single dedicated, isolated, non-switched 120Vac 20Amp circuit.

vi. Convenience Power - Power outlets placed at six foot intervals in the room for support and test equipment.

vii. **HVAC**
1. Air-conditioned with separate supply and return ducting.
2. Maintain constant temperature of 64^0 - 75^0 F with one air change per hour.
3. Relative humidity should be 40-50%.
4. Heat load specifications will be provided after network equipment specifications are finalized.

c. **Location**
i. Room shall be located such that no single Category 6 horizontal cable shall exceed a length of 90 meters or 295 feet from patch panel to station jack. This distance allows for a service loop at each end of the station cable, wall traversal distance, and allowing cables to run parallel and perpendicular with the joists. Cable pathways run parallel and perpendicular to the building walls. Running cables diagonally through the building or “as-the-crow-flies” will not be accepted.
ii. Minimum of one Communication Room per floor.
iii. Communications Rooms in multi-story building should be vertically congruent, located near the middle of each floor and within 90 meters of each other and all work area outlets. If they cannot be stacked install a minimum of four 4” conduits for a pathway between the rooms.
iv. Communications Rooms will not be located near, under or in bathrooms, laundry rooms, kitchens, water heaters or janitorial sinks.
v. Communications Rooms will not contain chilled water lines, roof drains, or pressurized hydraulic elevator fluid lines.

d. **UPS**
i. CCIT uses American Power Conversion (APC) UPS equipment.
ii. If generator backup power is available to the building all Communications Rooms will be powered by the generator, a transfer switch must be included to power the UPS.

e. **Conduit and Sleeves**
i. A minimum of 4-4” sleeves installed on the inside wall near the ceiling adjacent to the hallway for horizontal pathways.

ii. A minimum of 4-4" sleeves installed in the floor and in the ceiling for riser cabling to Communications Rooms that are located on the floors above or below other Communications Rooms.
iii. All wall and floor penetrations for Communications Rooms must be made with sleeved cores.
iv. A minimum of four 4" cores must be installed in Entrance Facilities, Equipment Rooms, and Telecommunications Closets.
v. In rooms or areas that are heavily populated with Work Area Outlets, an additional two 4" cores must be installed.
vi. All cores must be lined with sections of 4" EMT.
vii. All EMT sleeves must be reamed and have a plastic bushing installed on each end.
viii. All sleeves must extend 4" beyond the wall or floor.
ix. A section of vertical ladder rack must be installed as a pathway from floor to ceiling behind areas where cores stack between floors to secure pass-through cables and service loops.
x. All cores must be identified and labeled with Building number, floor, and TC "from," and the Building number, floor, and TC "to".

f. **Cable Trays**
   i. A continuous pathway of cable tray placed from all the conduits or sleeves up the wall and along the ceiling around the perimeter of the walls and over all equipment racks and cabinets.
   ii. The pathway must be strong enough and well secured to support the weight of the cables and any possible splice enclosures.
   iii. Cable tray, also known as runway or ladder rack, to line the perimeter of the room.
   iv. A minimum of 12" wide cable tray must be used for the pathway to the racks.

g. **Communications Racks**
   i. Size - Enclosed 19" by 84" locking racks with holes that comply with the 1.75U TIA/EIA standard.
   ii. Cable Management - Integral vertical cable management.
   iii. **Patch Panels**
      1. Type **–** Category 6, 24 port 568-B patch panels.
      2. Standards **-** EIA/TIA TSB-40 standards
      3. Labeling **-** Labeled with rack number and an alpha character. For example a rack with 2 patch panels would be labeled 1A, 1B, etc.
      4. Patch Cable Labeling – Patch cables are to be labeled with the Patch Panel Label and the port number at the end connecting to the device. The end at the patch panel is to be labeled with the name of the device it is connected to and port number.
      5. Rack Clearance – 3 feet of clearance is required around all sides of the rack/racks with the exception of sides where network racks are joined.
      6. All Cabinet to Cabinet connections need to be done with patch panels not free wire
   iv. **Rack Layout**

1. The patch panels will be installed using the following layout: the first patch panel will be installed at U7 from the top of the rack and each successive patch panel will be installed with 3U space between the patch panels.

h. Environmental Monitoring - both temperature and humidity with remote alarming capability. Monitors should be network enabled and capable of forwarding SNMP traps.

i. **Physical Security**
   i. Card Key - All Communications Rooms will be equipped with Card Access Locks (see Facilities Management for details.)

3. MDF

a. Adheres to Specifications of Communications Rooms
b. Telecommunications Backboard - AC-grade 3/4" x 4' x 8' sheet plywood, with no voids, covered on all sides with two coats flat black fire retardant paint mounted on rear wall of room.
c. Grounding and Bonding - Install a contiguous Intra-building grounding and bonding system in compliance with NEC Article 250 and TIA/EIA-607 using a minimum conductor size of 6 AWG to be located on each Telecommunications Backboard with Ground Bus Bar as directed.

4. Site MDF

a. **Adheres to Specifications of MDF.**
   i. All cabling from the right of way or other MDFs enter the building in this room.
   ii. Typically, outdoor cables need to enter the building, terminate onto a grounded device for lightning protection, and cross connect onto terminated indoor cables.
   iii. There shall be 6 ft between lightning conductors and communications cables and wires per NFPA 70 Article 800-13.
   iv. All entrance cables that need to transition from outdoor cable to indoor cable must do so within 50’ of entering the building.
   v. All outdoor inner duct must transition immediately upon entering the building.
   vi. No direct-buried cable is acceptable.

5. Computer Rooms

a. Will function as a Site MDF.
b. **HVAC Requirements**
   i. Computer Room will have adequate HVAC equipment to maintain a constant temperature and humidity level throughout the day, evening, and weekend timeframes.
   ii. Maintain constant temperature of 64^0 - 75^0 F with one air change per hour.
   iii. Relative humidity should be 40-50%.

iv. Heat load specifications will be provided after network equipment specifications are finalized.
v. The ambient temperature should not change more than 12 degrees in an hour.
vi. Each room must not contain any water or drain pipes except to support the HVAC equipment.

c. **Fire Suppression**
   i. FM200 System or equivalent
   ii. No sprinklers or sprinkler piping in the room.
d. Raised floor with a minimum of 12" clearance.
e. Cable tray below raised flooring

6. Cabling

a. **General**
   i. All cable must be new
   ii. All cables shall be PVC, Outside Plant, Riser, or Plenum rated as required by specific project specifications or local building code.

7. Category 6 UTP Cable

a. Four-pair cables shall consist of four-pair, 24-gauge, UTP. All four-pair Category 6 cables shall conform to TIA/EIA 568-B *Commercial Building Telecommunications Cabling Standard,* Horizontal Cable Section, Addendum 1-Transmission Performance Specifications for 4-pair 100 Ohm Category 6 Cabling (TIA/EIA-568-B.2-1).
b. The Category 6 cabling components shall be electrically backward compatible with existing Category 3, 4 and 5, plus future networks. The components shall be engineered and manufactured to compensate for any Category 3, 4, or 5 component crosstalk and shall provide at least Category 3, 4, or 5 performance in all of the Collier County Government's existing installed base of voice/data/video.
c. **Cables shall be capable of supporting the applications such as:**
   i. Analog and digital voice
   ii. Analog Baseband Video/Audio (up to 77 channels, 550 MHz)
   iii. 10 Mbps, 100 Mbps, and 1000 Mbps Ethernet with and without in-line power
   iv. 155 Mbps ATM
   v. 622 Mbps ATM
   vi. 270 Mbps Digital Video

8. Single Mode Fiber Optics

a. **See Fiber Optic Cable: #30.a**
b. **See Fiber Optic Cable Splicing and Fiber optic Terminations: #31-32**

9. Work Station Wiring

a. Terminations - All pairs shall be terminated.
b. Outlet Boxes **-** Each Communications outlet box will be a single gang, steel outlet box equipped with a mud ring securely mounted at planned locations.
c. Faceplates **-** Each outlet box will be equipped with a four position white modular faceplates with blank inserts for all unused positions securely mounted at planned locations.
d. Electrical **-** One duplex electrical outlet will be located on the same wall as the data outlet and be within three feet of the outlet.
e. **Furniture**
    i. Blocking Outlets - If furniture will be blocking an outlet secondary labeling for the outlet will be placed in line with the outlet above the level of the furniture.
    ii. Modular Furniture - Where modular furniture is being installed all Data Outlets will be installed in the raceways integral to the furniture.
f. Jacks **-** Communications jacks for all Category 6 cable will be ANSI / TIA / EIA – 568– B RJ-45 Category 6 compliant Ortronics or equivalent.
g. **Labeling -** Each Jack will be labeled with the Communications room number, rack number, patch panel designator and finally the patch panel port number.
    i. All faceplates must have printed, adhesive labels. Hand written labels are not acceptable.

10. Installation

a. **General**
    i. All cabling shall be installed according to specifications given in TIA/EIA 568-B *Commercial Building Telecommunications Cabling Standard, General Requirements, Cabling Installation Requirement Section* (TIA/EIA-568-B.1 Section 10).
    ii. Conduit will be schedule 40 PVC.
    iii. Each horizontal cable shall be installed in a "home-run" configuration. No "daisy chained" conduit or cables shall be allowed.
    iv. At no time shall pulling tension exceed 25 lbs. on horizontal cables.
    v. Traditional nylon synch style Tie Wraps shall not be used to bundle cables. Only Velcro Tie Wraps are acceptable to bundle cables.
    vi. No Intra-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as ballasts, generators, fans, motor control units, motors, etc. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.
    vii. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper shall be replaced.
    viii. Contractor shall observe the bending radius and pulling strength requirements of the cable during handling and installation.

ix. All cable routes to be approved by the BCCIT prior to installation of the cabling.
x. Contractor shall provide the County with detailed diagrams for all cable runs detailing exact locations of cable for review and approval by the BCCIT after coordination with other contractors, architects, and general contractor. **Documentation will include at a minimum:**
    1. Cable lengths between terminations, amplifiers, splitters, patch panels, and equipment;
    2. Exact routing of cable;
    3. Frequency rating, location and identification of amplifiers, splitters, and patch panels;
    4. Bonding and grounding methods and locations;
    5. Location and description of all associated equipment.
xi. **Cable Trays** - All wiring will be run in overhead cable tray systems.
    1. The Cable Tray system shall be an open steel mesh tray system designed for ease of access.
    2. The Cable Tray system shall be "UL Classified" as suitable for use as an electrical conductor for grounding and bonding.
    3. Where physical considerations preclude the use of cable trays other Cable Support Devices may be substituted. Acceptable Cable Support Devices include "J Hooks" and Cable Slings that are **Category 6 compliant.**
        a. These Cable Support Devices shall be hung securely by either "all-thread" material, or ceiling grid hanger wires dedicated only to hanging the Cable Support Devices on and not ones holding ceiling grid.
        b. The Cable Support Devices may also be secured to walls above ceilings.
        c. If "J" hooks are used, avoid placing any pressure or creating stress points on the cable. Maximum spacing between "J" hooks shall not exceed five feet.

b. **Cable Routing**
i. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the Communications Room.
ii. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room/closet and the work area should not exceed 10m (33 ft).
iii. Four horizontal cables shall be routed to each work area unless otherwise specified and as shown on project drawings.
iv. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
v. Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than or equal to 480 Vrms, shall be installed with a minimum clearance of 12 inches.

vi. Horizontal pathways should avoid being parallel to sources electromagnetic interference whenever possible. Crossing perpendicular is preferred.
vii. The installation of telecommunications cabling shall maintain a minimum clearance of 3 m (10 ft) from power cables in excess of 480 Vrms.
viii. For voice or data applications, 4-pair UTP or fiber optic cables shall be run using a star topology from the telecommunications room/closet serving that zone to every individual information outlet
ix. Each run of UTP cable shall not contain splices.
x. In the communications room/closet where cable trays or cable racking are used, the contractor shall provide appropriate means of cable management such as reusable color-coded hook and loop cable managers (ties) to create a neat appearance and practical installation.
xi. Continuous conduit runs installed by the General Contractor should not exceed 30.5 m (100 ft) or contain no more than two (2) 90-degree bends without utilizing appropriately sized pull boxes. If a conduit run not meeting the above-mentioned criteria is encountered, contact Project Engineer. Do not proceed with cable installation until Project Engineer provides written notice that the conduit run has been corrected to meet these specifications.
xii. The number of horizontal cables placed in a cable pathway shall be limited to a number of cables that will not cause a geometric shape change of the cables and not exceed 60% fill ratio.
xiii. Pulling lubricant compound compatible with the cable manufacture's specification should be used if making long or difficult pulls to reduce cable drag. Other lubricants such as liquid detergent are not acceptable. Lubricant is required on all fiber cable pulls.
xiv. Maximum pathway capacity shall not exceed a 60% fill.
xv. Fiber optic warning signs should be placed on all inner-duct and conduits containing fiber optic cable.
xvi. Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

11. Penetrations Through Fire Rated Structural Components

Fire Rated Structural Components penetrated with conduits/sleeves shall be properly Fire Stopped, in compliance with Fire Codes and UL Rated Penetration Systems. All Fire Rated Structural Component penetrations are subject to inspection by the Collier County Government Master Fire Technician and/or the State or County Fire Marshall and any other inspections required by State and local building codes. All attempts shall be made to prevent the spread of fire, smoke, or water.

a. During construction all sleeves must have a fire-stopping pillow installed in it.
b. All fire-stopping pillows must be reinstalled daily during cable installation and at no time will sleeves be left unprotected.
c. All sleeves must have a fire-stopping caulk applied to the outside circumference of the sleeve on each side of the wall penetration and from the top of a floor penetration.

d. Wherever it is not feasible to use a pillow or caulk, use fire-stopping putty.
e. All other fire-stopping methods need prior approval by Collier County BCC Department of Facilities Management.
f. Fire-stopping methods include mechanical systems, putty, caulk, pillows, intumescent sheets and wrap strips.
g. Fire-stopping materials must be prepared and installed using established quality control procedures.
h. All products used inside a building shall have the highest UL ratings available and will bear the UL stamp.
i. All copper cabling used in plenum areas must be stamped CMP.
j. All fiber optic cabling used indoors must be stamped OFNP.
k. All plenum rated innerduct used must be stamped “plenum.”
l. Plenum-rated innerduct shall be used in all indoor locations except where EMT is used.
m. Plenum rated fiber and innerduct must be used indoors to prevent possible future disruptions from later renovations that may add plenum air returns.
n. CCIT will make the final decision on whether to purchase the upgrade to the cable.
o. All paint used in Building Facility Rooms should contain an intumescent additive.
p. All floor mount penetrations for work area outlets will have a fire-stopping device contained within the monument.

12. Communications Room Termination

a. Contractor will be responsible for installing all patch panels, horizontal and vertical wire management, fiber optic distribution enclosures and any other items necessary to complete proper installation.
b. The Contractor will assemble and place all communication racks associated with the installation of Infrastructure Fiber Optic cable and Computer room horizontal twisted pair outlets.

13. Cable Bend Radius

a. Manufacturer’s recommendations for bending radius and pulling strength of the Category 6 and fiber optic cable should be adhered to.
b. In spaces with UTP cable terminations, the maximum bend radius for 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.
c. During the actual installation, bend radius on 4-pair cable shall not exceed eight times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

14. Cable Slack

a. In Communications room/closets a minimum of 3-meter (10-ft) service loop should be left for all cable types. This slack must be neatly managed on trays or other

support types and does not include length required to route the cable(s) to the proper termination point.

b. The amount of fiber cable slack at terminations points should allow the cable to be routed to the termination location with enough additional cable to reach a convenient location for termination.
c. Service loops and outlet slack add to the overall horizontal link length. Care is to taken to assure the service loop lengths and horizontal distances, when combined, do not exceed the 100-meter channel length as defined by TIA/EIA-568-B.

15. General Labeling Requirements

a. All cables, equipment racks, information outlets (face plates), patch panels, termination equipment, pull boxes and inner-duct will require labels.
b. All labeling must meet EIA/TIA 606 standards.
c. Labels will be placed in accordance with manufacturers' specifications.
d. All racks and cabinets will be labeled on the top, right corner, both front and rear.
e. Where cables are terminated (such as patch panels and information outlets), labels are required to be installed on both sides of the equipment and shall identify each cable that terminates on the equipment.
f. All information outlets will be labeled on the top center of the faceplate.
g. Only machine printed laminated labels that are mechanically fastened are acceptable for equipment, panel, riser and outlet labeling.
h. Horizontal and backbone subsystem cables shall be labeled at each end. Labels will be affixed 2" from each end. Handwritten markings on the cable will not be accepted. Additional labeling is required on cables that pass through locations such as conduit ends, backbone splice points, manholes and pull boxes at the point they pass through these devices.

16. Riser and Backbone Labeling Requirements

a. Fiber distribution centers should be clearly labeled on the front cover as to the location of the other end. This label should also indicate number of single-mode and multi-mode strands in this unit.
b. Backbone labeling and numbering should mirror each end. Risers should be vertical, top down with the same numbering sequence. Backbone cables shall be terminated in the same size fiber distribution center at each end with the single and multi-mode strands in the same positions.

17. Cable Testing

a. All information outlet wiring shall be tested from the outlet device to the patch panel. Each wire/pair shall be tested at both ends.
b. Testing shall be done utilizing a cable tester meeting EIA/TIA 568 standards; all testing equipment shall be calibrated annually and shall have a dated certificate.
c. Printed test results shall be assembled and delivered to the County's representative.
d. Test results for each 4-pair UTP cable must be submitted with identification to match labels on all patch panels and 8-position modular jacks.
e. **Category 6 Cabling**
    i. All category 6 field-testing shall be performed with an approved, TIA/EIA Level II field tester device. All installed channels shall perform equal to or better than the minimum requirements as specified by the table below. The results of all test and analyses shall be kept on file.
    ii. All Category 6 channels are qualified for linear transmission performance up to 300 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
    iii. All UTP field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
    iv. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
    v. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
    vi. Category 6 UTP horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-TSB-67 and ANSI/TIA/EIA-568-A-5. Test parameters include wire map, length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return Loss, attenuation, propagation delay, and delay skew.

vii. Category 6 tests should be made with a TIA/EIA Level II tester.

f. **Fiber Optic Cable Testing**
   i. See Fiber Optic Communication Cable Tests: #35

18. Workmanship

a. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
b. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.
c. Provide proper temporary protection of cable during the time between when the cable is pulled and when the final dressing and termination's are complete.
d. Do not leave cable lying on the floor.
e. Bundle and/or tie wrap the cables so they are off of the floor until they are ready to be terminated.
f. The Contractor is required to be a member of BICSI and have RCDD-certified staff overseeing the work or have work reviewed by an RCDD.
g. Where work dictates the extension, attachment, expansion, or augmentation of an existing system(s) or subsystem(s), the vendor will use materials and other necessary components compatible with those systems.
h. The building wiring shall be installed in a neat and secure professional manner that provides mechanical integrity for the cabling media and any associated components. The design and installation shall also offer ease of access and suitability for future rearrangements and changes.
i. Cable paths above suspended ceilings, mechanical rooms, closets, etc. shall not be blocked or covered in any way that would impede the addition of cable in the future.
j. All cables shall be tested by the Contractor to verify that the cables are installed properly, and that there are no kinks, cuts, or other damage to these cables

19. Walk-Thru

a. CCIT requires a full walk-through with the cabling contractor project manager to review every Computer Rooms, Site MDF, MDF, IDF, and all manholes, hand-holes, and significant pull-boxes and junction boxes.
b. The walk-thru may include a full demonstration of termination and testing on the various media.

20. Documentation

a. **Testing Documentation**
   i. All test results must be submitted in an electronic format, if CCIT does not have a program capable of reading the format, then the contractor must provide the software or all test results must be printed out and placed in a binder.
   ii. All results must include the cable identification numbers, test date and times, the operator performing the test, the make and model of the testers used.
   iii. All results must include the setting used to test, and the from-to locations of the cable.
   iv. Testing documentation is the certification of the cable plant.
   v. The Warranty period does not begin until the testing documentation is given to CCIT.

b. **As-Built Documentation**
   i. Fully documented scale drawings of the entire fiber optic and copper distribution system. Documentation shall be provided in both a hard copy binder and a soft copy on CD capable of being viewed and edited in AutoCAD. This will include building and floor layouts with workstation information outlet locations and labeling, distribution frames, cable routes, interconnect locations, intermediate and main distribution frame location, riser locations, and all other information pertinent to the installation.
   ii. Copies of mylars.
   iii. All floor plans must document all Workstation Outlet locations and number.
   iv. All floor plans must document all Computer Rooms, Site MDF, MDF, and IDF locations and numbers.
   v. All floor plans must document all horizontal pathway locations and numbers.
   vi. All floor plans must distinguish between UTP and fiber locations.
   vii. All cross-connects installed by the cabling contractor will be printed out in a spreadsheet or in an automated cable management system.
   viii. A spreadsheet identifying all faceplate locations by room and identifying the outlet numbers for each faceplate location.

21. Warranty

a. All components used in the Category 6 cabling system shall be warranted for a period of 25 years from date of installation against defects in materials and workmanship.
b. All components used in the optical fiber-based cabling system shall be warranted for a period of 25 years from date of installation against defects in materials and workmanship.
c. All labor and materials shall be covered with a one-year warranty from the date of acceptance of work order.
d. The warranty should cover defects in materials and workmanship.

e. The contractor must cover any and all of the OEM extended warranties.
f. All active equipment manufacturers must be able to replace any defective materials overnight.

22. Payment of Services

a. All payment options will not be in conflict with the General Contractor's contract or applicable County policies, ordinances, State and Federal laws.
b. CCIT reserves the right to withhold final payment until receiving all As-Built documentation**.**
c. CCIT may withhold partial final payment until approving documentation and inspection of work.

23. Definitions

a. Building Wiring Infrastructure – The horizontal copper wiring between the Communications Room and the wall jack, the vertical fiber optic and/or cooper wiring between Communications Rooms and the fiber optic entrance cable.
b. Card Key – Pegasys card key access locks.
c. Cipher Locks – push button combination locks
d. Computer Room – Room intended to house network equipment and server equipment.
e. Entrance Conduit – conduit from a Building/Site MDF to the right of way.
f. IDF – Intermediate Distribution Frame
g. LAN – The integrated system of building wiring infrastructure and networking equipment that allows computers and telephones to communicate within a building.
h. MDF – Main Distribution Frame
i. Networking Equipment – The active components necessary to implement an LAN or WAN. This includes routers, switches, media converters and UPS equipment.
j. Site MDF – main wiring point for a campus.
k. WAN – The interconnection of multiple LANs allowing communications between multiple buildings.

Collier County Information Technology Fiber Construction Standards:

24. Individual Proposals - All proposals must include all costs for the completed project to conform to the standards defined herein. Proposals will include:

a. Complete breakdown of materials, fees and labor
b. Completion timeframe and schedule
c. Ground Penetrating Radar locates on all County property
d. All engineering and design work required
e. All required permits
f. All materials and labor
g. All required locates
h. Installation of all materials including restoration of ground to original condition including topsoil, sand, concrete, or other required materials; and for disposing of surplus materials.
i. Comply with all Collier Construction Standards
j. All Acceptance Criteria
k. Must pass Collier inspections
l. Work may not be subcontracted without Collier County Information Technology's (CCIT) express written permission

25. Planning and Design – The Contractor is responsible for all detailed planning and design. All designs and schedules must be approved by CCIT. This work will include the following:

a. All Engineering
b. All drawings
c. Project schedule

26. Walkthroughs and Reviews

a. Contractor will conduct a design review with CCIT and other County staff.
b. Contractor will conduct a pre-construction walkthrough with CCIT and other County staff prior to commencing work and to site-validate design
c. Contractor will conduct a post-construction walk through with CCIT and other County staff for the purpose of reviewing the workmanship and design conformance of the installation. All defects and workmanship and deviations from design will be noted and corrected by the Contractor, at their expense, prior to payment.
d. Contractor will conduct a closeout and lessons learned meeting. All documentation will be submitted at this time and any defects, omissions and errors will be noted.
e. ll defects, omissions and errors in documentation will be corrected by the Contractor, at their expense, prior to payment.

27. Cable Diagrams - The Contractor shall provide two (2) paper copies of documentation for each fiber optic installation and one (1) digital copy of documentation in one of the following file formats: AutoCAD .dwg/.dxf, or Microsoft Visio .vsd/.vsdx. This documentation shall include:

a. Fiber optic splice diagram, indicating buffer tube and strand colors that have been spliced and their cable designations using industry standard color coding scheme (TIA/EIA-598-A), for every location where a splice is enclosed underground;
b. Fiber optic termination diagrams, indicating buffer tube and strand colors and type of termination, for every point where a termination has been completed;
c. **Layout diagram for completed installation to include:**
    i. Cable designation using industry standard color coding scheme (TIA/EIA-598-A)
    ii. Locations of splice and termination points
    iii. Buffer tube and strand colors for the run.

28. Other Required Documentation

a. Section drawings showing cross section of installation and other utilities in ROW
b. **GPS Coordinates** - data in electronic format suitable for import into ArcGIS. To include:
    i. 1 meter accuracy
    ii. Depth readings each time the conduit changes depth
    iii. Location of pull boxes
    iv. Location of splice cases
    v. Linear coordinates every 100 feet or when conduit does not follow a straight path
c. GIS Line shape file with NAD83 State Plane Florida East FIPS 0901(feet)
d. As-Built Drawings

29. Utility Coordination

a. It is anticipated that local road and utility construction projects will be in progress during the life of this Contract. The Contractor shall be required to coordinate his construction operations with those of other contractors doing work for the State, Collier County and City of Naples governments. This coordination includes on-site

cooperation and scheduling of work to eliminate or minimize any rework or duplication of effort.

b. The Contractor must obtain a Collier County right-of-way permit before beginning any construction activities. No shared permit is to be intended or implied with any other project or agency, and the permit that is issued shall only cover work requested by agencies of the Board of County Commissioners.
c. The Contractor must be knowledgeable and adhere to State and Local statutes regarding notification before beginning any underground work, specifically including knowledge of and adherence to the Underground Facility Damage Prevention and Safety Act, Chapter 556, Florida Statutes.

30. Fiber Optic Cable

a. **Description**
    i. The Contractor shall furnish and install fiber optic cable as described in the work request and in accordance with the requirements specified herein.
    ii. All fiber shall be shipped on reels of marked continuous length, and shall be provided from the same manufacturer.
    iii. No splices shall be permitted within the fiber jacket.
    iv. No point discontinuities of greater than 0.10 dB shall be permitted.
    v. After installation, each run of fiber optic cable shall be marked within one foot of each splice and/or termination with the location that the cable goes to. This nomenclature shall be submitted to the agency for approval prior to its use.
    vi. The nomenclature shall be used on the Optical Time Domain Reflectometer (OTDR) sweep test results specified separately.
    vii. **The following standards are applicable to this bid item and are hereby incorporated by reference**:

	ORGANIZATION	STANDARD	APPLICABILITY
2.	RUS	PE-90	Cable Construction
3.	TIA/EIA	598B-01	Color Coding
4.	TIA/EIA	472D0000	Fiber Optic Cable
5.	TELCORDIA	GR-20	Optical Characteristics

b. **Single-mode Cable**
    i. This cable shall consist of 12, 24, 30, 36, or 48 as described in the work request, arranged in color-coded buffer tubes of six individually color coded fibers except for the 48 fiber cable which shall consist of 12 fibers per buffer.

ii. When less than six buffer tubes are required for the number of fibers, polyethylene filler rods shall be used to maintain cable integrity.
iii. Each buffer tube shall be filled with a non-hygroscopic gel for protection of the fibers from impact and moisture ingress.
iv. Aramid strength members shall be bundled with the buffer tubes and the filler rods and the jacket shall also contain non-hygroscopic gel.
v. The entire cable shall conform to RUS Specification PE-90, unless the cable manufacturer's recommendation is more stringent.
vi. The minimum bend radius of the cable shall be 20 times the cable diameter.
vii. The maximum tensile strength shall be at least 2700 Newtons (600 pound force) short-term and 601 Newtons (135 pound force) long-term.
viii. **The exterior of the fiber optic cable jacket shall be manufactured with a color-coded stripe**. The purpose of the color coding is for internal control as well as ease of identification after installation. No fiber optic cable shall be accepted that does not conform to the color coding below:
    1. Collier County Traffic Operations – GREEN stripe & labeled 'Collier County BCC Traffic' every 3 feet.
    2. Collier County Information Technology – YELLOW stripe & labeled 'Collier County BCC IT' every 3 feet.
    3. Collier County Public Utilities – PURPLE stripe & labeled 'Collier County BCC Public Utilities' every 3 feet.
ix. **The fiber cable shall meet the following optical specifications:**

1.	Attenuation at 1310 nanometers	$\leq$ 0.56dB/mi
2.	Attenuation at 1550 nanometers	$\leq$ 0.19 dB/mi
3.	Point Discontinuity	$\leq$ 0.10 dB
4.	Core Diameter	8.3 μm
5.	Cladding Diameter	125.0 $\pm$1.0 μm
6.	Core-clad Concentricity	$\leq$0.8 μm
7.	Coating Diameter	245 $\pm$10μm
8.	Numerical Aperture	0.13
9.	Index of Refraction (1310nm)	<1.47
10.	Index of Refraction (1550nm)	<1.47

x. All fiber optic glass shall meet or exceed TIA/EIA-492CAAA, International Electrotechnical Commission (IEC) Publication 60793-2, and Telcordia GR-20-CORE.
xi. The operating, shipping and storage range of the cable shall be -40º F to +158º F.

xii. The installation temperature range of the cable shall be -22º F to +158º F.

c. **Installation**
   i. All fiber shall be installed in underground conduit.
   ii. Pulling in place shall be by hand or by an approved mechanical pulling machine. If a mechanical pulling machine is used, it must be equipped with a monitored or recording tension-meter.
   iii. At no time shall the manufacturer's recommended maximum pulling tension be exceeded.
   iv. Where pulling through pull boxes, approved pulleys and sheaves shall be used or the excess cable must be coiled in a figure eight and fed by hand.
   v. If sheaves are to be used, the cable should never be pulled through a radius less than the manufacturer's minimum bending radius.
   vi. Fifty feet of spare fiber shall be looped neatly in all pull boxes.
   vii. At each termination point, thirty feet of spare fiber shall be looped neatly within the cabinet or in an adjacent pull box. This fiber is for future additions or repairs to the fiber network.

d. **Building Entrance Point and Inside Fiber Pathways**
   i. A service loop of 50' will be left at every building entrance.
   ii. At no time shall an Outside Plant rated cable run inside a building unless it is encased in rigid metal conduit (2" EMT unless otherwise specified).

e. **Fire-Stopping**
   i. All penetrations into fire-walls or core holes between floors must be properly fire-stopped in accordance with the guidelines in BICSI TDM 95 Chapter 20. Fig. 11 and must also conform to any related NEC, Federal, State and local requirements for Fire-stopping.
   ii. Penetrations into the surface of any Firewall or presumed Firewall should be only slightly larger than the cable or cables that will need to pass through it. This will make Fire-stopping easier and allow the wall to maintain a better overall structural integrity.
   iii. Proper Fire-stopping should be performed on any hole and/or penetration of a firewall or solid wall. This may include the Contractor installing Mineral Wool in the space between the sheet rock walls and then installing a sheet rock patch on both sides before installing the Fire-Stopping Material.
   iv. Fire-stop any transitions between floors using or not using conduit or sleeve.
   v. When using Fire-stopping Putty in a conduit or sleeves between floors a section of Fire-resistant Mineral Wool must be inserted to create the proper base for the putty. Making a form out of cardboard is not acceptable.

vi. Fire-stopping pillows are also acceptable to seal an opening that may need to be reentered at a later time.

f. **Inside Fiber Pathways**

i. All pathways will consist of inner-duct, conduit or a combination of both.
ii. If broken or split, this inner-duct shall be spliced with the proper fittings.
iii. Inner-duct and fiber cable ran through Plenum airways will be Plenum rated.
iv. Where it enters a junction box or slack box the inner-duct will be connected to the wall mount box with the proper fitting to securely fasten the inner-duct to the enclosure.
v. Cables and inner-duct shall be rated according to TIA/EIA and NEC codes for the environment in which they are installed.
vi. Support for inner-duct or conduit shall be no greater than 4' intervals.
vii. All inner-duct or conduit will have a pull string provided for future use.

g. **Indoor Pull-points**

i. Pull points shall be installed or used at intervals not to exceed the manufacturer's specifications for the cable being placed.
ii. No service loops shall be left at indoor pull points.
iii. Service loops shall be installed only where a cable leaves a building or is terminated.

31. Fiber Optic Cable Splicing

a. **General Requirements**

i. All fibers shall be spliced by the fusion method.
ii. The Contractor shall use a fusion splice machine for this purpose.
iii. The splice machine shall be equipped with a method for estimating the achieved splice loss. Either the "Local Injection Detection" or "Core Alignment Loss Estimation" system is acceptable.
iv. The machine used shall be new from the factory or serviced and certified by the factory or its authorized representative within the previous six months from the commencement of its use on the project. The Contractor shall provide to the agency a letter from the manufacturer or his authorized agency certifying that this requirement is met.
v. Splice loss shall not exceed a bi-directional average of 0.10 dB per splice for a complete fiber run or a maximum of 0.15 dB bi-directional average for any single splice at 1310 and 1550 nanometers.
vi. At each splice location, fifty feet of fiber shall be coiled (on each side of the splice – one hundred feet in total) to allow for future access to the cable at a

distance from the splice point to accommodate a van or tent for the purpose of keeping the splice machine and craft-person out of the weather.

vii. When a fiber cable is accessed, only the buffer tube containing the fiber(s) to be accessed shall be opened.

viii. Only the actual fiber to be accessed shall be cut.

ix. If a fiber end is not to be used at the time, it shall be cut to a length equal to that of the fiber to be used and the spare neatly laid into the splice tray.

x. At least one and one-half revolutions of the splice tray of fiber shall be left on each end of fiber after splicing.

32. Fiber Optic Cable Splice Materials

a. At each splice point, splice organizer trays shall be provided to contain and protect the bare fibers and splices.

b. Splice trays shall be easily attachable and accessible. Splice tray raceways shall include a raceway for excess fiber storage that will accommodate the minimum bend radius of single-mode fiber without causing excessive signal losses due to bending or fiber damage.

c. The splice trays shall have a means to affix the buffer tube rigidly in place, and space & guides to allow “race tracking” of the fiber, and guides to locate the splice protectors.

d. The splice trays shall be layered above the transition/storage compartment and shall be easily slipped into place on two studs and secured with a hold down strap. Splice trays shall have fixed rigid slots for fiber placement.

e. Enclosures shall have provisions for storing fiber splices, non-spliced fiber and buffer tubes. Each tray shall be made of injection-molded plastic and have a hinged clear plastic cover for maximum fiber protection that allows for visible inspection of the fibers. The covers shall have a lock mechanism to hold them in place.

f. All splices shall be protected with a heat-shrink sleeve containing a stainless steel strength rod or protective sleeve and housing. Completed splice protectors shall be held in place with RTV silicone or adhesive tape. No more than 12 splices shall be placed in one tray.

g. All splice trays to be installed in surface level pull boxes

h. Buffer tubes only in the patch panel tray – tray must be able to slide out, without impacting fiber, for patching.

i. 100ft of slack at all splice points (50ft of slack from each side; in and out).

j. Must be labeled using non-destructive tags with permanent markings.

33. Fiber Optic Cable Termination

a. **General Requirements**

i. All terminations to fiber optic cable shall be made with type SC connectors to single fiber break-out cable.

ii. Where access to a trunk fiber or local fiber cable is made, a length of single fiber break-out cable shall be spliced onto the trunk fiber by the method outlined above.

iii. Nowhere shall a fiber be terminated directly.

iv. Where single fiber break-out cable is used, it shall be marked within six inches of the connector with appropriate nomenclature to identify it.

v. All single-mode break-out cable shall be yellow in color.

vi. The Contractor shall utilize the color codes and the splice diagrams as described in the work request for the termination of all cables.

vii. Termination enclosures should only contain buffer tubes; the tray must be able to slide out, without impacting fiber, for patching.

viii. Termination enclosures should also be labeled with each fiber optic strand's buffer tube and strand colors.

ix. **All fiber terminations will be installed in patch panels according to the following layout**:

1. Terminations and splices need to be completed using industry standard color coding scheme (TIA/EIA-598-A).
2. A machine printed layout card will be attached to each patch panel indicating the layout of the fiber strands within the panel.

b. **Fiber Optic Connectors**

i. All SC type connectors shall conform to the NTT-SC and Telcordia 326 Specifications for SC connectors.

ii. The connectors shall be applied by the adhesive and polish method. At least two grades of polish film shall be used and the fiber visually inspected after polishing.

iii. Any marks on the fiber core or on the cladding within a core diameter from the core shall be cause for rejection and re-termination of the fiber.

iv. The fiber strength member shall be affixed to the connector by crimp ring or by epoxy. If a crimp ring is used, it shall be crimped with a ratcheting tool that ensures correct crimp pressure.

v. The completed termination shall exhibit a loss of no more than 0.25 dB per mated pair when tested with an OTDR and a standard test cable. This requirement applies equally to field terminations and factory terminated pigtails.

34. Method of Measurement

a. The unit price per foot of cable furnished and installed shall include furnishing all material, hardware and labor necessary to make a complete and accepted installation as described in the work request. All cable ties, cable clamps and terminal connectors shall be included under this item.
b. Payment for fiber optic cable will be based upon the length installed between cable terminations, as determined by the manufacturer's sequential markings printed on the cable jacket, recorded to the nearest foot.

35. Fiber Optic Communication Cable Tests

a. **Pre-installation Test**
    i. The Contractor shall test all fiber optic cable prior to installation.
    ii. Cable delivered to the job site shall be tested on the reels prior to installation.
    iii. This test shall consist of a single direction sweep of each individual fiber with an Optical Time Domain Reflectometer (OTDR) that has been calibrated for the index of refraction of the fiber to be tested.
    iv. Verification of the fiber length and attenuation shall be made.
    v. Attenuation shall not exceed 0.56 dB/mile at 1310nm and 0.19 dB/mile at 1550nm.
    vi. No discontinuities greater than 0.1 dB over a distance of less than 300 feet shall be allowed.
    vii. If the cable fails to meet these requirements, the Contractor shall replace the entire reel at no additional cost.
    viii. Print-outs of the OTDR trace with the identification of the fiber and the attenuation and length noted on the print-out shall be provided.
    ix. This test may be eliminated at the Contractor's option if the manufacturer has done these tests at the factory and after the cable is placed on the reel and provides a typical OTDR trace together with a table of all attenuations and lengths of each fiber on a reel.
    x. If the Contractor elects to forgo this test, it shall in no way relieve him of the obligation to replace any cable that, after installation and testing, proves not to meet the specifications.
    xi. Cable replacement shall be done at no additional cost to the Collier County.
b. **Post-installation Test**
    i. After installation, the Contractor shall test all fibers from both ends with an OTDR.

ii. Those fibers that are not terminated at the time shall be tested using a bare fiber adapter.
iii. A pair of traces for each fiber shall be placed in a notebook and presented to CCIT.
iv. A loss table shall be included with each trace showing each splice or termination.
v. No active devices shall be connected for this test and all SC connectors shall be capped.
vi. The Contractor shall investigate any discontinuities greater than 0.20 dB/300 feet and repair them or replace the cable section at no additional cost to the agency.
vii. The required traces shall also be delivered on CD or DVD. All traces must be arranged in logical directories with a printed list of directories and filenames referenced to the fiber location provided. The Contractor shall provide (at no additional compensation) licensed software compatible with Microsoft Windows Operating Systems (latest versions) to allow viewing and printing of the traces.

36. Conduit

a. Exterior applications - 2 inch diameter HDPE, orange. All joints are to be glued using appropriate adhesive, using industry standard couplers, or be fused.
b. Interior applications – 2 inch EMT. All joints are to use industry standard connectors.
c. All unused conduits in outdoor pull boxes will be properly plugged with removable watertight plugs.
d. Pull strings will be installed in all conduit for future use.

37. Conduit Installation by Trench or Directional Bore

a. All new conduits connecting to existing conduit shall be of the identical size as the existing conduit.
b. No reducing couplings or reduction in the inside diameter of conduit shall be permitted.
c. Any conduit installed which is new from end to end (i.e. not coupled to an existing conduit), shall be a two-inch conduit.
d. Rigid couplings shall be used to join two or more conduits. Adhesive appropriate for and recommended by the manufacturer of the conduit may be used to assure a complete and durable seal at the coupling points.

e. At no time shall tape or any other adhesive be used in place of rigid couplings when two or more conduits are joined together.
f. At the agency's request, the contractor shall excavate a window at any point along a conduit trench so that couplings may be inspected.
g. All new conduit installed and all existing conduit used under this Contract shall be blown and/or rodded clean to the satisfaction of the contracting agency prior to the installation of any cable or wire in that conduit.
h. All underground conduit installed by open trenching and directional bore methods shall be identified by mule tape or a 12-gauge copper wire (tracer wire) installed in the conduit. Wire is preferred.
i. The mule tape or wire shall also be installed in all existing conduit used on this project.
j. The tape or wire shall be installed for the entire length of conduit(s).
k. The tape shall contain a means of being located by a metallic cable detector.
l. Identification tape shall also be installed above conduit installed by open trenching.
m. Identification tape shall be colored in accordance with American Public Works Association orange for communications and shall be continuously emblazoned with black non-fading ink with the message "CAUTION FIBER OPTIC" in minimum one-inch high block letters.
n. One length of identification tape shall be installed for all parallel conduits within one foot of each other; parallel conduits more than one foot apart shall have two or more identification tapes as needed.
o. The identification tape shall be continuous from conduit termination point to termination point and shall enter pull boxes with the conduit. For new conduit, the identification tape shall be at a depth of one foot above the installed conduit.
p. Sidewalk restoration shall be full width by section for all sidewalks five feet wide or narrower. For sidewalks eight feet or wider, the restoration may be in half-width sections or to the nearest existing seam or joint as approved by the agency's Engineer. Sidewalks between five and eight feet wide may be replaced to the nearest seam or joint only if existing and approved by the agency's Engineer.
q. Aesthetic sidewalk and/or pavement (brick, brick paver, paver block, colored concrete, granite, slate, etc.) shall be replaced entirely and the Contractor shall match color and texture in accordance with the local municipality's or owner's requirements.
r. Underground conduit shall generally be installed in non-pavement areas if possible. The Contractor shall install underground conduit in the grass utility strip if such a strip is available.

s. Conduit installation across driveways shall be accomplished by directional bore.
t. Under no circumstances shall the open trench exceed three feet in width.
u. All underground conduit must be installed no less than 24-30 inches below the surface.
v. Must meet PUD construction standards and inspections – see Collier County Public Utilities Engineering Standards – section 1.1.2.3
w. Road crossings should be done no closer than 100 feet from an intersection.

38. Conduit Installation into Existing Pull Boxes

a. All conduit, required as described in the work request, installed into existing pull boxes shall be installed in accordance with the requirements for conduit installation into new pull boxes.
b. The Contractor shall maintain the existing pull box and shall restore the surrounding area to a condition equivalent to that prior to when work began.
c. The Contractor shall immediately notify the agency if the Contractor determines that the existing pull box is unacceptable for reuse.
d. If the existing pull box needs to be temporarily removed or otherwise disturbed for the new conduit installation, new gravel shall be installed in the base of the reinstalled existing pull box as required for new pull boxes.

39. Removal of Existing Pull Box and Installing of New Pull Box

a. Where described in the work request or directed by the agency, the Contractor shall remove existing pull boxes and furnish and install new pull boxes such that the completed installation is in accordance with details specified herein.
b. The Contractor is responsible for ensuring that the pull box cover is flush with the finished grade or sidewalk. An even layer of gravel must be installed in the bottom of all outdoor pull boxes.
c. At no time should the Contractor install pull boxes in roadways, driveways, parking areas, ditches or public sidewalk curb ramps.
d. For all types of existing pull boxes, the Contractor shall excavate and remove the existing pull box and lid, adjust the pull box footing, adjust conduit terminations, add gravel, furnish and install a new pull box and lid and restore the surrounding grade surface.
e. The Contractor shall furnish and install all materials necessary to complete this work.

40. Pull and Junction Boxes

a. The fiber optic splice enclosures shall be capable of accommodating splice organizers to facilitate fiber management and shall accept mechanical, single fiber fusion splices.
b. The splice enclosure shall provide fiber optic cable penetration end caps on one end, to accommodate at least two trunk fiber optic cables and two branch fiber optic cables.
c. Water blocking techniques shall be used to ensure that the enclosure and cable entry locations do not leak when immersed in 19 feet of water for 30 days.
d. The enclosure end caps should be factory drilled to the proper diameter to accept and seal the fiber optic cable entry(ies).
e. Cable entry locations shall accommodate an assortment of fiber optic cable outer diameters ranging from 0.45 inches to 0.55 inches (+10 percent) without jeopardizing its waterproof characteristics.
f. Hinged splice enclosures with stainless steel latching devices shall be utilized.
g. All fiber optic splice enclosures shall meet the requirements of Telcordia Technologies GR-711-CORE and shall comply with all applicable NEC requirements.
h. Splice enclosures may encounter high water table conditions. Splice enclosures shall be non-filled (no encapsulate), airtight and prevent water intrusion, able to accommodate pressurization, and have the capability to be reentered without requiring specialized tools or equipment.
i. Splice enclosures shall also be supplied with all hardware necessary to provide solid mounting to the wall of the pull box in which it is to be housed.
j. All enclosures (both underground and aboveground) and associated facilities provided under this Contract shall include a quality assurance / quality control inspection for materials, workmanship and compliance of the product to meet these specifications.
k. The Contractor shall provide to the agency an executed Certificate of Compliance from the manufacturer indicating that the splice enclosures meet the requirements included herein.
l. All splice enclosures must employ a complete fiber management system consisting of splice trays and a stress relief system.
m. Each enclosure shall be designed to accommodate future expansion and contain modular splice organizers / trays capable of handling splices in a neat and distinguishable fashion.
n. Splicing capacity for 100 percent expansion shall be provided.
o. Trays shall be easily attachable and accessible.

p. Tray raceways shall include a raceway for excess fiber storage that accommodates the minimum bend radius of single-mode fiber without causing excessive signal losses due to bending or fiber damage.
q. Splice enclosures shall have provisions for storing fiber splices and non-spliced fiber / buffer tubes.

41. Communications Pull Box

a. Requirements
b. Pull boxes used for communications cable shall be, at minimum, sufficient to house the communication cable(s) without bending the cable(s) to less than 20 times the outside diameter(s) or as shown on the Plans (or as described in the work request).
c. The minimum allowable inside dimensions for the communications pull box are 24 inches wide by 36 inches long.
d. All pull boxes supplied shall have the word “COMMUNICATIONS” integrally cast into the covers.
e. All pull boxes in the public right-of-way must be registered on the Florida Department of Transportation’s Qualified Products List (QPL).
f. The maximum distance between pull boxes is 1000 feet, or less, if specified by the contracting agency.
g. Where underground conduit is covered by a paved roadway or driveway, a pull box is required within 20 feet of each side of the paved area.
h. A pull box is required at the apex of any point where underground conduit turns in a 90 degree radius, or where two or more conduits meet at a “T” junction.
i. The Contractor shall be responsible for properly sizing each pull box to ensure that all communications cable, including spare cable, is safely stored without violating the recommended bending radius of the communications cable.

42. Method of Measurement

- The unit price per communications pull box furnished and installed shall include furnishing all material, hardware and labor necessary to make a complete and accepted installation.

43. Fiber Optic Cable Markers

a. Fiber optic cable markers must be supplied by the Contractor.
b. Markers are to be placed at all pull boxes.
c. Markers are to be made of composite reinforced thermoplastic, and be white and orange in color.

d. Markers should be a minimum of 62 inches (1575 mm) long, 3 inches (75 mm) wide, and stamped with ‘CAUTION FIBER OPTIC CABLE’ on the front and back of the marker.
e. Installation should be adequate so that marker cannot be pulled out or removed manually.
f. The marker should self erect after vehicle impact.
g. Install a marker at each point along the fiber optic cable path where a 45-degree or greater change in direction occurs.
h. Install markers a maximum of 24 inches (600 mm) lateral displacement from the actual placement of the conduit and fiber optic cabling.
i. Install markers no later than 3 days following the installation of conduit to contain fiber optic cables, or of direct buried fiber optic cables.
j. Safeguard the conduit and cables during the installation of the markers.
k. Remove and replace any conduit or cables that are damaged during marker installation at no additional cost to contract.

44. Equipment Warranty

a. Until final acceptance, the Contractor shall be responsible for the function and operation of each component proposed.
b. The Contractor's responsibility includes, but is not limited to, all pickup and delivery of defective, repaired or replacement components.
c. Each component that is a vendor-supplied component and is covered wholly or partially by a manufacturer's warranty shall include the provision that the warranty is subject to transfer to the maintaining agency as named by the Department prior to final acceptance of the Contract.
d. The Contractor is responsible for ensuring that the vendor or manufacturer supplying the component and providing the equipment warranty recognizes the Department's designee as the original purchaser and owner of the component.

45. Service Maintenance Contract

a. The Contractor shall provide a service maintenance contract that completely covers each component installed as shown on the plans (or as part of the work request).
b. The Contractor is responsible for ensuring that the supplier of the service maintenance contract recognizes the Department's designee as the original purchaser and owner of the component as new.
c. The Contractor shall submit to the agency for approval copies of the proposed service maintenance contract prior to the commencement of testing.
d. The service maintenance contract shall be provided by the Contractor for a period of one calendar year to begin not more than 15 days prior to final acceptance of the project by the Department.
e. The service maintenance contract shall cover all parts, labor and other costs associated with the diagnosis, adjustment, removal, transportation, repair and reinstallation of any component.
f. The service maintenance contract shall provide for complete on-site service with a maximum on-site response time of one working day after request for service.
g. Payment to the Contractor for the service maintenance contract shall be included in the unit bid price for the units covered by the service maintenance contract and no additional compensation will be provided by the Department.

46. Payment of Services

a. **See Payment #22**

47. Applicable Standards

a. TIA/EIA 455-34 Attenuation
b. TIA/EIA 455-107 Return Loss
c. TIA/EIA 455-21 Durability
d. **ANSI/NECA/BICSI-568** -- Standard for Installing Commercial Building Telecommunications Cabling
e. **ANSI/TIA/EIA-568-B.1** -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
f. **ANSI/TIA/EIA-568-B.2** -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
g. **ANSI/TIA/EIA-568-B.3** -- Optical Fiber Cabling Components Standard
h. **ANSI/TIA/EIA-569-A** -- Commercial Building Standard for Telecommunications Pathways and Spaces
i. **ANSI/TIA/EIA-606(A)** -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
j. **ANSI/TIA/EIA-607(A)** -- Commercial Building Grounding and Bonding Requirements for Telecommunications
k. **ANSI/TIA/EIA-526-7** -- Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
l. **ANSI/TIA/EIA-526-14A** -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
m. **ANSI/TIA/EIA-758(A)** -- Customer-Owned Outside Plant Telecommunications Cabling Standard
n. **Install cabling in accordance with the most recent edition of:**
    i. BICSI -- Telecommunications Distribution Methods Manual
    ii. BICSI -- Cabling Installation Manual
    iii. BICSI -- LAN Design Manual
    iv. BICSI – Customer-Owned Outside Plant Design Manual
    v. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

Approvals:

☐ Approved by _____
☐ Approved by _____
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