**Facility Planning and Control**

**Office of Technology Services**

**8. GUIDELINES FOR COMMUNICATIONS WIRING**

**GUIDELINE REQUIREMENTS, SPECIFICATIONS, AND WIRING DIAGRAMS**

 **FOR**

 **COMMUNICATIONS CABLE/WIRE AND RELATED BUILDING FACILITIES**

General Note: Typically, construction contracts will not include telephone systems, only the conduit for them. Telephone systems shall not be included without the approval of the FPC Project Manager.

When transmitting design phase submittal documents such as drawings and/or specifications for review only, please use the following procedure:

1. It is not necessary to transmit the complete set of documents. Only the following items are required:
	1. Site plan(s) showing the telephone and other communications services entrance(s).
	2. Electrical floor plan(s) showing telephone and computer outlets and associated equipment rooms with backboards, conduit stubs, power outlets, lighting, grounding, and HVAC.
	3. Communications riser and/or wiring diagrams.
	4. Specifications associated with items “a” through “c” and any communication systems included in the project.
2. Pertinent information about the project:
	1. Project title and number.
	2. Number of Review days.
	3. Projected dates of bid advertisement or opening, or construction commencement, completion, and tenant move.
3. When required by the FPC Project Manager, deliver the aforementioned documents via email to:

**\_DOA-OTS-NCS-telecomcabling@la.gov****.**

**and copy the FPC Project Manager**

Otherwise, mail the complete set of documents to:

**State of Louisiana**

**Division of Administration**

**Office Facility Planning & Control**

**Post Office Box 94095**

**Baton Rouge, LA 70804-9095**

**Attention: (Name of Project Manager)**

Or Deliver to:

**State of Louisiana**

**Division of Administration**

**Office Facility Planning & Control**

**Claiborne Building, Suite 7-160**

**1201 North 3rd Street**

**Baton Rouge, LA 70802**

**Attention: (Name of Project Manager)**

1. The Designer will be responsible for notifying the FPC Project Manager when the Contractor is ready for inspections during the installation of the communications aspects of this project.
2. Designer shall comply with applicable articles in the current National Electric Code, and other required State Codes and laws, for communications systems as it pertains to cable/wire and associated building facilities for State owned or leased facilities.
3. Designer shall select the applicable requirements from the following lists and include them in pertinent State projects.

***NOTE: It is the responsibility of the Prime Designer and/or Sub-Designer(s) to ensure that all communications systems and associated space quantities, sizes, and environments are coordinated to meet all requirements herein. In the event of ambiguities, the more stringent shall prevail. All standards referenced herein shall be considered the latest ratified publication.***

1. Main Communications Equipment/ Wiring Room
	1. The room shall be designed for communications equipment/wiring only according to ANSI/TIA/EIA-569 and BICSI standards. The space shall not be shared with electrical **lighting and power control** and/or mechanical equipment.
	2. The size of the room shall comply with ANSI/TIA/EIA-569 and BICSI standards in collaboration with the User and FPC Project Manager.
	3. The location of the room shall be as close to the center of the communications outlet configuration as possible. The room level shall be above potential flood water.
	4. If the fire extinguishing sprinklers are required in the room, the Designer shall coordinate with the User and the FPC Project Manager for possible special requirements to protect electronic equipment.
	5. The room shall be provided with the proper architectural, HVAC, humidity, lighting, grounding, and power environment for communications equipment. **Ensure that interdisciplinary coordination is accomplished.**
	6. A minimum of two (2) 120 VAC, 20-A dedicated power circuits each terminated with two (2) duplex outlets shall be provided near the base of the backboard and spaced six (6) feet apart, minimum. Additionally, a minimum of two (2) 120 VAC, 20-A dedicated power circuits each terminated with two (2) duplex outlets shall be provided on the wall both nearest the equipment rack, one of which shall be fed from the building UPS and/or generator power if available.
	7. Fluorescent lighting shall be provided in the room with 50 foot-candles of illumination 3-feet above the finished floor, minimum.
	8. An isolated grounding source shall be provided in the room. The source shall consist of a ground bus installed at the base of the backboard and bonded to the main power service entry ground source.
	9. Wall shall be sheeted with 4’Wx8’Hx3/4”D backboards painted with a fire-retardant light-gray paint and installed according to good quality architectural and construction standards. Fasteners securing the boards to walls shall be recessed.
	10. Some projects may require special floor features; for example; static-free flooring, raised flooring, and/or heavy-load structural support. The Designer shall coordinate final requirements with the User, the FPC Project Manager, and OTS as applicable.
	11. The room shall not contain a suspended ceiling. Solid/closed support structures (i.e. concrete floor) above the ceiling grid height shall serve as the room ceiling to allow direct horizontal access to the served space. Where the ceiling is exposed to open attic space, interior quality plywood painted with white paint shall be fastened to overhead support beams (joists) to serve as the room ceiling. Walls shall extend the full height of the room.
2. Additional Communications Equipment/Wiring Rooms

These rooms shall conform to the same requirements as the main communications equipment/wiring room as outlined in Section “A” above, except that a minimum one (1) power circuit with two (2) outlets at the base of the backboard and an isolated grounding systems with #6 AWG, minimum, bonding is required in each room. Power requirements at the equipment rack remain the same.

1. Battery Room

Some projects may require separate battery and/or UPS rooms with special facilities. Since these rooms are usually not required unless a large PBX telephone or computer system is installed in the building, the requirements are not listed here. When required, the Designer shall coordinate final requirements with the User, the FPC Project Manager, and OTS as applicable.

1. Cable Pathways
	1. Cables shall be placed in accessible voice spaces above ceiling and/or under floors unless conduit or other types of raceway systems are required.
	2. Cable drops from ceilings to workstation communications outlets shall be placed in conduit inside wall and column cavities. Surface mounted raceway on the outside of solid walls and columns, and/or **floor poke-throughs** may only be used as a last resort and require pre-approval from the User, FPC Project Manager, or OTS as applicable. **Communications/power drop-poles**, floor-duct, and under-carpet systems are not acceptable.
	3. Conduit
		1. EMT shall be used indoors unless code requirements mandate other types of raceway systems for unusual applications.
		2. RMC shall be used outdoors aboveground and in transitions from underground to aboveground.
		3. RNC schedule 40, minimum, shall be used underground directly buried in accordance with the NEC, User, FPC, and OTS requirements as applicable. The minimum depth of earth cover shall be twenty-four (24) inches. Warning tape and tracer wire shall be employed.
		4. Concrete encasements shall be used underground when required. The concrete shall be 1500 psi (minimum) poured and formed to give a minimum three (3) inch thick cover around the conduit/duct. The entire encasement shall be dyed.
		5. Road crossings shall be constructed as required by the User and the appropriate government authority, if applicable. Some roads such as city, parish, or state streets and highways require permits and special methods of crossing (cut & patch, bore, steel casing, etc.)
		6. Hand/manhole and aboveground pedestal closure designs shall be coordinated with the User, the FPC Project Manager, and OTS as applicable.
		7. The main service entrance conduits shall be provided with a minimum of two (2), four (4) inch empty conduits, minimum, stubbed up at the main backboard. The ends of these conduits shall stub-up/terminate at locations that shall be coordinated with the User and/or Telephone Company. Long radius 90-degree bends are required on all elbows installed below grade. There are other equipment requirements such as cables and/or innerduct to be pulled, the number of bends allowed, and pull box details that are usually required by the User and/or Telephone Company.
		8. Conduits installed inside walls from ceiling space to workstation wall outlets shall be one (1) inch in diameter, minimum. These conduits shall stub-up a minimum of six (60 inches into accessible ceiling space. The other end should terminate in outlet boxes consisting of 4”x4” (nominal, 2-gang) metal boxes with single-gang plaster ring recessed in the walls as required. Unless otherwise required for unique situations, the boxes shall be mounted eighteen (18) inches AFF to centerline of box for desk/wall applications, forty-eight (48) inches AFF (maximum) for wall phones/payphones, and according to all other ADAG requirements.
		9. Some projects may require continuous conduit runs from communications equipment/wiring rooms to communications outlets. This is the exception, not the rule. When it does apply, the above size and type requirements shall also apply. Conduit runs shall be designed to conform to ANSI/TIA/EIA-569 standards. For example, a maximum of 100-feet and two (2) 90-degree bends between pull boxes are allowed. Outlet bodies and outlet boxes are not acceptable as pull boxes for communications, unless they are located at the ends of conduit runs.
		10. A minimum of four (4), two (2) inch (minimum) EMT empty conduits shall be provided daisy chain linking all equipment/wiring rooms.
		11. A minimum of two (2), four (4) inch (minimum) EMT conduit sleeves shall be provided through floors daisy chain linking all vertically stacked riser equipment/wiring rooms.
		12. Pull strings shall be provided in all empty conduit runs. End caps shall be provided on all empty conduit terminations.
		13. Bushings and identification labels shall be provided on all conduit pad/slab stub-ups and ends.
		14. Where conduit runs penetrate fire or smoke rated barriers, they shall be sealed with a fire stopping compound complying with National Fire Protection Association and state Fire Marshal requirements.
2. Cable/Wire/Hardware
	1. Communications Outlets

The quantity and combination of devices on any given faceplate shall be configured by the Designer. This information, as well as location of the outlets, shall be obtained from the specific requirements of the User by the Designer and shown on the drawings. **As a minimum**, each workstation shall be initially provided with two (2) jacks having two (2) cables, all Category 6A rated. **The ANSI/TIA/EIA-568 standard is a triplex outlet (voice, data, LAN) wired with three cables. Some applications may require more. The exact configuration and rating shall be determined by the Designer in collaboration with the User, FPC, and OTS requirements. Wiring diagrams are included herein indicating some of the wiring and termination requirements.**

* + 1. Each workstation wall outlet shall consist of one (1) duplex port telecommunications outlet manufactured by Hubbell Premise Wiring, as specified by OTS or equal approved by the Designer **and** OTS.
		2. Each modular furniture workstation outlet shall consist of one (1) duplex port telecommunications outlet manufactured by Hubbell Premise Wiring, as specified by OTS or equal approved by the Designer **and** OTS, installed in the furniture base raceway punch outs.
		3. The outlets shall be equipped with any combination of different wiring devices, as required, eight (8)-pin, modular, Category 6A RJ45 jacks, coaxial type connectors, fiber optic connectors; all made by Hubbell Premise Wiring as specified by OTS or equal approved by the Designer **and** OTS.
		4. Communications outlet labeling shall be executed according to the OTS standard. Accordingly, all telecommunications outlet face-plates shall be numbered with the floor number, followed by the closet location (N, E, S, W, or C), followed by the telecommunications outlet patch panel port number taken from the total number in that closet. Telecommunications outlet face-plate numbers are to be assigned sequentially across the area covered by its designated closet. Individual jack positions are not to be labeled on faceplates. Jack positions are: “Blue” for top left (Primary Data), “White” for top right (Secondary Data),. For example, a cable serving room 1103-B, being the twenties drop from the northern most closet, would be marked on the faceplate and in the equipment room as “1N020”. Labels shall be type-printed. No hand-written labeling shall be allowed.
	1. Cable/Wire

**All computer/data/voice and riser cables shall be installed completely (placement and terminations) by qualified, experienced installers of such wiring.**

Jacket colors for all station cables shall be Blue for Primary Data, White for Secondary Data.

* + 1. The computer/data/voice station cabling shall consist of at least two (2), four (4)-pair, 24 AWG, UTP (Unshielded Twisted Pair) cables per outlet rated CMR or CMP by the NEC as required by the application. This cable shall have a rating of **Category 6A** for transmission characteristics as specified by the ANSI/TIA/EIA-568 standard “for individual components”. Addition-ally, these cables shall have “publicly advertised” performance characteristics recorded at 500 MHz and 328-feet, minimum:
			- **Power Sum ANEXT >= 58.1 dB**
			- **Power Sum AACRF >=30.2 dB**

manufacturer name and design/ model construction for the entire project. No mix-matching of brands for voice and/or data shall be allowed. Computer/data/voice station cables shall be General Cable’s “GenSPEED 10 MTP Series” or equal approved by the Designer **and** OTS.

* + 1. The telephone/riser cables shall consist of a 25 pair 24 AWG, **Category 3** rated (minimum), solid annealed copper, fully color-coded, over-lapped aluminum shield, and vertical riser or CMP rated construction, as required by the NEC and application.
		2. When required, fiber optic cables shall be provided with a quantity of twelve (12)-strands to each floor or closet, minimum. Fiber optic cable characteristics for multimode fiber shall comply with ANSI/TIA/EIA-492AAAA-A, “Detail Specification for 62.5 Core Diameter / 125 µm Core Cladding Diameter Class 1A Multimode, Graded Index Optical Waveguide Fibers”. Fiber optic cable characteristics for single-mode fiber shall comply with ANSI/TIA/EIA-492CAAA, “Detail Specification for Class IVa Dispersion-Unshifted Single-mode Optical Fibers. All fiber optic cable shall be loose tube or tight bound type rated CMR, or CMP by the NEC as required by application and manufactured by Corning, or equal approved by the Designer **and** OTS. Each manufacturer’s name specified shall be accompanied with a model, series, or type name/number, specification sheets, and sample of the product for consideration. **Fiber optic cable shall be installed completely (placement and terminations) by factory certified installers of such wiring.**
	1. Connection Hardware

**All Category 6A and fiber optic termination panels, connectors, and hardware shall be mounted and terminated by factory certified installer of such components.**

* + 1. Data UTP patch panels mounted on relay racks shall be provided in the communications equipment/wiring rooms and connected and arranged in color coded fields as required by OTS - see wiring diagrams herein. Ports on all blocks and panels shall be terminated in sequential alphanumeric order with each port individually labeled for uniform location identification across each color coded field. The panels shall be 48-port / 2-rack space style, provided in quantities (as required) and be equipped with the necessary integral quantity (as required plus 25% spares) of eight (8)-pin, modular, Category 6A compliant RJ45 ports with 110 type wire connectivity, and manufactured by Hubbell Premise Wiring, as specified by OTS or equal approved by the Designer **and** OTS. All Category 6A rated components shall have EIA/TIA 568-B pin-out. See wiring diagrams herein.
		2. Voice UTP shall be terminated on 110 type patch panels and data UTP on 110 type patch panels (see Section “a” above for specifications), **all Category 6A rated,** as required, mounted on backboards, frames, and distribution racks, as required, and connected and arranged in color coded fields as required by OTS - see wiring diagrams herein. Ports on all blocks and panels shall be terminated in sequential alphanumeric order with each port individually labeled for uniform location identification across each color coded field, including the data panels. All connecting hardware shall be manufactured by Hubbell Premise Wiring, as specified by OTS or equal approved by the Designer **and** OTS.
		3. All fiber optic cables shall be terminated in patch panels mounted on the backboards or distribution racks. The termination panels shall be equipped with locking doors, tamper-proof side-panel covers, and integral splice tray mounting brackets, trays, and hardware to provide for fusion splicing of pigtails. The patch panels shall be Corning “Pretium” type with appropriate bulkhead panels and blank fillers, as specified by OTS or equal approved by the Designer **and** OTS.
		4. Multimode fiber optic termination connectors shall be field terminated epoxy/polish-type ceramic SC, or LC style (as required) as manufactured by Corning, AMP, Comm/Scope, or approved equals by the Designer **and** OTS. Each manufacturer’s name specified shall be accompanied with a model, series, or type name/number, specification sheets, and sample of the product for consideration. “No-Polish” or “Cleave, Sleeve, & Leave” type connectors shall not be allowed.
		5. Singlemode fiber optic termination connectors shall be factory terminated UPC polished pigtails with ceramic SC, MT-RJ, or LC style (as required) ends manufactured with Corning optic fiber (Corning glass) as specified by OTS or equal approved by the Designer **and** OTS. Each manufacturer’s name specified shall be accompanied with a model, series, or type name/number, specification sheets, and sample of the product for consideration.
		6. Relay racks shall be 19"W x 84"H (nominal) black aluminum free standing with bolt-down capability to any floor and grounding lugs connected to building ground, EIA Spec. No. RS-310C, or approved equal by the Designer.
	1. Testing
		1. Testing shall be performed in the presence of a representative as designated by the Designer and/or FPC Project Manager. Sufficient advanced notice of test dates shall be provided to coordinate testing.
		2. All voice (station, riser & outside plant) cables and associated connection hardware shall be tested and documented by the Contractor. The test procedure shall demonstrate as a minimum:
			+ Continuity (more than 2,600 ohms is considered open)
			+ Shorts (60,000 ohms or less is considered a short
			+ Proper polarity (top and ring correct)
			+ Proper termination (splits & wrong terminations)
			+ Grounded conductors (60,000 ohms or less to ground is considered a fault)
			+ Detection of AC or DC power on any conductor (power fault test)
			+ User’s equipment must function normally when connected to the installed wiring.
		3. All UTP data station and riser cables and associated connection hardware shall be tested to certify the performance category of the link as installed. All Category 6A rated station cables shall be tested in accordance with procedures laid out in ANSI/TIA/EIA-568 for the “Permanent Link”. Any cable that fails testing shall be reported along with the procedures used to rectify the failure (IE. Replaced cable, reterminated the jack, etc.). Contractor tests shall utilize an ANSI/TIA/EIA-568-B Level III compliant cable tester (Fluke DTX or equal). Electronic results for each UTP Category rated four pair cable in Portable Document Format (PDF) shall be submitted Flash Drive as a part of the Contractors as built project performance acceptance records. In addition to the above information the documentation shall include a pass/fail indication for the specified cable, the test date, the serial number and software version of the scanner used, and a copy of the calibration certificate of the scanner. File formats requiring proprietary software applications for reading the results shall not be acceptable. If the vendor requires additional information concerning the testing requirements, refer to the TIA/EIA ANSI/TIA/EIA-568 Telecommunications Building Wiring Standard. **Category 6A rated testing shall be executed by factory trained technicians with ample field experience. Technician certification shall be submitted to the Designer with the test documentation.**
		4. The Contractor shall test, certify and document each fiber optic strand. **Fiber optic testing shall be made by factory trained technicians with ample field experience. Fiber technician certification shall be submitted to the Designer with the fiber test documentation.** Tests shall include attenuation and polarity of the installed cable plant with an optical loss test set (OLTS) the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR), and the fiber endfaces with a fiber optic videoscope. All tests performed shall be documented OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels, and OTDR traces, event tables, and length measurements for multimode and singlemode links and channels. Each cabling link shall be in compliance with the following test limits and procedures:
			1. Optical loss testing for backbone link or channel with attenuation calculated by formulas specified in ANSI/ TIA/EIA-568, and resulting in a maximum allowable connector loss <= 0.5dB, maximum allowable splice loss <= 0.1dB, both exceeding that of the standard and as specified by OTS.
			2. Optical loss for the horizontal fiber link attenuation shall be based on the maximum 90-meter distance and may be tested using a fixed upper limit based on the loss of two connector pairs (one at the telecommunications outlet/connector and one at the horizontal cross-connect) plus attenuation coefficient for 90-meters of optical fiber.
			3. Optical loss for centralized multimode link attenuation shall be based on the maximum 300-meter distance and may be tested using a fixed upper limit based on the loss of two connector pairs (one at the telecommunications outlet/connector and one at the horizontal cross-connect) plus attenuation coefficient for 90-meters of optical fiber.
			4. All multimode fiber optic links or channels shall be tested and documented at 850 and 1300 nm in accordance with ANSI/ TIA.EIA-526-14A, Method C, Three Reference Jumpers, standard.
			5. All single mode fiber optic links and channels shall be tested and documented at 1310 and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.3, Three Reference Jumpers, standard.
			6. OTDR trace plots shall be performed at 850 and 1300 nm for multimode and 1310 and 1550 for single optical fibers using both a launch and receive cable in each span. Reports shall include the full trace plot with cursors place appropriately to document the overall length, the attenuation of every event in the full trace, and the overall attenuation of the link/channel.
			7. Test reports shall be presented to the OTS Project Manager and the User in Portable Document Format (PDF) and native OTDR trace files on Flash Drive as a part of the Contractors as built project performance acceptance records.
1. General
	1. Applicable Documents – The following current ratified publications of standards and codes shall apply to all telecommunications related work:
		1. ANSI/TIA/EIA Standard for Commercial Building (568, 569, 570, 606, 607, TSB’s)
		2. BOC’s and AT&T Plant Standards
		3. BICSI: Telecommunications Distribution Methods Manual (TDMM); Outside Plant Design Reference Manual (OSPDRM); Information Transport Systems Installation Reference Manual (ITSIMM)
		4. FCC Part 68
		5. National Electric Code (NEC/NFPA-70)
		6. Other State Adopted Codes
		7. Underwriters Laboratories
		8. IEEE P1100 (Emerald Book)

\*In the event of ambiguities among the above documents, the more stringent shall prevail.

* 1. Maintenance Considerations

All wiring shall be installed to maximize the safety, maintainability, and performance effectiveness of maintenance personnel and manpower. Terminations and splices shall be placed and supported with convenient accessibility so as to maximize the ease and efficiency with which it can be maintained. All cables in equipment/wiring rooms shall be provided with ten (10) feet long maintenance loops, when required, to facilitate future modifications.

**Definitions of Terms Used in this Section**

A Amperes or Amps

ACO All Communications Outlet

ADAAG Americans with Disabilities Act Accessibility Guidelines

AFF Above Finished Floor

ANSI American National Standards Institute

AWG American Wire Gauge

BOCs Bell Operating Companies

CM Communications

 (cable, general purpose)

CMP Communications Plenum

 (cable, fire rated)

CMR Communications Riser

 (cable, fire rated)

EIA Electronics Institute of America

EMT Electrical Metallic Tubing

FCC Federal Communications Commission

FPC Facility Planning & Control

HVAC Heating, Ventilating, and Air Conditioning

IBM International Business Machines

IEEE Institute of Electrical and Electronics Engineers

LAN Local Area Network

NEC National Electrical Code

nm nanometer

OIS Office of Information Services

OTDR Optical Time Domain Reflectometer

OTS Office of Technology Services

PBX Private Branch Exchange

RMC Rigid Metallic Conduit

RNC Rigid Nonmetallic Conduit

TIA Telecommunications Institute of America

UPS Uninterruptible Power Supply

UTP Unshielded Twisted Pair

VAC Volts Alternating Current 

**This section includes four (4) pages of drawings included in a separate “docx” file.**