Florida State University

Telecommunications Infrastructure Standard

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THE FLORIDA STATE UNIVERSITY
INFORMATION TECHNOLOGY SERVICES

INTRODUCTION TO….

ITS' TELECOMMUNICATIONS INFRASTRUCTURE STANDARD

Information Technology Services (ITS) is proud to release the latest update to the FSU Telecommunications Infrastructure Standard. ***Release2.4.*** A Telecommunications Infrastructure Standard for FSU has been in existence for over 19 years, and has undergone 17 revisions. ITS in conjunction with the departments of Network Computing Technology, Network & Communications Technology and Facilities Design and Construction has evolved and developed the Florida State University Telecommunications Infrastructure Standard.

The mission of ITS is "to provide an effective, comprehensive and secure technology infrastructure to deliver the highest quality and sustainable information and technology provider. ITS strives to engage the University Community in support of the University's mission of teaching, research, creative endeavors and service."

Additionally**,** "ITS has the responsibility of design, development, approval, installation, maintenance and management of telecommunications wiring and infrastructure in all FSU owned and leased buildings and properties. This would include but is not limited to voice, video and data infrastructure with fiber, copper or coaxial cabling." **This also includes telecommunication rooms, raceways, conduit systems, duct banks and the campus telecommunications manhole system. Such responsibility implies a first right of refusal by ITS on all wiring design, development, approval, installation, maintenance and management.**

ITS works closely with many departments at FSU to assure that this mandate is carried out. We do this in two main ways.

a. ITS in conjunction with Facilities Planning and Facilities Design and Construction review design documents in several phases of completion to assure their compliance to local and national standards and codes. Typically, schematics, design development, 50% and 100% drawing are all reviewed and input on changes are implemented throughout the process.

b. Design professionals, departments and electrical engineers have ready access to this standard to reference when questions or conflicts should arise in any construction or renovation process. Through close interaction during the design of new projects, the review of renovation projects and future campus planning the entire design team assures that uniform, cost effective and high quality telecommunications infrastructure are consistently installed.

We are pleased to have this valuable tool available to you as you design telecommunications infrastructure here at FSU. Please feel free to contact our office when needs arise. Our goal is to be available to assist you at any time before or during the decision making process.

Thank You

REVISION HISTORY

Subsequent modifications are listed below:

Rev	Date	Change
1.0	6/12/92	-Document created with IRM assistance
1.1	7/15/92	-Minor editorial changes
1.2	8/26/92	-ADA Act added to standard compliance
1.3	9/6/92	-Level 5 wiring added (CDDI)
1.4	9/16/92	-Revision foot note on each page -Special usage room requirements -Table of contents
1.5	10/6/92	-Minor editorial changes and format changes -Clarify high voltage conduit conflicts in relationship to telco conduit -Clarify conduit run lengths vs location of pull boxes -Change 100 m individual conduit length runs to 90 m -Define MDF vs IDF -Redefine equipment room sizes (IDF and MDF) -Clarify contiguous wall space requirements MDF vs IDF -Add information on how to key lockable MDF and IDF panels -Add RFI/EMI electrical, overhead clearances conflicts to equipment room -Remove all 20 mbps references and replace with 100 Mbps -Remove all specific references to vendors in data wiring sections -Add 25 pair level 5 riser to vertical riser section -Add EIA/TIA TSB-36 and TSB-40 to standards -Identify and outline customer premise equipment (CPE) room
1.5 (a)	11/18/92	-Quantify high voltage electric conduits better -Change DRAFT to Draft in Progress -Better define hand hole in B. MANHOLE section -Quantify when the OTC will start record keeping and assignment of any cables within the OSP system -Change qty 5 ea. 1" to qty 3 ea. 1 " in Zoned Conduit System section -Add diagram of ceiling race way and spec out -Add laboratories to special usage areas -Rewrite section, Conduit and Manhole System, F. Conduit Run Length -Change MDF and IDF room dimensions to accommodate a longer single wall -Add table showing linear , contiguous wall space for MDF's -Remove foot note on linear , contiguous wall space for MDF's -Minor editorial changes
1.6	11/30/92	-Change all mbps references to Mbps -All uninterruptible power supply to emergency backup -Minor editorial changes -Place all vertical riser conduit next to wall with plywood -Add open office space/modular furniture to special application areas .....

-Reformat outline in MEDIA section
-Reformat content of MEDIA section to better reflect continuity of specifications
-Change references to level 5 STP to read level 4 STP
-Change reference to vertical rows in TERMINATION section to read vertical columns

1.6 (a) 12/1/92 -Add overhead racking Attachment 6 and reference CONDUIT AND MANHOLE SYSTEM, D, 3.
-Minor editorial changes

1.6 (b) 1/6/93 -Replace attachment # 1,2,3,4,5 with new revision
-Minor editorial changes

1.6 (c) 4/22/93 -Editorial changes
-Cover page changes
-Fiber optic cable optical performance changes

1.6 (d) 6/1/93 -Add homerun conduit from fire and alarm panels to IDF rooms

1.6 (e) 10/25/93 -Deeper gang boxes at termination end of conduit runs (2 1/2" deep)
-Clarify that no obstructions shall go through ceiling raceways
-Clarify that no janitor's rooms shall be placed in IDF or MDF rooms
-Clarify that ceiling raceway shall be used in conjunction with conduits stubbed above ceiling and ran back to the ceiling raceway.
-Conduits run in slabs or other concrete structures shall be PCV Sch 40.

1.6 (f) 6/10/94 -Remove "Draft in Progress" from front title sheet
-Clarify voice cabling specification to state (CAT3)
-Clarify that all cabling installed under grade shall be fill cable
-Change single mode fiber connectors to SC

1.6 (g) 3/13/96 -Ceiling distribution systems design preference rearranged
-Define the physical size of pull boxes in horizontal conduits runs
-Covers for 4" square gang boxes defined
-Replace Newton cable tray with Atlas Center Hung Cable Tray
-Add Telecom Room (TC) terminology to vertical distribution section
-Remove verbiage on painted/sealed floors in MDF/IDF rooms. Replace with VCT covering only.
-Add room layout verbiage to equipment room requirements
-Addition of wireless verbiage in OTHER section of specification
-Added verbiage to INSPECTION AND TESTING INSTALLATION section to assure test results get to OTC
-MASTER PLAN section renamed to CAMPUS MASTER PLAN
-Added more information outlets in classrooms
-Minor editorial changes
-Change AT&T 110 to Krone 66 type terminal devices

2.0 2/1/2000 MAJOR UPDATE
- Addition of underground entrance conduit recommendations.
- Addition of spare conduit to requirement for recommended entrance conduit counts.
- Added references to building entrance buried and aerial cable section.

- Added manhole interior hardware list.
- Added concrete strength for manholes – 3500 psi.
- Added outside plant conduit duct bank requirements.
- Added special outside plant applications.
- Added recommended design guidelines to horizontal pathway /conduit.
- Added design guidelines to horizontal pathway / cable tray.
- Added elevator conduit requirements to horizontal pathway special consideration section.
- Added ADA requirements to horizontal pathway special consideration section.
- Changed Vertical Riser section to Intrabuilding backbone Riser Conduit System.
- Added location, height and installation recommendations for riser sleeves to riser conduit design section.
- Changed section II from Equip rooms to telecom rooms and equip rooms.
- Changed name of main telecom room from MDF to MTC.
- Changed name of telecom rooms from IDF to TC.
- Added serving floor space recommendations for TC's.
- Added restrictions on other utilities and services sharing MTC and TC's.
- Changed wall coverage of plywood in MTC and TC to include all walls.
- Added installation requirements of plywood on walls in MTC and TC.
- Added lighting requirement section for MTC and TC.
- Added power requirements section for MTC and TC.
- Added room size recommendation section for MTC and TC.
- Added work clearance section for MTC and TC.
- Added RFI/EMI section for MTC and TC.
- Added pathway installation section for MTC and TC.
- Added ceiling section for MTC and TC.
- Added location section for MTC and TC.
- Changed door height and optional lock-box to entry section for MTC and TC.
- Added vertical stacking of rooms and conduit/sleeve recommended layout for MTC TC rooms.
- Added Fire Protection section to MTC and TC.
- Added environmental control section to MTC and TC.
- Added wall lining section to CPE rooms.
- Added lighting section to CPE rooms.
- Added power section to CPE rooms.
- Added rooms size section to CPE rooms.
- Added RFI/EMI section to CPE rooms.
- Added pathway section to CPE rooms.
- Added ceiling section to CPE rooms.
- Added locations section to CPE rooms.
- Added entry section to CPE rooms.
- Added conduit alignment to room layout of CPE rooms.
- Added fire protection section to CPE rooms.
- Added environmental section to CPE rooms.
- Added depth and plywood requirement for inside of terminal boxes.
- Added lighting section to CPE rooms.
- Added Power section to CPE rooms.
- Added grounding section to CPE rooms.
- Added configuration of conduits to CPE room section.
- Added outside plant section to media chapter.

- Added topology section to Intrabuilding backbone distribution cabling section.
- Specified data cables are used with special circuits.
- Specified voice backbone riser cable shall be Category 3 or higher.
- Added codes and standards referencing riser cable.
- Added CATV coaxial intrabuilding backbone section.
- Added Optic Fiber backbone riser section.
- Added Special data applications riser section.
- Added code considerations for intrabuilding backbone riser cables.
- Changed Riser Termination Wiring section to Intrabuilding Backbone Cross-connection.
- Added topology information to Intrabuilding backbone cross-connect section.
- Added voice jumper cross-connect guidelines to Intrabuilding backbone cross-connect section.
- Added Fiber Optic Jumper section.
- Added Data circuits cross-connect section.
- Changed "Wiring Distances" section to be "Intrabuilding Backbone cabling lengths".
- Added cable length chart for copper and fiber optics.
- Added cross-connect equipment length.
- Added Fiber maintenance loop section.
- Added Intrabuilding backbone cable bend radius section.
- Added specification for ANSI/TIA/EIA 568A and 568B under Horizontal Cabling section.
- Changed minimum station outlet for voice to be category 3 or higher.
- Added to data outlet configuration performance guidelines for category 5E jacks.
- Changed CATV horizontal cable from RG59 to RG11.
- Added conduit/cable tray requirement for CATV cable installation.
- Added conduit/cable tray requirement for fiber optic multi-mode and single mode horizontal cable.
- Removed section on jumper wires for data.
- Changed "Horizontal lengths" section to "Horizontal cabling system design considerations".
- Added horizontal cabling link and channel lengths section.
- Added cabling practices (installation) section.
- Added horizontal cable slack section.
- Added code requirements to Terminations section.
- Added Wall and relay rack layout considerations section.
- Made changes to cable routing section including layout and use of cable management devices.
- Added voice riser termination device S66M1 blocks.
- Added use of data patch panel as termination device for data copper riser cables.
- Added CATV riser termination section.
- Changed horizontal outlet configuration to single gang faceplate with a minimum of four ports.
- Added removed Ortronics IMO reference from outlet section.
- Added new voice jack insert termination configuration section.
- Added new data jack insert termination configuration section.
- Changed CATV jack insert to include snap in insert.
- Changed "optional outlets" section to "additional jack inserts terminations".

- Added customer option for additional jacks to "additional insert terminations section".
- Added ADA requirements to terminations section.
- Added "horizontal voice cable termination" section.
- Changed termination recommendations for voice station cables.
- Added horizontal data cable termination section.
- Removed Krone 66 type block as termination device for data horizontal cables.
- Added CATV horizontal cable termination section.
- Added fiber horizontal termination section.
- Added drip loops, use of D rings and jumper lengths for voice cross connects in horizontal cross-connect section.
- Added horizontal data circuits cross connects section.
- Added horizontal fiber jumper section.
- Changed cross-connect color coding figure in labeling section.
- Added backbone riser terminal labeling.
- Added labeling guidelines for patch panels and voice, data and catv outlets.
- Changed horizontal outlet numbering scheme.
- Added "handwritten labels are not recommended".
- Added "Telecommunications Grounding and Bonding" section.
- Added OTC "Recognized Hardware, Media and termination Materials" section.
- Added "has developed both a ten year and twenty year plan" to section on campus master plan.
- Added 18 new applicable codes and standards to the "Applicable codes and standards" section. Added "Glossary of terms" section.
- Added Illustrations section.
- Added Illustrations 1 thru 7.

2.1 7/25/00

I.D.1.a.9 - Added 4"W x 16"L x 3"D (Raco 956 or Equiv) to Horizontal pathway.
I.D.1.a.10 - Added flush cover to 4"x4" wall box (Raco 787 or Equiv).
I.D.1.a.11 - Changed wall box for paytelephones, wall phones etc to 4"x4".
- Added B/C grade plywood as an option for backboard material.
I.D.2.f - Added Card security / card swipe conduit requirement.
- Removed Thin and thick wire Ethernet from media section.
- Changed Prestolite to Krone in recommended materials section.
- Changed Siecor to Corning in recommended materials section.

2.1 10/18/00 - Added minimum size opening for access panels below pull boxes in hardcoat ceilings. D.1.a.9

2.1 02/21/01 - Change to define entrance conduit requirements. A total of 2w4 (2-4") conduits as a minimum into any building under 10,000 square ft usable floor space. Conduit duct banks entering buildings of over 10,000 square feet shall be sized with the assistance of the Office of Telecommunications.

2.2 03/30/01 - Changes made to various areas to clarify conduit installation design criteria including the attachment to walls, turning down conduits to TBB, floor height, etc. To eliminate confusion the term closet was replaced with room.

2.2a 07/24/01 - Change Section I.B. MANHOLES from "round lids no less than 32 inches" to read "round lids with a diameter of 32-1/2 inches."

2.2a 08/22/01 - Change Section I.B. MANHOLES from " New manholes shall be 8'x8'x8' deep octagon" to" New manholes shall be 8'x8'x7' deep octagon".

2.2a 10/25/01 - Change Section III.C.4.a.2 (Horizontal cabling practices) to read " Do not cinch cable bundles tightly. Velcro straps should be used on all data cable bundles and

not cable ties to avoid overtightening and deformation of the cable jacket. Avoid deforming the jacket.

2.2b	8/24/02	-	Addition to Section I.D.2.g "Floor Outlets – Floor outlets shall be multiservice recessed floor boxes, Wiremold/Walker part number RFB4-SS with RFB-4TKO-SS internal communications brackets. Any equivalent box shall be approved in advance by the FSU Office of Telecommunications."
2.2b	11/5/02	-	Added specifications and restructured Horizontal Pathway Sections D.1.b Secondary Design Choice - Ceiling Raceway and D.1.c.Third Design Choice – Zone Conduit.
2.2b	2/14/03	-	Restructured Horizontal Pathway Sections D.1.b Secondary Design Choice -. Zone Conduit. Third Design Choice –Ceiling Raceway and D.1.c
2.2b	2/14/03	-	Misc corrections. New description of clearances in Communications rooms.
2.2c	7/8/03	-	Sec I.D.1.a Horizontal Pathway, added specifications of catv conduit to be ¾".
2.2c	7/8/03	-	Sec II.B Power, Added A/C outlet to be installed in each comm. Room on end of Relay Rack.
2.2c	7/8/03	-	Sec III Approved Media, changed OSP entrance Fiber to the standard of 12 single mode and 6 multimode 50 micron fibers.
2.2c	7/8/03	-	Added new labeling standard 606A
2.2d	2/5/04	-	Add description of Code Blue installation requirements.
2.2d	4/27/04	-	I.D.2 Added Access / Security Door Raceway requirements
2.2e	6/18/04	-	IV.C.1.b.1a Addition of angled faceplates as a standard in all new residential halls
2.2e	8/3/04	-	Added specification for inside Code Blue Emergency phones.
2.2e	9/30/04	-	II.D.2 Added electrical specifications for Access systems.
2.2e	11/10/04	-	Changed station outlet fiber option standard from 62.5/125 to 50/125 micron SX+.
2.2e	11/10/04	-	Riser standard for fiber riser was changed from 62.5/125 to 50/125 micron SX+.
2.2e	11/10/04	-	Removed MT-RJ jumpers and changed jumper standard to 50/125 micron, SX+.
2.2e	11/10/04	-	Added Standards for fiber connector panels.
2.2e	11/10/04	-	Added fusion splicing as standard for termination of fiber.
2.2e	11/10/04	-	Add Sub-Section B – "OSP Termination" under Termination Section.
2.2e	11/10/04	-	Added new standard Fiber materials and hardware to materials List.
2.2f	04/11/05	-	Added New elevator telephone template.

2.2g	07/27/05	- Changed Sec II Telecom Rooms requirement for 2 – 4" conduits between telecom rooms on same floor to 1 – 4" minimum.
2.2g	05/22/06	- Changed Emergency Blue Light Phones from Code Blue to Talk-A-Phone
2.3	06/20/12	- The entire Telecommunications Infrastructure Standard has been restructured and reorganized with this latest revision. The changes are too numerous to list here. Only the major changes will be referenced here for the sake of brevity and clarity. - Cover sheet changed to reflect that the Office of Telecommunications (OTC) is no longer referenced. The department has been re-named and is now referred to as ITS, Network & Communications Technology (NCT) - Table of contents was revised to reflect the revisions - A new section begins the document and is called "Architectural / Engineering Design and Construction Documentation" - The section previously referred to as "Conduit and Manhole System" is now the "Outside Plant & Related Infrastructure" section. - A new section, "Inside Plant & Related Infrastructure" has been included which upgrades the recommendations for horizontal pathway distribution among other revisions. It also includes raceway requirements for wireless access and security systems. It changes the minimum conduit size requirements for telecommunications outlets from 1" to ¾", along with new requirements for cable tray and zoned conduit systems. - Previous sections and paragraphs pertaining to the installation and termination procedures for telecommunications cabling have been eliminated, as have any illustrations pertaining to same. - Illustration # 2 is not used.

NOTE:

1) Versions 1.4, 1.5, 1.5 (a) and 1.6 were made with input from the FSU Networking Committee
2) Revision 1.6 (c) was made with input from the IRM Office at FSU
3) Version 1.7 will include a glossary of terms

I. ARCHITECTURAL / ENGINEERING DESIGN and CONSTRUCTION DOCUMENTATION

A. CAMPUS MASTER PLAN

FSU has developed both a ten year and twenty year campus master plan which will include documentation of telecommunications service infrastructure for existing and future buildings. New construction and renovation projects planners should reference these plans and budget for the costs associated with the installation of new OSP infrastructure to support new facilities. Planners should work closely with ITS and Facilities to determine the best overall OSP design.

B. CONSTRUCTION DOCUMENTS

1. The ITS Network Infrastructure design team has a responsibility to assist in the design for all telecommunications facilities on the FSU campuses. We work closely with Facilities Planning and Facilities Design and Construction as construction documents are developed. The goal is to end up with a design for the building occupants which will meet their current and future infrastructure and networking needs. We ask to be included during all phases of design including schematic, design development, 50% and 100% construction documents. We will also ask that we be consulted during the development of change orders which could conceivably affect telecommunications systems design, as determined by the Facilities project manager in coordination with ITS Network Infrastructure. Prior to the beginning of construction, the A/E along with Facilities Planning – Space Management shall review and confirm that room numbers identified on the construction documents are accurate, approved by Space Management and not subject to wholesale changes during construction.

    a) Prior to the beginning of any campus construction project, a complete set of
    b) 100% construction documents should be provided to ITS Network Infrastructure for our files.

C. INSPECTION AND TESTING DURING AND AFTER INSTALLATION

Frequent inspections should be conducted during the installation of the new services and wiring. These inspections should be conducted jointly by the Facilities' project manager and the staff person directly responsible for building services. It is important that the design professional work with IT'S, and the University Project Manager to outline the specific tests the contractor must perform to gain acceptance of the new services. All finished test and inspection results should be delivered to ITS.

D. AS-BUILT DOCUMENTATION

A complete set of as-built documents should be submitted to ITS for our files as well. As with Facilities, these documents are critical to the coordination of room numbers, changes in floor plans and other changes that might affect current or future infrastructure and networking needs for the facility and its occupants.

II. OUTSIDE PLANT & RELATED INFRASTRUCTURE

A. MANHOLE SYSTEM

1. FSU has an extensive network of telecommunication manholes throughout campus. The facility design professional should assure all renovations and new construction projects connect to this system where needed. Any new manhole number assignment shall be coordinated through ITS' Network Infrastructure.

2. The strength of concrete used for manholes shall be at least 3,500 PSI

3. New manholes shall be 8'x8'x7' deep octagonal type; lids shall be round with a diameter of 32 1/2 inches. Hand holes (small manholes) are not acceptable unless approved by ITS. Square lids are not permitted. Lids should have pull-slots for easy removal, shall be DOT H20 traffic rated, and labeled "TELECOMMUNICATIONS" or "COMMUNICATIONS." Grounding shall be included in the design of all OSP systems, including manholes. The distance between manholes shall not exceed 300 feet and should be void of 90 deg. bends. However, if 90's are necessary, they shall be sweeping 90's and the distance between manholes shall be reduced by 30 ft. for every 90 deg. bend included in the run. No more than two 90 deg. bends shall be installed between any two pulling points.

   a) Manhole interior hardware must be galvanized. Manholes should be equipped with the following:
   b) Bonding inserts and struts for racking.
   c) Pulling Eyes at least 7/8" in diameter.
   d) An 8 inch floor sump.

B. OUTSIDE PLANT CONDUIT (INTER-BUILDING DUCTBANKS):

The University has a system of underground duct-banks throughout its property used for providing telecommunications services to University buildings. The use of conduit space in the Telecommunications duct-banks shall be managed by ITS' Network Infrastructure department.

1. Outside Plant duct-banks shall meet the following requirements:

   a) The recommended size for conduit used between manholes is 4 inches in diameter. Duct-banks interconnecting manholes shall consist of a minimum of 6 - 4" conduits (6W4); however, 8 – 4" conduits are recommended in most applications. Consult with ITS Network Infrastructure design team during design to determine the best solution for the project.

   b) Conduit should be buried at a minimum depth of 36 inches (or to meet local codes) and encased in concrete rated at a minimum 2,500 psi. Where conduit will be placed in a roadway, 3,500 psi rated concrete should be used in conjunction with a 10 & 1 mixture (concrete and sand) from the top of the duct-bank to the underside of the road base. Special circumstances may require more stringent measures and must be reviewed and approved by ITS design team. To minimize the chance of accidental dig-up, place a plastic warning tape a minimum of 18 inches below the surface and directly above the conduit. It is recommended that Telecommunications conduit not to be placed in joint trenches with other utilities. When this is necessary, the design professional shall contact the ITS project manager for design and coordination. Other utilities shall not be placed in telecommunications ducts.

c) Do not include more than two 90 degree bends. Bends must be long sweeping bends with a minimum radius not less than 10 times the diameter of the four inch conduit. LB's shall not be used.

d) Conduit shall be corrosive – resistant and one of the following type:
- Rigid galvanized conduit
- Plastic polyvinyl chloride (PVC) Schedule 40 or equivalent.

e) A #3/0 AWG copper ground wire shall be placed in the trench above the concrete encased duct bank. Telecommunications conduit shall not be poured and encased in the same concrete as the campus medium voltage (5kv-12kv) electrical conduit system. A minimum or 18" of fill should be placed between the two duct-banks unless an exception is approved in writing by ITS.

f) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

g) Provide a pull cord having a metallic member (tone tape) with a minimum test rating of 200 lbs. pulling strength in each conduit. Reference: Arnco DL WP12LC Tone Tape or equivalent.

2. Hand-holes / Pull-Boxes – Where hand-holes / pull-boxes are used, they shall be installed using a weather-proof door/panel or cover arranged for access from the top. Avoid installation adjacent to sprinkler system discharge. Conduits should be installed with sweeps. Do not use a pull-box in lieu of a bend. Telecom Pull boxes SHALL NOT be used by other utilities.

C. SERVICE ENTRANCE:

The Service entrance is the route by which Telecommunication service cables enter a building. There are three types of service entrances: 1.) Underground Entrance - buried conduit (FSU responsibility); 2) Buried Entrance - cable buried in a trench (Service Provider responsibility); 3.) Aerial Entrance - cable drop from a pole to a building. (Service Provider responsibility)

Service entrances shall terminate at the main telecommunications room / terminal room location of the building; usually on the ground floor or basement of a facility.

1. Underground Entrance – The following recommendations are made for underground entrances:

a) The recommended size for conduit used in an underground entrance is 4 inches in diameter. A spare conduit of equal size is recommended, thus giving a total of 2 - 4" conduits (2W4) as a minimum into any building under 10,000 square ft. usable floor space. Conduit duct-banks entering buildings of over 10,000 square feet shall be sized using Table 1 on Page 7, and/or with the assistance of the ITS Network Infrastructure design team.

b) Conduit should be buried at a minimum depth of 36 inches (or to meet local codes) and encased in concrete rated at a minimum 2,500 psi. Where conduit will be placed in a roadway, 3,500 psi rated concrete should be used in conjunction with a 10 & 1 mixture (concrete and sand) from the top of the duct-bank to the underside of the road base.

Special circumstances may require more stringent measures and must be reviewed and approved by ITS design team. To minimize the chance of accidental dig-up, place a plastic warning tape a minimum of 18 inches below the surface and directly above the conduit. It is recommended that Telecommunications conduit not to be placed in joint trenches with other utilities. When this is necessary, the design professional shall contact the ITS project manager for design and coordination. Other utilities shall not be placed in telecommunications ducts. A #3/0 AWG copper ground wire shall be placed in the trench above the concrete encased duct-bank. Telecommunications conduit shall not be poured and encased in the same concrete as the campus medium voltage (5kv-12kv) electrical conduit system. A minimum or 18" of fill should be placed between the two facilities or as agreed upon during the design phase.

c) Entrance conduit must not include more than two 90 degree bends without a pull box, hand-hole or manhole (as appropriate). Underground 90 deg. ells shall be sweeping and shall transition from PVC to RGC (rigid galvanized conduit) below grade before entering building. Bends must be sweeping bends with a radius not less than 10 times the inside diameter of the four inch conduit. Grounding bushings and connectors are required. NO LBs will be considered.

d) Conduit shall be corrosive – resistant and one of the following type:
- Rigid galvanized conduit
- Plastic polyvinyl chloride (PVC) Schedule 40 or equivalent.

e) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

f) Conduits shall have a pull cord having a metallic member (tone tape) with a minimum test rating of 200 lbs. pulling strength in each conduit. Reference: Arnco DL WP12LC Tone Tape or equivalent.

g) When terminating entrance conduit within a building, design conduits entering from:

- Below grade - to extend 4 inches above the finished floor.
- Through ceiling - to extend to 8 1/2 feet above finished floor.
- Through walls - install with sweeps not less than 10 times the inside diameter of the conduit to turn conduit down on wall to extend to 8 1/2 Feet above finished floor, or at a point above the eight (8) foot tall TBB.

h) Provide and install end bells to seal the inside-the-building and manhole ends of all conduits to prevent rodents, noxious gases and water from entering building and telecom rooms.

i) All entrance conduits shall be securely fastened to the building so they can withstand a typical placing operation.

j) Telecommunications conduits shall be used for telecommunications cables only and shall not be used for joint use with electrical utilities.

Redundant service entrances with diverse routes are recommended for buildings which provide critical services such as research facilities, health care facilities, police stations, fire stations and other similar buildings.

Table 1 - Recommended Quantity of Service Entrance Conduits

Gross Building Floor Area (x 1000 Ft. Sq.)	No. Of Conduits (includes spare)
0 - 10	2 (minimum)
10 - 50	4
50 - 100	6
100 - 200	8
200 - over	size in coordination with ITS

2. Direct Buried Cable Entrance - This method is discouraged and may only be used for temporary service to a building. Design for buried cable should be coordinated with ITS.

3. Aerial Entrance - This method too should only be considered for temporary service, or if an underground or direct buried service cannot be made available to the site. When approved, pole sizes, cable clearances and cable sizes should allow for future growth and flexibility. The installation of aerial cable entrance facilities and associated supporting structures shall be coordinated with ITS.

   - Design professionals and contractors shall contact ITS' Network Infrastructure design team for evaluation and determination of exceptions to design guidelines for entrance conduit.

D. EMERGENCY BLUELIGHT TELEPHONE (EBLT) CONDUIT

The FSU main campus has over 300 EBLT devices located throughout the property. Each new campus building project will typically incorporate one or more EBLT's into the design. The exact location of these instruments will be determined under the guided recommendation of the FSU Public Safety Office with the FSU Police Department. The service conduit(s) will be provided under the direction the Architect/Engineer (A/E) during the design of the new construction project.

1. Each EBLT requires a single 2" PVC schedule 40 telecommunications conduit. No interconnections to other EBLT's. are permitted. The conduit should originate from the nearest building TR. This conduit will be located at a minimum depth of 30" with marker tape placed 18" below grade and above the conduit. A 12" X 12" traffic rated junction box shall be provided within 6 feet of the EBLT where the 2" conduit will terminate. 1 – 1" conduit will be installed from this junction box into the EBLT pad. The conduit run shall not exceed 200 ft. from the point of origination to termination. Conduit and boxes identified here are the use of telecommunications cabling alone, and shall not be shared with electrical conduits and/or conductors, or other utilities. Install a WP12LC Tone Tape or an insulated #12 AWG copper conductor.

2. Installation guidelines other than telecommunications pathway, such as foundation details, power requirements, tower mounting, etc., are provided by the manufacturer in cooperation with the A/E. ADA requirements apply to every installation. Refer to section VI for EBLT device specifications.

III. INSIDE PLANT & RELATED INFRASTRUCTURE

A. HORIZONTAL PATHWAY DISTRIBUTION SYSTEMS (INTRA BUILDING)

Telecommunication wiring distribution may be made through various ceiling distribution systems, especially where suspended ceilings are utilized.

1. HORIZONTAL CONDUIT DESIGN RECOMMENDATIONS

a) Preferred Design Method

"Homerun" Conduit System – Each workstation Voice / Data outlet box shall be installed using a minimum 3/4" conduit; CATV and wireless access point outlet boxes shall be installed using minimum 3/4" conduit. All conduits shall be home-run or routed directly to the main telecommunications room (MTR) or telecommunications room (TR) of the same floor. (Physical Star Topology). Conduit shall be EMT with STEEL set screw or compression fittings. No die-cast fittings are permitted. Flex conduit shall not be used in buildings for telecommunications raceway. Horizontal conduits designated for outlets shall not feed floor to floor or be daisy chained from outlet to outlet.

Because the facilities conduit distribution system, once installed, is of "fixed capacity", it is often cost effective to install sufficient distribution conduits to accommodate potential changes and growth.

1) The total individual conduit length including pull boxes used for telecommunications systems should not be longer than 250 feet.

2) Conduit runs should take the most direct path possible, following parallel lines of the building.

3) There should be no continuous sections of conduit longer than 100 feet. For sections that are longer than 100 feet, insert pull boxes so that no segment between pull boxes exceeds the 100 foot limit.

4) There should be no more than two 90 degree bends between pull boxes. Additionally, pull-boxes shall not be used instead of or otherwise placed within a 90 deg. bend.

   If a conduit run requires more than two 90 degree bends, then pull boxes should be installed to minimize the bends; however, a third bend may be permitted in a pull section if any of the following exceptions apply:

   a. The run is shorter than 33 feet.

   b. The conduit size is increased to the next trade size, and

   c. One of the bends is located within 12 inches of the end of the cable feed end.

   d. Total bends in the conduit run shall not exceed 270 deg. maximum.

5) Conduit bend radii shall be as specified in the current edition of the National Electrical Code for conductors without lead sheath. Field and machine bent radii are acceptable.

6) Provide a pull cord with a minimum test rating of 200 lbs. pulling strength in each conduit. Greenlee Jet-line, Part number 430 or equivalent.

7) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

8) Terminate conduits through the structural floor in the telecommunications rooms three (3) inches above the floor surface. For conduits entering from the ceiling conduits should be installed to turn down and extend to 8 1/2 feet above finished floor in the Telecommunications rooms or equipment rooms. All conduits shall be dressed at the same level and installed with rigid conduit straps to the wall.

9) Pull-Boxes - Pull boxes shall be a minimum of 4"W x 12"L x 4"D (Raco 956 or Equiv) for a single 1" or 3/4" conduit. For each additional conduit two (2) inches should be added to the width of the box. 4 inch square outlet boxes shall not be considered for pull-boxes under any circumstances. Pull Boxes are not to be used for termination or splice boxes under any circumstances. Install pull-boxes in easily accessible locations, preferably above suspended ceiling. In the case of hard-coat ceilings, an access panel shall be installed in the ceiling directly beneath any pull boxes. The opening shall be a minimum of 24" x 24" to allow for access (or larger if recommended by design professional). Pull Boxes should be provided with a suitable hinged panel or cover arranged for access from the bottom. Conduits should be arranged to allow a straight pull through the box with no bends. Do not use a pull-box in lieu of a bend. Telecom Pull boxes shall not be used by other utilities.

   NOTE: Designs that require pull boxes be mounted more than 10 feet above the floor shall first be approved by ITS.

10) Telecommunications Workstation Outlet Boxes - All standard telecommunications wall mounted workstation outlet boxes installed in dry wall, plaster or concrete block shall be four (4) inches square by at least 2 1/4" deep made by Steel City or equivalent. All boxes shall be trimmed out, allowing for a clear and unobstructed 4" opening. Provide all boxes with flush cover (Raco 787 or equiv). Boxes should be installed 18 inches above finished floor or the same height as electrical outlets at the workstation. Do not install outlet boxes back to back to serve adjacent rooms. Boxes should be offset to avoid compromise of the effectiveness of the sound barrier. Boxes shall not be installed and connected by the same conduit in a daisy chain method or from floor to floor.

11) Outlet boxes for wall instruments, payphones and other special applications shall be 4"W x 4"H x at least 2 1/4"D. These boxes should be mounted at 48" above the finished floor unless obstructed and/or otherwise noted by the design professional. Installation of outlets where obstructions exist shall meet all ADA requirements for clearance as specified below.

b) Secondary Design Choice

Cable Tray Conduit System - Ceiling raceway (cable tray) systems are considered as a secondary option for campus buildings. This option is frequently chosen because of lower initial installation cost of the telecommunication pathway only. The overall savings however are negligible when long term costs are considered. The ITS design team does not generally recommended this option due to long term maintenance issues, increased costs of plenum rated materials, increased installation labor costs, the potential for wire damage and the potential fire code violations.

1) Cable tray should 12" ladder style tubular raceway with 6" side fence; Homaco Part TRC-512, or as approved by the ITS design team. Raceway sizing and installation shall be made based on manufacturer recommendations. Cable tray capacity is 40% to 50% as determined by the static load capacity of the tray and length of the support span and is limited by ANSI/NFPA 70, Section 318.

2) Supports shall be installed no more than five (5) feet apart and within two (2) feet of any fitting.

3) The cable tray conduit system uses cable tray in conjunction with 1" and 3/4" conduits from the outlet box. Conduits should be continuous from the outlet box to the cable tray. Where the conduits meet at the cable tray, they should be reamed and cleaned and a grounding bushing installed. The conduit should be bonded to the cable tray using the installed grounding bushing and a#12 AWG solid copper conductor.

4) Transition pans, curved runways, runway "T", or horizontal radius runway sections shall be used to avoid sharp turns that may cause damage to cable.

5) Ceiling raceway shall be readily accessible and placed in ceilings that utilize removable tile. If transition of hard-coat ceiling is required access hatches of a minimum of 24" x 24" should be installed every 15 feet.

6) Ceiling raceways shall be installed in ceilings of hallways and shall avoid passing over office spaces, offices, classrooms and other occupied spaces.

7) There shall be no other utility or support system structures running directly through the ceiling raceways; e.g., all-thread rod, Kindorf or Unistrut channel. Sprinkler heads, HVAC ductwork and similar utility system apparatus shall not drop through ceiling raceways. When designing the layout of horizontal pathways in the ceiling spaces, ensure that other building components (e.g. lighting fixtures, structural supports, air ducts) do not restrict access.

8) Telecommunications Raceways not be shared by power cables. Refer to the NEC (NFPA 70) or consult with the design professional and ITS.

9) Cable Trays shall have adequate clearance above the tray for installation of cabling and to withstand pulling cables during installation. Raceways should be installed allowing a minimum of:

10) Three (3) inches of clear vertical space above the ceiling tiles to ensure accessibility to the tray. When sufficient space is available above raceway provide up to six (6) inches between tray and ceiling tiles.

11) Twelve (12) inches of clear vertical space above the tray.

12) Because cable installed in tray is susceptible to electro-magnetic interference (EFI), raceways should be routed to avoid electrical equipment and interference to the degree possible. Avoid crossing or running tray parallel to florescent lighting fixtures and electrical devices that produce EMI. Always keep a minimum 4 inches clearance from these devices. All metallic cable trays must be grounded/bonded. Tray bonding and grounding should follow all applicable building and electrical codes including ANSI and NFPA 70, section 318-3 (c).

13) Ceiling raceway shall be used in conjunction with 1" and 3/4" conduits from outlet box(s) and run to the ceiling raceway. Conduits should extend all of the way to the tray. Conduit should be properly cleaned, a bushing installed and bonded to the cable tray.

14) The design and installation of Ceiling Raceway Systems shall be installed to meet ANSI/NFPA70, Article 318 – Cable Trays, and all applicable national, state and local codes. The selection, design and installation of Ceiling Raceways should be pre-approved and coordinated with ITS.

c) Third Design Choice

Zoned Conduit System - Zoned conduit systems are recommended for areas with a high density of telecommunications outlets (computer labs, concentrated modular office spaces, etc.) into zones. Each voice/data outlet within a zone is a continuous run of 1" conduit from the outlet location to a centrally located junction box. The junction box will have a specified number of larger conduits which route back to the TR located on the same floor from where the outlets are served.

1) The smallest zoned conduit system would concentrate four separate outlet locations into one 2" conduit. The 4 incoming 1" conduits will terminate in a junction box 12"W x 12L x 6"D. The junction box will have 1 outgoing 2" Conduit, which will route back to the TR on the same floor.

2) The ratio of 4 – 1" conduits to 1 – 2" conduit should always be maintained. For example: 8 – 1" incoming conduits will require 2 – 2" outgoing conduits. It should also be noted that alternatively, 1 – 4" conduit can substitute for 2 -2" conduits.

3) The size of the junction box will increase in size by 6" in width and length and 2" in depth for every 4 incoming 1" conduits. For example, 8 – 1" incoming conduits will require a junction box => 18"W x 18"L x 8"D; 12 – 1" incoming conduits will require a junction box => 24" x 24" x 10"D.

4) The use of junction boxes larger than 24" is not recommended. Any application that would require the use of a larger junction box should be coordinated with the ITS Network Infrastructure design team.

5) All junction boxes used in the zoned system must have either a hinged or screw type cover plate.

6) Junction boxes must be located in readily accessible locations. They should be accessible from a corridor from a removable acoustical ceiling panel. Installation above hard-coat, drywall or other type non-accessible ceiling systems should be avoided.

   Note: High speed twisted copper data cables are highly susceptible to degradation of operation due to any change in physical characteristics; i.e., flattening of cable. Devices that do not provide continual support of the cables are not recommended. The use of J-Hooks, D-rings, cable hangers and other devices for horizontal distribution are not acceptable.

B. INTRABUILDING BACKBONE RISER CONDUIT SYSTEM

A vertical telecommunications conduit riser system shall be provided for bringing telecommunication cables from the Main Telecommunications room MDF to the various floors of the building. As a design guideline, the vertical cable riser system should use a series of vertically aligned 4" sleeves in each floor beginning in the ceiling of the telecommunication room in the basement and ending in the floor of the telecommunication room of the uppermost floor. Ideally, all telephone rooms in multi-story building should be vertically stacked; however, this is not always possible. A design deviation from a system using sleeves to a piped system should be considered instead. The design professional should consult with ITS on a case by case basis to ensure that needs are met.

C. RISER CONDUIT DESIGN RECOMMENDATIONS

1. The vertically aligned 4" sleeves should be located in the vertically aligned (stacked) telecommunications rooms on each floor. Riser conduits or sleeves entering through the floor shall extend 3 inches above finished floor at the wall. Riser conduits or sleeves extending down from the ceiling shall extend to 8 1/2 feet above finished floor. If turns are required they shall meet the bend radii already specified in this document. All conduit ends shall be dressed at the same level and installed with rigid conduit straps or equivalent to the wall. Design professionals and installation contractors shall contact the ITS project manager to address exceptions due to structural conflicts.

2. All sleeves and Riser Conduit shall be 4 inches in diameter.

3. Sleeves should not be place in the middle of the Telecommunications room floor, but placed next to the wall that has plywood attached, preferably starting in the left corner when entering the door.

4. Construct all sleeves to conform to the National Electrical Code and local Fire Codes.

5. All Sleeves should extend 3 inches above the finished floor level.

6. All sleeves should be clean, dry, unobstructed, labeled for identification, reamed and fitted with bushings.

7. After the riser cable has been installed, all unused sleeves shall be fire stopped.

8. The quantity of sleeves depends upon the building's usable floor space serviced by the sleeves. The quantity and size of the sleeves shall be applicable to conduit when vertical stacking of rooms is not possible. Table 2 shows the recommended quantity of sleeves to be provided, and typical vertical riser arrangements, and including one spare for emergency use and one for coax or fiber optic use.

Table 2: Recommended Sleeve Quantities

Usable Building Floor Area (x 1000 Ft. Sq.)	No. Of Sleeves
0 - 50	4 (minimum)
50 – 100	6
100 - 200	8
200 +	10 *

Consult with ITS and Facilities during design to confirm exact requirements based upon building usage.

D. ACCESS / SECURITY SYSTEM CONDUIT REQUIREMENTS:

1. Door Requirements:

   a) Perimeter access doors should have: Card reader / Electronic lock, door contacts and request to exit devices.

   b) Perimeter stairwell door should have: door contact and request to exit devices.

   c) Classroom doors should have: card reader, door contact and request to exit.

2. Security Sensors / Camera locations: These devices require a single gang outlet box at each location. A 3/4" conduit shall be provided from the outlet box to the TC located on the same floor as the device. If a cable tray conduit system is used the conduit should route from the outlet box to the cable tray.

3. Door Conduit Requirements: Each ground floor exterior door and other specified doors shall be provided with a 12" x 12" junction box and a 1" conduit "homerun" to the TR. Provide the following:

   a) From the J-box provide a 1/2" conduit to the door contacts in the header (2 for double doors).

   b) From the J-box provide a ¾" conduit to the card reader or pin pad location. Terminate in a single gang box.

c) From the J-box provide a ½" conduit to the strike side in the door frame (for electric strike.)

d) Provide a ½" conduit to the hinge side in the door from power supply provided with the electrified panic devices when used. From the J-box provide a ½" conduit to the power supply.

e) Holes shall be drilled in the door header frame for wiring the door contacts.

f) Provide a ½" conduit from the request to exit box to the J-Box. The request to Exit box shall be a standard single gang outlet box mounted horizontally 1 foot above the door frame inside the room being exited.

4. Electrical Requirements:

a.) Access Control Panels should be located in the TC and be provided with 120 VAC, 20 amp dedicated circuit from the building emergency generator.

b.) Doors with electrical emergency exit bars require 120 VAC, 20 amp dedicated circuit from the building emergency generator.

Note: FSU ITS maintains examples of the most current access control door Configurations. These may be found in the current version of the FSU Design Guidelines and Specifications. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met.

E. WIRELESS ACCESS SYSTEM CONDUIT REQUIREMENTS

1. Wireless Access Points (WAP)

a) A raceway system for owner provided wireless access points (WAP) will be designed for all new and renovation construction projects. Basic requirements for this system will follow those outlined for telecommunications/data outlet boxes except as noted below:

b) Raceway conduits may be installed in accordance with any of the three raceway distribution methods as described under III.A.1 Horizontal Pathway Design Recommendations, type's a., b., or c.

c) 3 - WAP device locations may be connected via a continuous run of 3/4" conduit, but must "homerun" to the telcom room (TR) at that point.

d) ITS will permit more than 3 WAP's be connected to a single conduit "homerun" If the conduit size is increased to 1". No more than 6 WAP devices locations installed per "homerun.

e) If a cable tray system of distribution is utilized, then the same requirements as standard data outlets will be observed.

F. SPECIAL USE CONSIDERATIONS

Some specific types of areas and uses differ from "office/conference room" type space as mentioned above. Therefore, these areas should be addressed in the list below:

1. Classrooms: A minimum of one outlet should be installed on every wall. This outlet would be configured with 1 - voice jack, 1 – data jack and 1 – CATV jack. Teaching consoles should have 1 – outlet with min. 6 – data jacks installed. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements as it pertains to classroom technology systems.

2. Laboratories: These areas are unique and at times may require more telecommunications resources than other areas. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements.

3. Modular Office Furnishings: Modular furniture may require special hardware for telecommunications resources than other areas. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements.

4. Fire/Burglar Alarm Panels: A dedicated 3/4" conduit shall be run from each fire and burglar alarm panel to the TC backboard. This is required to UL approve systems. Please refer to the latest revision of NFPA and NEC codes available.

5. Elevators - A dedicated 3/4 inch homerun conduit shall be run from the TC located on the same floor as the elevator equipment room and should terminate in the elevator equipment enclosure. Elevator instruments are normally provided by the elevator equipment manufacturer and are pre-installed in the elevator cab.

6. Floor Outlets – Floor outlets shall be multi-service recessed floor boxes, Wiremold/Walker part number RFB4-SS with RFB-4TKO-SS internal communications brackets. Any equivalent box shall be approved in advance by ITS.

7. Internal Emergency Blue Light Phones (EBLT): Emergency phones located inside require a dedicated 1" "homerun" conduit from the TC to the Flush Mount Enclosure box where the phone is to be installed. Roll up access for ADA is required in all public devices, with a maximum reach of 48".

G. MISCELLANEOUS REQUIREMENTS:

1. Wiremold 4000 – Areas with a high concentration of telecommunications and power outlets are often designed with surface mounted raceway systems manufactured for a clean professional finish. These systems permit power wiring and telecommunications cabling to be distributed together in a dual channel raceway, and are approved for this application by NFPA 70/NEC. These raceway systems are also used in existing buildings and renovations where existing building materials make it difficult to recess conduit and boxes. Any desire to

substitute this system requires written approval by ITS Network Infrastructure during the design phase

2. Open (Free) Wiring - Open wiring is prohibited in new construction projects, including renovations and remodeling projects.

3. Conduits installed in slabs or other concrete structures shall be PCV Schedule 40 or Rigid Galvanized Conduit. The minimum size for horizontal cabling is one (1) inch.

IV. TELECOMMUNICATIONS ROOMS / EQUIPMENT ROOMS

A. DEFINITION

This section identifies 3 (three) physical spaces within a building that are critical to the proper management and transport of telecommunications (voice, video, data) services. They are the Main Telecommunications Room (MTR), Telecommunications Rooms (TR) and the Customer Premise Equipment (CPE) Room. Any of these rooms may be referred to as a Telecom Room.

The primary telecommunications room for the entire building is the Main Telecommunications Room (MTR). This room serves as the entrance facility for the building where all outside plant conduits terminate. It houses the Main Distribution Frame (MDF), where the service entrance cables terminate and interface with the intra-building backbone distribution cabling system and to the horizontal cross-connect and cabling serving that floor. The MDF is considered the point where the regulated telephone company will install the building entrance protectors. This point of interface is called the demarcation point. The demarcation point is where the cabling responsibility of the Service Provider (regulated telephone company) ends and where the cabling and equipment responsibility of the University ITS begins.

Other wiring rooms/rooms within a building are referred to as Telecommunications Rooms (TR). TR's are "floor serving". There shall be a minimum of one TR per floor. A TR is not required on the same floor as an MTR unless needed due to cable length requirements. It is recommended that multiple TR's should be provided on the same floor if usable floor space exceeds 10,000 sq. ft. or the conduit length between the horizontal cross-connect in the TR and any Telecommunication outlets being served would exceed 270 total feet. Maximum allowed length of horizontal cable installed to outlets must not exceed 295 feet. Pathway length should be kept to a maximum of 270 feet to accommodate the cable length.

The MTR and TR rooms contain the intermediate distribution frames (IDF's) which include the terminations for the backbone cables in the riser system coming from the MDF and the terminations for the horizontal cabling and cross connects on the floor served. In addition to cable terminations and cross connects in these rooms they may in some cases serve as an equipment room for data, video and other equipment.

The Main Telecommunications room MTR and TR rooms are not to be shared facilities for other services and therefore should not house electrical equipment, plumbing, janitor sinks, or to be used as a storage area. HVAC Duct other than that serving the room, electrical conduits for other areas, sprinkler system piping, drain pipes, steam pipes, chilled water pipes, or any other systems should not be routed through the interior of the MTR, TR or CPE rooms. Any other conceived use for the telecommunications rooms that does not follow the intended use of telecommunications is not permitted.

The design professional shall make provisions for separate CPE room(s) within newly designed and renovated buildings where private departmental / customer computer and server equipment will be located. Such rooms shall be contiguous to the MTR and TR rooms. If this is not possible, these areas shall be connected via a series of 4"conduits. If the rooms cannot be contiguous, the designs must be approved by the ITS

B. REQUIREMENTS

1. MTR / TR Room(s) and Customer Premise Equipment (CPE) Rooms

The design for these equipment rooms shall conform to the following specifications:

a) Wall Linings - All walls should be finished, i.e. sheet-rock/painted, and lined with 3/4 inch thick, AC Grade plywood backboard, 8 foot high by 4 foot wide and affixed in such a manner that it will support the weight of the cable, terminals, and other equipment. This allows for coverage of the entire area on which connecting hardware and cable management hardware may be mounted. The plywood should extend around the entire room, corner to corner on every wall. Smooth side shall be installed out. The plywood backboard shall be void free and treated with two coats of fire retardant paint materials. Use flush hardware and supports to mount plywood. The strength and placement of mounting hardware shall be sufficient to handle the total anticipated load (static and dynamic) and mounting of cabling components. The placement of the plywood backboard shall be on top of the wall covering, i.e. sheet-rock, etc. and is not a substitute for the wall covering.

b) Lighting recommendations –

1) A light intensity level of 50 footcandles should be provided, measured at 3 ft. 6" above finished floor.
2) Do not use dimmer switches.
3) Locate light fixtures a minimum of 8', 6" above the finished floor.
4) Emergency lighting shall be provided and circuited to the building emergency power system.

c) Power –

1) Provide at least one dedicated 120 VAC, 20 amp (non-switchable) quadraplex receptacle on each wall.
2) Locate receptacles at least 6 inches above finished floor.
3) Receptacles must not be controlled by wall switches.
4) Provide one (1) dedicated 120 VAC, 20 amp (non-switched) receptacle to be installed at the end of the End Relay Rack in each communications room at 18 inches above finished floor. For special applications or high density telecommunication rooms, such as rooms with servers, node equipment or power over Ethernet equipment, a 30 AMP twist-lock electrical outlet may also be required. Consult with ITS Network Infrastructure design team during design to make this determination. Installation of the relay racks is performed by the ITS Network Infrastructure. The design professional shall coordinate the placement of the electrical outlets with ITS during design.

5) If the building is provided with an emergency generator system or UPS (uninterruptible power supply), the electrical power and lights in the MTR / TR room shall be supplied from that power source.

6) Switches, thermostats or other devices shall be installed beside the door and not in walls containing telecommunications backboards. At no time should these devices be mounted on walls that will contain the TBB or CBB (Communications Backboards).

d) Room Sizing –

1) MTR / TR Room Sizing - The recommended minimum floor dimension for an MTR shall be 90 square feet (i.e. 9′ x 10′) and the minimum TR on each floor shall be 70 square feet (i.e. 7′ x 10′). These minimum sizes shall be increased as building size, floor square footage served or usage increases. The design professional shall consult with ITS if questions arise concerning the proper sizing. The following recommendations are made for sizing of both MTR and TR:

Area Served	Room Dimensions
5,000 sq. ft. or less	70 sq. ft. (i.e. 7′ x 10′)
5,000 sq. ft. to 8,000 sq. ft.	90 sq. ft. (i.e. 9′ x 10′)
8,000 sq. ft. to 10,000 sq. ft.	110 sq. ft. (i.e. 10′ x 11′)

**Single floors that are above 10,000 ft. may require an additional communications room due to limits on communications cable lengths.

2) Smaller Single Story Buildings – In smaller single story buildings less space is needed. In most cases there will be only one Telecommunications Room, Room or Terminal Can. The following minimum is recommended for these applications:

Building Floor Area Served	Served by
Less than 5,000 sq. ft.	Shallow Room (3′ x 8.5 ‘) Walk in room (5′ x 5′)
Less than 1,000 sq. ft.	Wall Cabinets, Enclosures, etc.

Note: The design professional shall work with ITS to determine the sizing of any cabinets or enclosures.

1) Work Clearance - The NEC Section 110-16 provides requirements for working space and clearance around electrical equipment that is exposed (i.e. unguarded, uninsulated). Provide the following clearances for equipment and cross connect fields in the TR:

- Allow a minimum of 1 meter (3.3 ft.) of clear working space from equipment and the wall where wall mounted cross-connect fields are being mounted when determining the size of the Room.
- Allow for 6 inches depth off wall for wall mounted equipment.

- Provide space of at least 4 feet from center line of rack to wall in front and in rear of each equipment rack or cabinet. Provide isles at least 32 inches wide.
- In corners a side clearance of 12inches is recommended.

e) Relay Racks are typically installed in MTR, TR and CPE rooms for the termination of horizontal data cabling, fiber optics and LAN and other equipment. Installation is typically made by the university ITS. The size of a typical Relay Rack is 19 inches wide, 7 feet 6 inches high, has a 32" footprint and meets ANSI/EIA-310D.

f) RFI / EMI Restrictions –

- Due to RFI and EMI the MTR / TR / CPE rooms shall not house any electrical equipment (i.e., step down transformers, electrical panels, etc).
- The equipment room shall be in a location where electromagnetic interference is minimal to none.

g) Pathway Installation –

- Conduits are to be clamped to the wall so that they will support the pulling of cable and shall be bonded to the Telecommunications ground using grounding bushings.
- Conduits shall be dressed even, reamed, cleaned, bushings installed and contain pull cord capable of 200 lbs. of pull strength. Sleeves, conduits and raceways must not be left open after installation of cabling. Once cable is installed fire-stop all sleeves, conduits, and raceways in accordance with building codes.

h) If two telecommunications rooms are located on the same floor they should be connected with a minimum of 2 - 4 inch conduits, unless otherwise approved during design. Terminate conduits through the structural floor in the telecommunications rooms three (3) inches above the floor surface. For conduits entering from the ceiling or walls the conduits should be installed to turn down and extend to 8 1/2 feet above finished floor in the Telecommunications rooms or equipment rooms. All conduits shall be dressed at the same level and installed with rigid conduit straps to the wall. Design professionals and installation contractors shall contact ITS to address exceptions due to structural conflicts.

i) Cable Tray - Each MTR and TR shall have Cable Tray for the routing of cable inside the rooms that is a minimum of 12" wide installed from corner to corner on every wall mounted 8 feet above finished floor. All trays must be bonded and grounded to the Telecom ground bus bar for the room. Typical cable tray shall be Homaco TRC-512 with all associated hardware. Substitutes must be approved by ITS.
When cable trays are approved for use versus conduit for horizontal cabling they should protrude into the telecommunication room and be installed in a continuous loop around the room at the top edge of the 8 foot high TBB which should be on all four walls of the room. Sizing and manufacturer shall be coordinated with ITS.

j) Ceilings –

- To permit maximum flexibility and accessibility, false ceilings (drop ceilings) are not permitted in MTR or TR rooms.

- Over-head clearances shall be at least 9 feet (i.e., HVAC duct work, sprinkler heads, etc.).

k) Location –

- To minimize the horizontal cable lengths within a maximum of 295 feet, locate the telecommunications room / room (TC) on each floor as close as possible to the center of the area it is to serve.
- Ensure that the Telecom rooms are directly accessible from the hallway or other common area. Telecom room should have only one door and not be used as a passage way to other rooms.
- It is recommended that all TC rooms be vertically aligned (stacked) above the MTR and each other.

l) Entry –

Personnel entry to MTR / TR room(s) shall be through a locked door at least 36 inches wide, 80 inches high. The door should open **outward** unless building codes prohibit. Doors swinging in eliminate three feet of usable wall space. In the advent that the door must swing in the design professional shall add the lost wall space in the design and increase room size to compensate. The door is to be keyed by the FSU key bank for the ITS equipment room key. In special applications where a Telecommunications Terminal Cabinet (Box) is used, the box installed shall be capable of being locked. Personal entry to a locked panel shall be via an FSU key bank key for ITS.

m) Dust Elimination –

The walls and ceilings of all equipment rooms shall be dust free and painted with a light color latex paint. The floor shall be tiled with VCT or concrete which has been sealed with sealant.

n) Room Layout - In new buildings the MTR and TR shall be designed to be vertically stacked directly over each other. The MTR and TR rooms shall be laid out as to allow for proper use of space.

- All Outside Plant (OSP) 4" conduits entering the MTR shall be located on one wall, preferably starting in the left-hand corner inside the door. If it is not possible to locate in the left-hand corner inside the door, Conduits should be installed beginning in a corner of the room. Avoid installing the OSP conduits or Riser sleeves in the middle of the backboard (wall).
- It is recommended that the 4" intra-building backbone riser sleeves be placed directly above the OSP conduits in the MTC and in the same location in each stacked TC room so straight pulls can be made from the floor sleeves to the ceiling sleeves.
- Horizontal conduits shall enter on another wall and other services shall be properly distributed along the remaining walls. Any questions about room layout should be directed to the ITS design team.
- Avoid mixing 4" entrance, riser and horizontal conduits.

o) Grounding / Bonding – Refer to Section III for requirements.

p) Fire Protection – Provide fire protection for MTR and TR rooms if required by applicable codes.

q) Environmental Control – Provide heating, ventilation and air conditioning that will maintain continuous and dedicated environmental control 24 hours per day, 365 days per year. Since the MTR and TR rooms house equipment the normal temperature range should be 65 degrees to 78 degrees with minimum 30% to maximum 55% relative humidity. Switches, thermostats or other devices shall be installed beside the door and not in walls containing telecommunications backboards. At no time should these devices be mounted on walls that will contain the TBB (Telecommunications Backboards)

V. TELECOMMUNICATIONS GROUNDING AND BONDING

Statement: The information provided in this document for the design of the Telecommunications grounding and bonding system does not replace national, state, local or other applicable codes, laws or regulations.

Telecommunications grounding and bonding is additional grounding and bonding specifically for telecommunications systems and serves to minimize electrical effects and hazards, augment electrical bonding, and lower the system ground reference potential. Requirements and guidelines for this system are found in ANSI/TIA/EIA-607.

A. GROUNDING PRACTICES

1. Main system ground:

a) The first choice for connection of the Telecommunications Grounding/Bonding system is direct attachment to the closest point in the buildings electrical service grounding electrode system. Electrical power cabling and Communications cabling must be effectively equalized. (reference NEC 800-40). The architect/engineer shall specify that a #3/0 AWG copper ground conductor be provided to the TBB backboards of the MTR and each TR connection to the Telecommunications grounding and bonding system. This grounding conductor shall be installed by a qualified electrician. ITS Network Infrastructure personnel will connect grounding and bonding conductors to telecommunications panels and other equipment.

b) In buildings without electrical service install a driven ground rod(s) as necessary to achieve 5 ohms to ground.

c) If the ground conductor is installed in conduit or raceway, the conduit or raceway must be bonded on both ends to the ground.

VI. BLUE LIGHT EMERGENCY TELEPHONES

The construction budget for renovations or new construction projects should include the costs of conduit, Talk-A-Phone Emergency Telephones and hardware necessary to install emergency phones. The A/E will incorporate this specification into the contract documents when applicable. ITS installs

the cabling and telephone line required. The exact location of instruments shall be recommended by the Public Safety Office within the Florida State University Police Department.

Talk-A-Phone units require AC power for the lighting which should be dedicated, 20 Amp, Non-switched service. The two most common Units which are to be used for exterior installations are listed below. Model numbers and features change frequently so the Office of Telecommunications should be contacted for current model numbers:

1. Blue Light Emergency Phones

   a) Tower Emergency Phone Unit
   Talk-A-Phone, Tower with ETP-400 Phone, Part Number ETP-MT/R-FSU
   Note: Tower unit to have circulation vent
   b) Wall Mounted Emergency Phone Unit
   Talk-A-Phone, Wall Mount unit with ETP-400 Phone, Part Number ETP-WM-FSU/400

   Internal Emergency Phones – Emergency phones located inside require the following:

   A dedicated 1"" homerun conduit shall be run from the telecommunications room for the voice line to a FME – Flush Mount Enclosure box where the phone is to be installed. **See ADA requirements for height of the enclosure**. A 120 volt A/C, 20 amp dedicated circuit shall be provided to a single gang outlet mounted in the bottom of the FME Box. The design professional should consult with the OTC concerning the university instrument of choice or any required signaling devices.

VII. APPLICABLE CODES AND STANDARDS

The design and installation of FSU telecommunications infrastructure attempts to meet parameters of all applicable local, state and national codes and standards. Issues that fall under codes are a requirement. Though many telecommunications design issues fall under established standards that are not code, these standards have been adopted at FSU and it is highly recommended by this office that the standards listed in this document be followed. At times, conflicts arise between published guidelines such as REA, EIA, TIA, NFPA, IEEE, NCTA, BICSI, and individual company policies. Therefore, this document reflects portions of and/or references the following specifications. Drawing and design documents should be specific for each project and include, either as a direct excerpt or by reference, information from these sources:

- AT&T, former Bell System Practices (BSP's)
- General Telephone, installation and construction practices
- Northern Telecom, installation practices
- RUS (formerly REA), Rural Utilities Services USDA/RUS
- BICSI, Telecommunications Distribution Methods Manual
- ANSI/TIA/EIA-568A, Commercial Building Telecommunications Cabling Standard.
- ANSI/TIA/EIA-568B, Commercial Building Telecommunications Cabling Standard
- TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
- TIA/EIA TSB-75, Additional Horizontal Cabling Practices for Open Offices.

- ANSI/TIA/EIA-569A, Commercial Building Standard for Telecommunications Pathways and Spaces.
- ANSI/TIA/EIA-606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings.
- ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
- ANSI/NFPA-70, National Electrical Code
- NFPA-101, Life Safety Code
- NFPA-780, Standard for the Installation of Lightning Protection Systems.
- Other applicable NFPA Codes.
- ANSI/IEEE Codes, All Applicable Codes.
- NESC, National Electrical Safety Code (ANSI/IEEE C-2, overhead and underground telecommunications cable).
- ISO/IEC 11801, Information Technology. Cabling for Customer Premises.
- IEC 603-7, Part 7, Modular Connectors
- FCC Part 68, Connection of Terminal Equipment to the telephone network.
- FCC Part 15, Radiation Limits.
- FCC Part 76, Cable TV Service. Code of Federal Regulations (CFR) – 10CFR47, Part 76.605. Signal Quality for CATV. Federal Communications Commission (FCC).
- Publications and Industry Standards for CATV. Society for Cable Television Engineers (SCTE)
- Local Uniform Building Codes
- National Cable Television Association Handbook
- General Instruments/Hewlett Packard, broadband testing procedures
- Individual university facility and construction guidelines
- Department of Management ~~General~~ Services, Division of Communications, State of Florida.
- Americans with Disabilities Act

Finished drawing and design documents should not conflict with the above standards and should not deviate from the intent or spirit of this document. It is the responsibility of the design professional for all designs to meet the most current codes and standards at the time of construction.

VIII. GLOSSARY OF TERMS

ADA	Americans with Disabilities Act
Aerial Service	Telecommunications Cable installed on supporting structures such as poles, sides or buildings, and other structures.
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
Backboard	Plywood covered wall in telecommunications room or in terminal boxes used to mount termination devices, hardware and equipment.
Backbone	Cabling and pathway used to connect the telecommunications rooms, cross-connects, entrance facilities and equipment rooms.

Bridge Tap	The connection of two circuits in parallel to each other or a cable pair continued beyond the point at which the pair is connected to an instrument.
Buried Service	A cable installed under the surface of the ground (not in conduit) in such a manner that it cannot be removed without disturbing the soil. Also called direct buried cable, trenched, or bored.
Busbar	A copper bar used as a common point for connection of the building electrical service ground to all telecommunications hardware and equipment in a room or terminal box.
Cable Bend Radius	The radius that a cable can bend before risk of damage or decrease in transmission performance.
CATV	Community Antenna Television (Cable TV)
Coax	Coaxial Cable. A central conductor surrounded by dielectric and a tubular outer conductor.
Conduit Duct bank	An arrangement of conduit ducts in tiers, encased in concrete used for installing telecommunications cables between buildings.
CPE Room	Customer Premise Equipment Room. Often called Data Equipment Room. This room houses private departmental / customer equipment.
Cross Connection	A connection made between cables, subsystems and equipment by the use of patch cables, or jumper wires run between the terminating devices.
CUP	Florida State University Central Utility Plant.
D Ring (Distribution Ring)	Cable Management Device attached to the backboard.
dB	Decibel
Demarcation point	A point of interface where two services are connected. An example at FSU would be the point at which the local dial tone provider terminates their cables in the Main Telecommunications Room for cross-connection to the Intrabuilding cabling.
EIA	Electronics Industries Association.
EMI	Electromagnetic Interference. An unacceptable or undesired response, malfunction, degradation, or interruption to the intended operation of electronic equipment caused by the coupling of electrical or magnetic fields.
EMT	Electrical Metallic Tubing
Encased Conduit	Conduit contained inside poured concrete.

Exposed Cable	Any cable that is located so that it is subject to lightning, power induction, or differences in ground potentials.
F Connector	Coaxial Connector commonly used for terminating CATV Cables.
Outlet Faceplate	A plate or cover which holds multiple communications jacks, mounted on a surface, and covering the electrical box and communications cables in the wall.
FCC	Federal Communications Commission
FDDI	Fiber Distribution Data Interface
Foot-Candle	a unit of luminance on a surface that is everywhere one foot from a uniform point source of light of one candle and equal to one lumen per square foot
Gas Tube Protector	An Overvoltage Protector with metallic electrodes in a gas atmosphere contained in a glass or ceramic envelope.
Horizontal Channel	The Horizontal cabling which includes all elements of the Horizontal cabling Link, plus the equipment cords in the telecommunications room and the work area. Contains all elements needed to support telecommunications applications over the horizontal cabling.
Horizontal Link	The horizontal cabling which includes all horizontal components except for equipment cords in the telecommunications room and at the work station.
ICEA	Insulated Cable Engineers Association
IDF	Intermediate Distribution Frame. A field of termination devices on which the intrabuilding backbone cables are terminated for cross-connection to the horizontal cabling system. Normally found in the Telecommunications Room on each floor.
IEC	International Electromechanical Commission.
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IMC	Intermediate Metallic Conduit
Interbuilding Backbone	A Cable between two buildings.
ISDN	Integrated Services Digital Network. An integrated data network in which the same time division switches and digital transmission paths are used to establish connection for different services.
ISO	International Standards Organization
ITS	Information Technology Services

KV	Kilovolts (1000 volts)
LAN	Local Area Network. A geographically limited data network used for the local transport of voice, data, and video.
Loose Buffer	In a fiber optic communication cable, one type of component used to encapsulate one or more optical fibers for the purpose of providing such functions as mechanical isolation, protection from physical damage and fiber identification. The buffer may take the form of a miniature conduit, contained within the cable and called a loose buffer, or loose buffer tube, in which one or more fibers may be enclosed, often with a lubricating gel.
Maintenance Loop	An additional length of cable on the end of an installed cable that allows for later use if any of the cable must be shortened or the termination devices moved.
Manhole	A hole through which a person may gain access into an underground vault or structure.
Marker tape	A plastic tape placed in the ground to identify buried cable location if dug up.
MDF	Main Distribution Frame. Also called the Main Cross-connect. The cross-connect in the Main Telecommunications Room (room) where the entrance cables terminate and cross-connect to the building Intrabuilding Backbone Riser cables.
Media	The physical path for telecommunications services. (i.e., copper cable, fiber optic cable, coaxial cable, radio, etc.)
Mhz	Megahertz. One million hertz or one million cycles per second.
Modular Jack insert	The modular communications jack that snaps into a faceplate.
MTC	The Main Telecommunications Room (room) for the entire building. This room serves as the entrance facility for the building where all Outside Conduits terminate. It houses the Main Distribution Frame (MDF), where the service entrance cables terminate and interface with the intrabuilding backbone distribution cabling system and to the horizontal cross-connect and cabling serving that floor. The MDF is considered the point where the regulated telephone company will install the building entrance protectors.
Multimode Fiber (MMF)	An optical fiber that supports the propagation of more than one bound mode. A multimode optical fiber may be either a graded-index (GI) fiber or a step-index (SI) fiber.
MUX	A device that combines multiple inputs into an aggregate signal to be transported via a single transmission channel.
NCT	Network & Communications Technology; a departmental subset of Information Technology Services

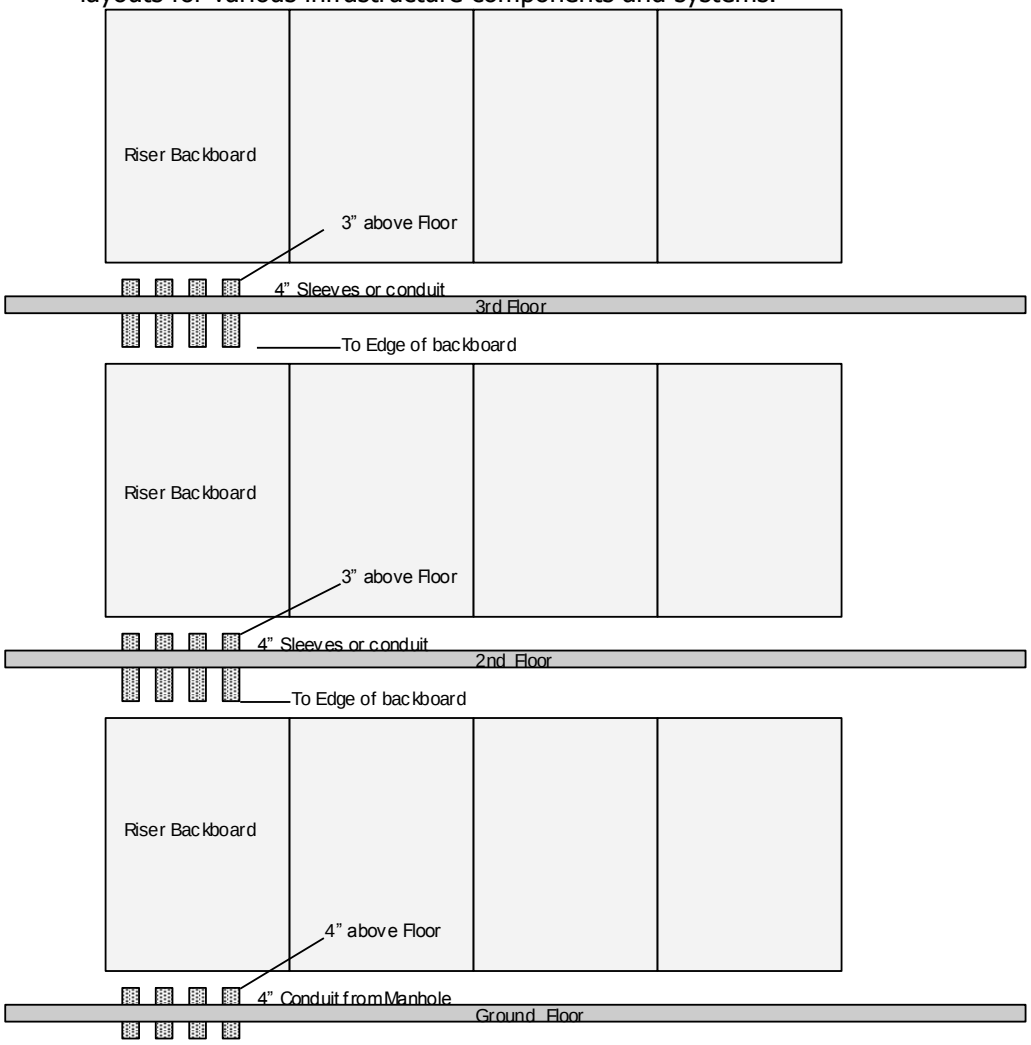
NEC	National Electrical Code.
NESC	National Electrical Safety Code.
NFPA	National Fire Protection Association.
NI	Network Infrastructure; a division of Network & Communications Technology for ITS.
OFNP	Optic Fiber Non-conductive Plenum.
OSHA	Occupational Safety and Health Administration.
OSP	Outside Plant. Telecommunications facilities located outside of the building. Either underground, direct buried or aerial.
OTC	Office of Telecommunications
Outlet	A faceplate with modular jacks located at the workstation.
Pathway	Structures that conceal, protect, and support telecommunications cables. (i.e. Conduit, cable rack, trays, J-hooks, under floor ducts, cellular ducts, trench ducts, Raised access floor, etc.)
PBX	Private Branch Exchange. Telephone system usually serving as a small Central Office for the individual business and located on their site. Provides access to the public switch network.
PE Cable	Filled Cable for use in OSP applications. Designated by the Rural Utilities Service.
Plenum rated	Cable used in a designated area, closed or open, used for the transport of environmental air.
PSI	Pounds per Square Inch
Pull Box	A device to access a raceway, used for access to allow for pulling cable.
Pulling Eye	Metal loop securely fixed to the end of a cable or anchored in the wall of a manhole to allow for the pulling of the cable into the duct bank.
PVC	Polyvinyl Chloride
Raceway	An enclosed channel or pathway designed to hold cables.
Relay Rack	A vertical frame upon which one or more units of equipment and patch panels are mounted.
RFI	Radio Frequency Interference. Any Radio Frequency disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment.

RGC	Rigid Galvanized Conduit
Riser Cable	Intrabuilding Backbone Cable that runs vertically to the IDF in a Telecommunications Room (room).
Single Mode Fiber	An optical fiber in which the signal travels in one mode. The fiber has a small core diameter, typically 8.3 µm.
Sleeve	A Conduit placed through a wall or floor to allow the passage of telecommunications cables.
Solid State Protector	An Overvoltage Protector using high-power semiconductor technology providing fast action and balanced circuits.
STP	Shielded Twisted Pair. A transmission line composed of a twisted 2-wire metallic transmission line surrounded by a sheath of conductive material that protects it from the effects of external fields and confines fields produced within the line.
Sump, Manhole	A fitting at the lowest point of the manhole floor used to pump a manhole dry before working in it.
T-1 (Carrier)	A digital transmission system which operates on two twisted pairs at a speed of 1.544 Mbps. The system is capable of carrying 24 channels (individual circuits) at 64Kbps.
TBB	Telecommunications Bonding Backbone. A 6 AWG or large copper conductor that provides for direct bonding and runs from the Telecommunications Main Bonding Bus bar to the bonding bus bar in each TC and CPE room.
TC	Telecommunications Room. The Telecommunications Rooms (TC) are "floor serving" and at least one is located on each floor. The IDF and Horizontal cable for the floor are usually located in the TC (also referred to as TR).
Telecom	Telecommunications
Terminal Block	An insulating base with binding posts used to terminate telecommunications cables and cross connect between cables.
Terminal Box	A metal box with a hinged lockable door used for installing terminal blocks, terminating cables and cross connecting. The box provides protection against dust, mechanical damage, weather and vandalism.
TIA	Telecommunications Industry Association
Tight Buffer	A tight buffer consists of a polymer coating in intimate contact with the primary coating applied to the fiber during manufacture. The protective thermoplastic coating is normally a diameter of 900 microns.

TMGB	Telecommunications Main Bonding Bus bar. The main bonding bus bar is located in the Main Telecommunications Room and provides a connection point for the main building electrical service ground to safely carry lightning and other power fault currents away from the telecommunications systems. The TBB to other Telecommunications Rooms is connected to the TMGB.
TSB	Technical Service Bulletin
Underground Cable	A telecommunications cable installed in an underground duct system which separates the cable from direct contact with the soil.
UPS	Uninterruptible Power Supply
USOC	Universal Service Order Code
UTP	Unshielded Twisted Pair. A transmission line composed of a twisted 2-wire metallic transmission line surrounded by a sheath of non-conductive material.
Wire mold	A surface mounted enclosed channel designed to hold cables.
Workstation	An individual user interface where the desk, computer, communications, and other equipment is located and connected to the telecommunications outlet.

IX. ILLUSTRATIONS 1 & 3 (Illustration #2 purposely left out)

Illustrations are to aid the design professional and installer in the development and installation of a telecommunications infrastructure in new and existing (renovation) projects. It includes recommended layouts for various infrastructure components and systems.



Note: All Conduit and Sleeves are to be clean, dry, unobstructed, reamed, labeled, capped for protection and fitted with bushings. Conduit is to be provided with pull tape with a minimum pull rate of 200 lbs.

Fig 1. RISER CONDUIT LAYOUT

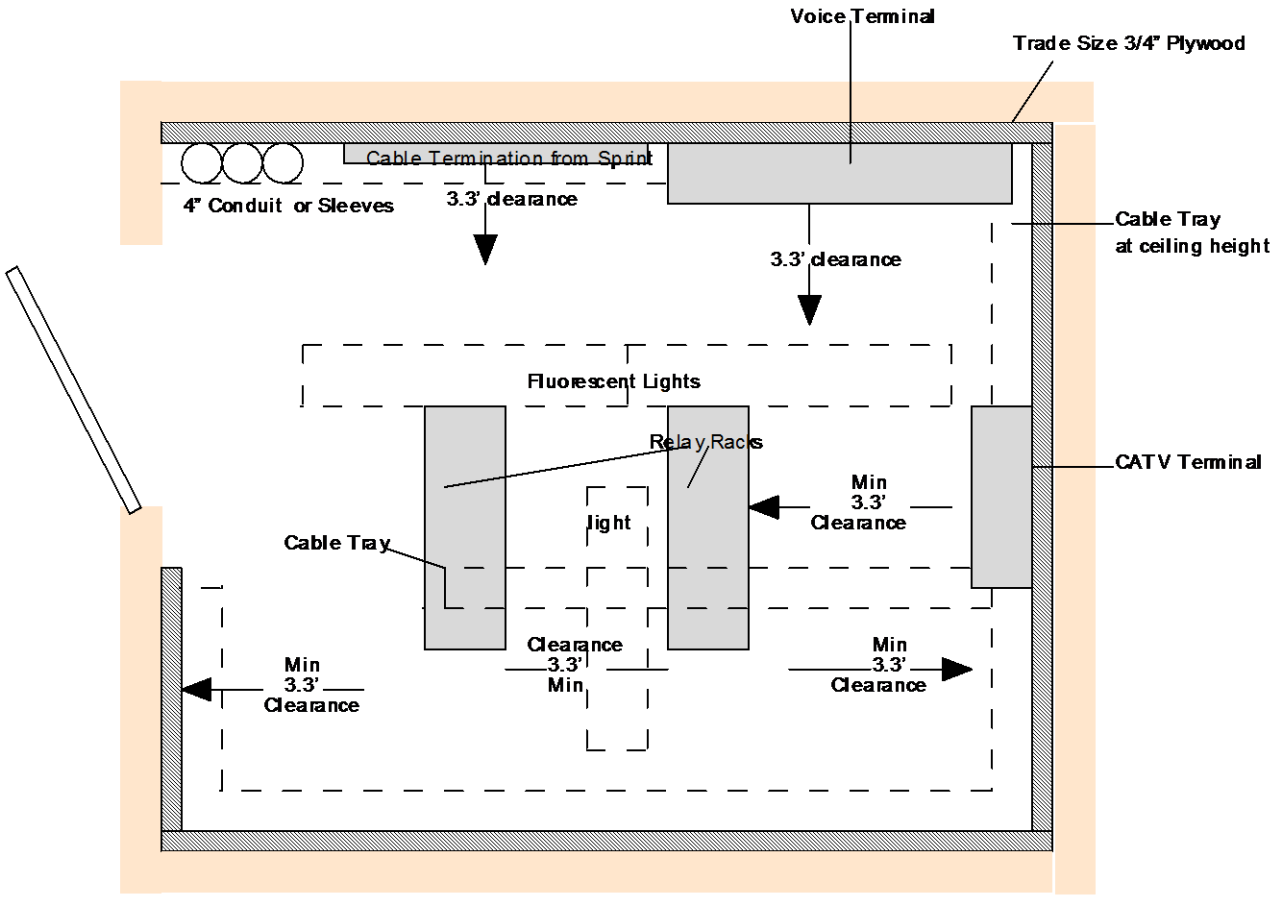


Fig 3. TYPICAL TELECOMMUNICATIONS ROOM
MINIMUM 7' X 10'