City of Charleston
Network Infrastructure Guidelines

It is the intent of the City of Charleston Information Technology Department to ensure an infrastructure within and between all City occupied buildings that meets the technology needs of the present while providing for growth into the future. It is our intention to ensure compliance with all applicable regulations and codes, including, but not limited to the following:

ANSI/TIA/EIA-568-B. (Except as noted)
ANSI/TIA/EIA-569
ANSI/TIA/EIA-606
TIA/EIA-607
FCC - Federal Communications Commission.
OSHA (Standards-29 CRF) Telecommunications -1910.268
BICSI Telecommunications Distribution Manual
NFPA-National Fire Protection Association
South Carolina Department of Labor Rules and Regulations
NESC - National Electrical Safety Code

The following guidelines are requirements the City's Information Technology Department consider to be key elements of the preceding regulations and codes along with generally accepted infrastructure procedures, and those procedures and practices deemed desirable in our environment.

To ensure uniform compliance with these regulations, codes, procedures and practices, the City's Information Technology Department requires the following inspections by an RCDD. All costs for inspections will be incurred by the appropriate architect, contractor or other vendor as project costs. Inspections will be submitted to the appropriate IT personnel, and all parties involved will be notified of the result of the inspections. Required inspections are listed in section VIII. "Acceptance."

TABLE OF CONTENTS

I. GENERAL INFORMATION

These guidelines are provided as a guide to the overall expectations of the City of Charleston's Information Technology Department in an attempt to ensure an infrastructure within and between all City-occupied buildings that meets the technology needs of the present while providing for growth into the future. The following information is pulled from regulations and codes along with generally accepted infrastructure procedures, and those procedures and practices deemed desirable in our environment. In the event of a discrepancy between this document and current regulations or codes, the current regulation or code will prevail. The information contained within is not all-inclusive, but intended to be used in combination with the City's inspection procedures. Inspections, and the Information Technology Department's acceptance of those inspections, will be considered to be the final test of compliance with the City's requirements.

The Information Technology Department is responsible for designing and implementing the following cabling systems:

1) Data communications
2) Video surveillance and security systems
4) Telecommunication systems
5) Security systems
6) Audio/Video systems

A. Standards for telecommunications rooms versus telecommunications spaces

Telecommunications Rooms (TR) are required for all buildings that meet any of the following criteria:

1. More than one floor will be utilized by users or print stations.
2. The building has the ability to host more than ten user or print stations.
3. Buildings that do not meet any of the aforementioned criteria, may utilize Telecommunication Spaces (TS) as defined below.

B. Specifications for Telecommunications Rooms (TR)

1. Location shall be as close as possible to the center of the area served. The location of each TR shall provide a distribution system that will create a horizontal cable run of no more than 275 feet. All TR's must be accessible from the main hallway, or other common area.
2. Telecommunications room spaces shall be dedicated to the telecommunications function and related support facilities. Telecommunications room space should not be shared with electrical installations or other maintenance facilities rooms.
3. There shall be a minimum of one TR per floor. Additional TRs shall be provided when the horizontal distribution distance to the work area exceeds a cable length of 275 ft.

4. Multiple TR's on the same floor should be interconnected by a minimum of four conduits (3 trade size), or equivalent pathway for each trade.
5. TR's in multi-floor buildings should be stacked vertically when possible and be interconnected by a minimum of four conduits/sleeves (3 trade size), or equivalent pathway for each trade.
6. The minimum size of the TR shall be 6'x9'. These dimensions are literal, and are not meant to provide a "square footage" calculation The door shall be a minimum of 36" wide and 80" high without a doorsill, hinged to open outward (code permitting) into the main corridor.
7. HVAC shall be included in the design of these rooms to maintain a temperature equivalent to that of the adjacent office area. These systems shall be operational on a 24 x 7 schedule. In buildings designed for utilization by more than 25 occupants, TR's shall have independent cooling systems with the ability to maintain relative humidity at between 60% and 70%.
8. Lighting should provide a minimum of 50-foot candles, measured 3' above the finished floor, and mounted 8.5 feet above the finished floor.
9. Each TR will require one quad (double duplex) receptacles at each rack location (both data equipment and file servers). One 20Amp/120V circuit will feed each receptacle.
10. Each TR shall have a grounding plate that is bonded to building ground.

C. Specifications for Telecommunications Spaces (TS)

1. The location of each TS shall provide a distribution system that will create a horizontal cable run of no more than 275 feet. All TS's must be equipped with a backboard and accessible from the main hallway, or other common area.
2. TSs may be located in private offices or other controlled spaces, but may not be located in a space designated as a public area. TSs should not be shared with electrical installations or other maintenance facilities rooms.
3. HVAC for the TS shall be designed to maintain a temperature equivalent to that of adjacent office areas. These systems shall be operational on a 24 x 7 schedule.
4. Lighting should provide a minimum of 50-foot candles.
5. Each TS will require one quad (double duplex) receptacle at each rack location (both data equipment and file servers). One 20Amp/120V circuit will feed each receptacle and requires a #6 AWG (minimum).

II. GENERAL INSTALLATION REQUIREMENTS

All new and remodeled areas will conform to the Americans with Disabilities Act of 1990 with respect to the functionality of telecommunications devices and accessibility to telephones and communications devices.

A. Ceilings and Walls

1. Do not modify the grid structure in any way.
2. Any ceiling tiles that are damaged during the installation process must be replaced and installed by the contractor. New tiles must match the type and design of the adjacent areas.
3. Any grid members that are damaged during the installation process must be replaced and installed by the contractor.
4. Any walls that are damaged shall be fully repaired at the contractor's expense.

B. Working Environment

1. All work will be performed in a neat and workman like manner.
2. Daily clean up is required of all site areas.

C. Abandoned Cables

1. It is contractor responsibility that all unused (abandoned) cables shall be removed from the ceiling and riser areas in accordance with the 2005 NEC. (NEC 800.154 and NFPA 90A section 4.3.11.1.2)
2. Any cables that are identified outside the scope of each project should be reported to the IT Department.
3. The contractor will remove the debris, and arrange for off-site disposal.
4. All open wall penetrations that result from the removal of abandoned cables shall be properly sealed.

D. Sleeves

1. Each contractor is responsible for identifying sleeves installed for the purpose of their trade.
2. Use galvanized rigid conduit/sleeves for penetrations through exterior masonry/concrete walls and foundations, concrete floor slabs on grade and above grade, and concrete-filled decks.
3. Use only fire-rated listed assemblies for the type of sleeve being installed through CMU walls or gypsum walls for communications penetrations. Sleeve type shall be galvanized rigid conduit or electrical metallic tubing.
4. In floor penetrations, extend sleeve 1" to 3" above finished floor unless noted otherwise.
5. A minimum of four (4) 3" sleeves is required into all TR's. Additional sleeves will be installed as needed. .
6. Sleeves must have a protective bushing on each side to prevent jacket chaffing. This may be a throat bushing or a screw on bushing.

E. Grounding

1. Grounding shall conform to ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code® and manufacturer's grounding requirements as minimum.
2. Ground equipment racks, housings, messenger cables, and raceways.
3. Connect cabinets, racks, and frames to single-point ground that is connected to the building ground system via #6 AWG (minimum) copper grounding conductor.
4. Any connection to building steel must be annotated on the as-built drawings.
5. Ground all points of contact on building steel prior to fastening grounding lugs.

III. INFRASTRUCTURE PATHWAYS AND SPACES

A. Conduits

1. In existing structures, the communications contractor must install all necessary conduits, unless otherwise provided by the City.
2. All conduits must meet applicable codes and guidelines to determine material, type, and sizing. Conduits for telecommunications shall not be smaller than 1" in diameter.
3. Flex-conduit shall not be used for telecommunications pathways without the written approval of the IT staff.
4. All conduits should be marked "Communications Cabling."
5. Each conduit must be attached to building structure at intervals to prevent sagging, or movement in joints. Conduit systems shall not attach to other trade work.
6. Cables must be installed in conduit from the cable tray to the wall outlet. (New construction)
7. All conduits must have a nylon pull string both before and after cable installation.
8. There shall be no more than two (2) 90° bends between any pull points.
9. The use of "LB's" is strictly prohibited.
10. In cases where a conduit enters the building more than 50' from the nearest TR the designer has two options in accordance with the NEC:
    a) Install a backboard, terminate the outdoor conduit on the backboard, then run a conduit to the nearest TR (preferably the Primary TR). This will allow for a splice between outdoor cables and plenum cables.

b) Install an approved pull box at the building entrance with a conduit continuing to the nearest TR (preferably the Primary TR). This will allow the outdoor cable to be run straight into the TR with no transition to plenum cables.

B. Cable Trays

1. Flexible trays shall be used whenever possible. Designers must ensure that the installers use proper mounting methods.
2. Cable trays shall be installed in all main corridors, and any other area that will have a large cable count. This will typically be in buildings that have more than 25+ occupants.
3. Trays should be stopped 6" – 12" away from firewalls. Install the appropriate number of sleeves through the firewall to connect both trays. The sleeves must provide the same number of square inches as the tray.
4. Sleeves will be required to accommodate: data, voice, surveillance, and alarm cables. Size the tray and sleeves accordingly.
5. Each cable trade must be bundled and separated in the trays.

C. Other Supporting Systems

1. "J" hooks may be used in some areas, providing they meet the specifications for Category 6 cable installations. Minimum distance between "J" hooks is 5'.
2. Other manufactured support structures may be used with permission of the IT Department.
3. Data/Power poles may be used where necessary. Include the use of these devices in each Scope of Work that incorporates their use. Poles must be fastened to the ceiling grid with proper hardware, and securely fastened to the floor with anchors.

D. Exterior Pathways

1. Any trenches must be back-filled with a "mound" of dirt to accommodate settling. A site visit must be performed within four (4) weeks. The contractor must fill any recessed earth.
2. It is the responsibility of the contractor to contact a service locator to mark all existing cables and conduits. The contractor assumes all responsibility for damage to underground facilities and services.
3. Aerial cables – A self-supporting, or figure eight cable may be used in some instances. Contractor must show proof of proper training, and attaching hardware for each application.
4. Transition Points – Any outdoor rated cable that enters the building must be transitioned to an indoor rated cable. Ensure that the 50' ruling is followed per the NEC guidelines. Fusion splices must be utilized, and splice cases shall not be installed above the ceiling.

IV. FIRESTOPPING

A. General Guidelines

1. New and existing raceways, cable trays, and cables for power, data, and communications systems penetrating *non-rated* and *fire-rated* floors, walls, and other portions of building construction shall be fire stopped where they penetrate new or existing building construction.
2. Fire stopping shall be accomplished by using a combination of materials and devices, including, fire stopping materials (caulks, putties, pillows), to make up a complete fire stop. Cabling contractors must coordinate with the electrical contractor on site to ensure compliance with other fire stop systems.
3. Verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed.
4. Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.
5. Fire stopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables, as well as hose streams.
6. All telecommunications sleeves shall be sealed with a re-enterable sealant whenever possible. Caulk may be utilized around the outer surface of the sleeve, but not inside the sleeve. Non-hardening putty is the preferred material to seal the inside of the sleeve.
7. Each sleeve shall be labeled with the UL system, “F” & “T” rating, and the manufacturer’s name and products used. If all sleeves are identical in design, this information may be listed on the as-built documentation.

   This section paraphrases sections of the following fire stopping references:

   - ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
   - 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.
   - 9th edition of the BICSI Telecommunications Distribution Methods Manual, Chapter 15, Fire stopping.

B. Fire stopping Products

1. 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.
2. Select appropriate type or types of through penetration fire stop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.

3. 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.
4. 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.

V. LABELING

A. Labeling Standards

1. Labeling shall meet the intent of ANSI/TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure standards.
2. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606-A standard color codes for termination blocks. Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
3. Label cables, outlets, patch panels, and punch blocks to match the existing labeling in the building. For new installations, the contractor will coordinate with the IT Department.

B. Backbone (feeder) Cable Labeling

1. All backbone cables will be clearly marked at each termination point showing the local TR, and the far end TR.
2. All splices must be clearly annotated at the termination point to provide location of splice point, and type of splice.
3. If a splice is made for the purpose of stripping out pairs, the contractor shall clearly annotate the path of each bundle at each termination point.
4. Splices shall not be installed in the ceiling spaces without written permission of the IT staff.
5. Fiber optic cables should terminate in rack mount enclosures whenever possible.

VI. LAN CABLING – Horizontal Distribution

A. General Information

LAN cabling consists of the following infrastructure:

1. Data cabling – workstation outlet to patch panel, necessary intra-building / inter-building connections.
2. Voice cabling – device outlet to Patch Panels approved by the Information Technology Department, necessary intra-building / inter-building connections.

B. Horizontal Distribution of Data Cabling

1. All copper connectivity hardware must be approved by the Information Technology Department.
2. All terminations shall follow the EIA/TIA 568B wiring scheme.
3. Data cables will be from the same manufacturer throughout each project.
4. The BICSI training guidelines are the preferred installation methods. Whenever a conflict in guidelines exists, the more stringent shall prevail.
5. All horizontal distribution cable shall be installed in one continuous run from the TR, to the workstation outlet. No splicing will be allowed.
6. All pull-strings in cable trays and conduits will be replaced when cables are installed.
7. Following the BICSI TDMM guidelines, the contractor shall provide a minimum of 10 feet of cable slack at each TR, and a minimum of 1 foot of cable slack for each workstation outlet.

C. Horizontal Distribution of Voice Cabling

1. All copper connectivity hardware must be approved by the Information Technology Department.
2. Terminate voice cables on Patch Panels in each TR. Maintain a separate Patch Panel for workstation and backbone cabling.
3. All terminations shall follow the EIA/TIA 568B wiring scheme.
4. All cables shall be capable of supporting Voice over IP and analog systems. Voice cables will be from the same manufacturer throughout each project.
5. The BICSI training guidelines are the preferred installation methods. Whenever a conflict in guidelines exists, the more stringent shall prevail.
6. All horizontal distribution cable shall be installed in one continuous run from the TR or TS, to the workstation outlet. No splicing will be allowed.
7. All pull-strings in cable trays and conduits will be replaced when cables are installed.
8. Following the BICSI TDMM guidelines, the contractor shall provide a minimum of 10 feet of cable slack at each TR, and a minimum of 1 foot of cable slack for each workstation outlet.

VII. LAN CABLING – Backbone Distribution

A. Fiber Optic Cable

1. All interconnected TRs or TSs shall have as a minimum one (1) backup Cat6 copper backbone cable, one (1) hybrid fiber cable with four (4) multimode fibers, and two (2) single-mode fibers.

2. When fiber optic cable passes through a vertical riser closet secure fiber to wall vertically every 48” or follow manufactures recommendations.
3. Any design that includes a splice of any kind must be approved by the Information Technology Department prior to installation. All splices shall be performed using a fusion splice method.

B. Copper Cable

1. Copper backbone cables will be used primarily for voice applications. Copper cables will not be used for data applications unless specified by the Information Technology Department.
2. Backbone cables for voice will be Category 6 Plenum cabling.
3. All terminations of copper cables will be performed on Patch Panels. The use of “66” blocks will not be allowed.
4. LAN cabling contractor is responsible for cross-connecting all Voice cables from the outlet, through the TR, and into any main TR, should one exist. A continuity test and certification is required.
5. All blocks shall be clearly labeled by block, and pair.

C. Copper Testing (horizontal and backbone)

1. Testing shall conform to TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted Cabling Systems and ANSI/TIA/EIA-568-A-1, Propagation Delay and Delay Skew Specification for 100 ohm 4-pair cable. Testing shall be accomplished using level II field testers.
2. Test each pair and shield of each cable for opens, shorts, grounds, crosstalk, and pair reversal.
3. If copper cables in the backbone contain more than 5% bad pairs, or if outer sheath damage is the cause of bad pairs, remove and replace the entire cable. If horizontal cable contains bad conductors or shield, remove and replace cable.
4. All test results must be presented to the IT Department in printed and electronic format. The test results MUST be in the original form provided by the manufacturer’s software; reviewed and signed by an RCDD.

D. Fiber Optic Testing (horizontal and backbone)

1. Contractors shall provide the results of bandwidth and attenuation tests performed by the manufacturer prior to shipping. The test results shall be provided on the original form provided by the manufacturer.
2. It is highly recommended that the contractor tests the optical cable on the spool with a light source and power meter utilizing procedures as stated in ANSI/TIA/EIA-526-14A: OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant. This will prevent additional costs after installation if damage occurred during shipping.

3. The contractor is required to provide attenuation and/or OTDR tests of every terminated fiber after installation is completed.
4. The fiber optic installation and testing procedures must comply with ANSI/TIA/EIA-568-B.3 Optical Fiber Cabling Components Standard.
5. All test results must be presented to the IT Department in printed and electronic format. The test results MUST be in the original form provided by the manufacturer's software.
6. Maximum dB loss at a multimode connector shall be 0.5dB at 850 nm as viewed by the OTDR.
7. Maximum dB loss at a splice shall be 0.3dB at 850nm, as viewed by the OTDR.
8. A minimum 200 foot fiber test lead shall be used between the OTDR and the fiber under test.
9. A minimum 200 foot fiber test lead shall be connected to the far end of the fiber under test with the OTDR.
10. No fiber optic cable installation will be accepted without the following tests being performed:
    a) For every multimode fiber installed end-to-end attenuation loss testing shall be performed at both 850 nm and 1300 nm wavelengths.
        - The results must be recorded on 3.5" disks or CDs.
        - OTDR tests need to be taken only at one wavelength (850), and they are also to be recorded to 3.5" disks or CDs.
    b) For every single-mode fiber installed end-to-end attenuation loss testing shall be performed at both 1310 and 1550 nm wavelengths.
        - The results must be recorded on 3.5" disks or CDs.
        - OTDR tests need to be taken only at one wavelength (1310), and they are also to be recorded to 3.5" disks.
11. Contractor shall follow the ANSI/TIA/EIA-598-A Optical Fiber Cable Color Coding guidelines.
12. Provide a loss budget of proposed multi-mode fiber cable plant and single-mode fiber cable plant. Measured results shall be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, the contractor will test cable with OTDR to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the City.

VIII. ACCEPTANCE

It is the responsibility of the vendor to coordinate a site visit with the IT RCDD inspector at the required inspection times listed below.

A. Required Inspections:

1. Architectural plans for new building projects, and/or renovations require an architectural review by a City IT designated inspector prior to submission for bids.

2. A material inspection by a designated City IT inspector is required to ensure materials meet or exceed the requirements of the City. This inspection is to be conducted and submitted to the IT Department prior to the commencement of installation.
3. A conduit inspection must be acquired from a designated City IT inspector and submitted to the City prior to conduit being covered up by walls and/or ceilings.
4. During the cable testing phase, a designated City IT inspector must be present to witness and verify the cable testing results. This inspection will be submitted to the appropriate parties in the IT Department and approved and signed by an RCDD.

Any items that are found to be in error will be documented, and the vendor will provide a date that all items will be corrected and schedule, at the vendor's expense, a follow-up inspection. When inspections result in a positive report, that report will be submitted to the IT Department by the RCDD. The IT Department will notify the vendor of their acceptance.

Inspections that report unsatisfactory results in the following areas will not be accepted by the IT Department.

- Above ceiling inspection of cable tray use, proper cable colors and jackets, firewall penetrations, improper cable attachment to other trade work.
- General work area inspection to ensure work debris has been removed, faceplate installation, label placements, comparing labels to the as-built drawings.
- TR inspection to ensure proper cable support, proper labeling, proper cable termination, work debris removed, patch cord delivery, as-built documentation posting, general cable bundling practices.
- Test results (copper and fiber)
- As-built format and clarity
- Fiber Optic labeling
- Ceiling tile conditions