State of Georgia

Telecommunications Guidelines

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Telecommunications Guideline

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State of Georgia Telecommunications Design Manual, July 1, 2002
Telecommunications AEC Design Manual, September, 2001

Scheduled Review

Twelve months from the effective date.

Overview

The intent of this manual is to provide guidance to professionals engaged in designing and constructing projects for the State of Georgia, all of which usually include a telecommunications component. The design of any telecommunications Information Transport Systems (ITS) requires the use of national and international standards and codes. These codes ensure the integrity and longevity of the ITS.

This manual does not specifically address safety issues associated with its use. It is the responsibility of the user of this manual to determine and use the applicable safety and health practices of OSHA, NEC, NESC and any other life/safety standards. The State of Georgia shall not be liable with respect to any liability, loss or damage caused directly or indirectly by application of this manual.

The manual is divided into two sections. The first section is intended to provide designers and engineers references to standards and codes that affect the design, installation, and maintenance of a Telecommunications ITS. The second section is to provide architects, designers, and construction contractors with specific requirements regarding Georgia State government facilities.

Purpose of this Manual

Effective telecommunications and networking cannot be accomplished without adherence to standards. Additionally, cabling infrastructure costs cannot be contained without adherence to sound installation and management practices. To ensure that the future telecommunications and connectivity needs of agencies are met in a cost–effective manner, this manual confirms the State of Georgia's support for ANSI/TIA/EIA and IEEE standards for telecommunications.

The following standards are applicable to telecommunications cabling:

- The American National Standards Institute (ANSI) approves standards as having been properly developed.
- The Telecommunications Industry Association (TIA) develops standards for cables.
- The Electronics Industry Association (EIA) focuses on physical device standards.
- The Institute of Electrical and Electronics Engineers (IEEE) publishes networking and telecommunications standards

Section one:

1.0 Regulatory Codes and Standards

- **The following standards and regulations are periodically revised due to the ever–changing technologies that drive the performance of voice and data communications. It is the responsibility of the design professional to be familiar and up–to–date with the current regulatory and best practices for telecommunications design.**

1.1 Regulatory Agencies

Currently, the following agencies and their codes, standards and regulations shall govern all telecommunications work performed for the State of Georgia.

Acronym	Organization	Web Site
ANSI	American National Standards Institute	www.ansi.org
ASTM	American Society for Testing Materials	www.astm.org
BICSI	Building Industry Consulting Service International	www.bicsi.org
BOCA	Building Officials and Code Administrators International, Inc.	www.bocai.org
EIA	Electronic Industries Alliance	www.eia.org
EPA	Environmental Protection Agency	www.epa.gov
EPD – Georgia	Georgia Environmental Protection Division	www.dnr.state.ga.us/dnr/environ
FCC	Federal Communications Commission	www.fcc.org
ICEA	Insulated Cable Engineers Association, Inc.	www.icea.net
IEEE	Institute of Electrical and Electronic Engineers, Inc	www.ieee.org
IEC	International Electro–technical Commission	www.iec.ch
ISO	International Organization for Standardization	www.iso.ch
NEMA	National Electrical Manufacturers Association	www.nema.org
NFPA	National Fire Protection Association	www.nfpa.org
NEC (NFPA 70)	National Electrical Code	www.nfpa.org
OSHA	Occupational Safety and Hazard Administration	www.osha.gov
SCTE	Society of Cable Telecommunications Engineers	www.scte.org
RUS	Rural Utilities Services	www.rurdev.usda.gov/rus/
TIA	Telecommunications Industry Association	www.tiaonline.org
UL	Underwriters Laboratories	www.ul.com

1.2 National Electrical Code, NFPA 70

The National Fire Protection Association has acted as the sponsor of the National Electrical Code (NEC) since 1911. The original Code was developed in 1897 as a result of the united efforts of various insurance, electrical, architectural, and allied interests. The purpose of the NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. The NEC provides the minimum code requirements for electrical safety. In telecommunications distribution design, the NEC must be used in concert with the ANSI/EIA/TIA standards identified below, which are intended to insure the performance of the telecommunications infrastructure. Designers shall always consult with the local municipal Authority Having Jurisdiction (Building/Fire Inspector), who may have additional, more stringent requirements, beyond those contained in the NEC.

The particular sections of the NEC of interest to designers and installers of telecommunications distribution, telecommunications systems, and information processing systems are:

Article 250 -- Grounding
Article 517 -- Health Care Facilities
Article 645 -- Information Technology Equipment
Article 770 -- Optical Fiber Cables and Raceways
Chapter 8 -- Communications Systems

The National Electrical Code is available from:

National Fire Protection Association
1 Batterymarch Park
PO Box 9101
Quincy, MA 02269-9904

1.3 ANSI/TIA/EIA Standards

The Telecommunications Industry Association/Electronics Industry Association (ANSI/TIA/EIA) engineering standards and publications are designed to serve the public interest by eliminating misunderstandings between manufacturers and purchasers. The standards facilitate interchangeability and improvement of products, and assist the purchaser in selecting and obtaining the proper product for his particular need.

ANSI/TIA/EIA Standards are updated every 5 years. Due to the rapid changes in the telecommunications and electronics industries, ANSI/TIA/EIA publishes periodic Telecommunications System Bulletins (TSB) which provides additional guidance on technical issues that must be addressed prior to the next scheduled revision of the Standards. The information contained in TSBs is usually incorporated into the applicable Standard during the next Standard revision. Standards and publications are adopted by

ANSI/TIA/EIA in accordance with American National Standards Institute (ANSI) patent policy.

ANSI/TIA/EIA Standards are available from:

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5704
1-800-624-3974

Optical Fiber Systems Test Procedures, ANSI/TIA/EIA-526 (series)

ANSI/TIA/EIA-526 contains a series of test procedures developed to provide uniform procedures for testing all or part of optical fiber systems or subsystems intended for optical communications or data transmission use. The base document is ANSI/TIA/EIA-526.

Cabling Standard, ANSI/TIA/EIA-568 (series)

The ANSI/TIA/EIA-568 (series) is the Commercial Building Telecommunications Cabling Standard. This standard defines a generic telecommunications cabling system for commercial buildings that will support a multi-product, multi-vendor environment. It also provides direction for the design of telecommunications products for commercial enterprise.

The purpose of the standard is to enable planning and installation of building cabling with little knowledge of the telecommunications products that subsequently will be installed. Installation of cabling systems during building construction or renovation is significantly less expensive and less disruptive than after the building is occupied. ANSI/TIA/EIA-568 establishes performance and technical criteria for various cabling system configurations for interfacing and connecting their respective elements.

Pathways and Spaces, ANSI/EIA/TIA-569 (series)

The ANSI/EIA/TIA-569 (series) is the Commercial Building Standard for Telecommunications Pathways and Spaces. This standard recognizes three fundamental concepts related to telecommunications and buildings

(1) Buildings are dynamic.

Over the life of a building, or campus, remodeling is more the rule than the exception. The standard recognizes that changes will take place.

(2) Building telecommunications systems and media are dynamic.

Over the life of a building, or campus, both telecommunications equipment and cabling requirements change dramatically. The standard recognizes this fact by being as independent as possible from specific vendor equipment and media.

(3) Telecommunications is more than just voice and data connectivity.

Telecommunications also encompasses many other building systems including environmental controls, security, audio, television, sensing, alarms and paging.

Telecommunications includes all low voltage signal systems that convey information within or between buildings.

In order to have a building, or campus, successfully designed, constructed, and provisioned for telecommunications, it is imperative that the telecommunications design be incorporated during the preliminary architectural design phase. To accomplish this, the architect must work closely with the GSFIC/RCDD; and the Agency's Facilities Coordinator.

Administration Standard, ANSI/TIA/EIA-606 (series)

The ANSI/TIA/EIA-606 (series) is the Administration Standard for the Telecommunications Infrastructure of Commercial Buildings. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications rooms, and other telecommunications spaces. The purpose of this standard is to provide a uniform administration scheme that is independent of applications, which may change several times throughout the life of a building. This standard establishes guidelines for owners, end users, manufacturers, installers, and facilities administrators involved in the administration of the telecommunications infrastructure.

Grounding and Bonding, ANSI/J-STD-607 (series)

The ANSI/J-STD-607 (series) is the Commercial Building Grounding and Bonding Requirements for Telecommunications. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to insure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of this standard are additional technical requirements for telecommunications that are beyond the scope of the NEC. These standards are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568, and installed in the pathways and spaces designed in accordance with ANSI/TIA/EIA-569.

1.4 Local Area Network Ethernet Standard, IEEE 802.3 (series)

The State of Georgia typically utilizes the Ethernet LAN protocol at all facilities. All State of Georgia telecommunications infrastructure must be designed to support the Institute of Electrical and Electronic Engineers (IEEE) Ethernet 802.3 standards. Most State organizations are in the process of migrating to the 1000Base-X Gigabit Ethernet protocol based on the IEEE 802.3z standard. All newly installed cabling shall support this protocol.

Careful consideration must be given to the multimode optical fiber distance limitations and signal loss limitations (less than 2.5 dB end-to-end) necessary to support the IEEE 802.3z protocol.

1.5 BICSI Telecommunications Distribution Methods Manual

BICSI is an ITS Association whose mission is to provide state-of-the-art telecommunications knowledge to the industry, resulting in good service to the end user. BICSI develops and publishes the Telecommunications Distribution Methods Manual (TDMM). The TDMM is not a code or standard. The TDMM is an extensive volume of information on the various aspects of telecommunications systems and telecommunications distribution. The TDMM provides discussions and examples of various engineering methods and design solutions that can be selected and employed in order to meet the requirements of the NEC and ANSI/TIA/EIA standards.

Additional BICSI Publications:

BICSI -- Cabling Installation Manual
BICSI -- LAN Design Manual
BICSI – Customer-Owned OSP Design Manual

BICSI publications are available from:

BICSI
8610 Hidden River Parkway
Tampa, FL 33637-1000
1-800-242-7405

1.6 Local Code and Regulatory Compliance

Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of this manual as if herein repeated or hereto attached. Contractors shall notify the agency immediately in writing of any possible code violations. Where the requirements of this manual are more stringent than applicable codes, rules, regulations, and ordinances, the GTG requirements shall apply.

All pertaining statutes, ordinances, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction over the construction of ITS will be followed in the design and installation of cabling systems. These include, without limitation, applicable building codes, and disability regulations (ADA), municipal codes, fire codes, state statutes and the regulations of the Occupational Safety and Health Administration (OSHA).

1.7 Adherence to Reference Documents

This manual does not exclude any part of the ANSI/TIA/EIA standards but may recommend additional practices based upon field experience in state facilities. It is the responsibility of the designer to be familiar with the most current revision of the ANSI/TIA/EIA standards and to utilize the standards without exception unless recommended to do otherwise by this manual. Codes shall be followed; however, where they may differ with standards, the more stringent code requirement shall be followed.

1.8 Industry Standard Drawings and Specifications

1.8.1 Overview

The latest (2004) CSI Master Format Construction specifications shall apply to all projects. The telecommunications 'T-Series' drawings shall be included in addition to the other CSI Divisions. Some drawing elements may be combined onto a single sheet for smaller projects. Drawings required for a project shall be determined in the pre-design stage. Some projects may require all of these drawings and more to convey the intent of the necessary design intent of the ITS. Drawings shall be provided to address both inter-building and intra-building telecommunications needs based upon the scope of work developed during the pre-design stage of the project.

1.8.2 Applicable Drawings

T0 Series Campus or Site Plans – Exterior Pathways and Inter-building Backbones

T1 Series Layout of complete building(s) per floor – Serving Zone Boundaries, Backbone Systems and Horizontal Pathways

T2 Series Serving Zones Drawings – WAO Locations and reference labeling scheme

T3 Series Detail drawings to scale of the Service Entrance Room (SER), Main Equipment Room (MER) and Telecommunications Rooms (TR) – detail plan views, elevations, equipment rack and wall mounted equipment.

T4 Series Typical detail drawings of faceplate labeling, fire stopping, ADA compliance, Safety, DOT, and other detail drawings as necessary to effectively describe both inter-building and intra-building design elements.

T5 Series Schedules of cabling and equipment spreadsheets for cutovers.

T0 Drawings
Show physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and inter-building backbone cabling on plan view drawings and major system nodes and related connections on the logical system drawings.

Sheet Number	Sheet Title
T0-SP	Physical Site Plan
T0- SL	Schematic/Riser Diagram Site Plan
TO-SP	Pathways Physical - Site Plan
T0-PL	Schematic/Riser Diagram - Site Plan
T0-FP	Physical Fiber Backbone - Site Plan
T0-FL	Schematic/Riser Diagram Fiber Backbone - Site Plan
T0-CP	Physical Copper Backbone – Site Plan
T0-CL	Schematic/Riser Diagram Copper Backbone – Site Plan
T0-LP	Physical Legacy Systems – Site Plan
T0-LL	Schematic/Riser Diagram Legacy Systems – Site Plan
T0-RL	Riser Logical – Site Plan
T0-DL	Data System Logical – Site Plan
T0-TL	Telephone System Logical – Site Plan
T0-VL	Video System Logical – Site Plan
T0-BP	Backbone(s) Physical Plan – Site Plan
T0-BL	Backbone(s) Logical Plan – Site Plan

T1 Drawings

T1 drawings shall include layouts of the complete building per floor. The drawing indicates location of serving zones, communication equipment rooms, access points, pathways and other systems that need to be viewed from the complete building perspective.

Sheet Number	Sheet Title
T1-1	Building Plan For The First Floor
T1-PP	Building Pathways Plan View
T1-PL	Building Pathways Logical View
T1-FP	Building Fiber Plan View
T1-FL	Building Fiber Logical Plan
T1-CP	Building Copper Plan View
T1-CL	Building Copper Logical View
T1-XP	Building Coax Plan View
T1-XL	Building Coax Logical View
T1-LP	Building Legacy Systems Logical View
T1-LL	Building Legacy Systems Logical View
T1-RL	Building Riser Logical View
T1-DL	Building Data System Logical View
T1-TL	Building Data System Logical View
T1-VL	Building Video System Logical View
T1-EL	Building Electrical Logical View
T1-BP	Building All Backbone(S) Plan View
T1-BL	Building All Backbone(S) Logical View

T2 Drawings
In these drawings the building is divided up into serving zones. Drawing indicates outlet locations, telecommunications rooms, access points and detail callouts/cross-references for telecommunication room details and other congested areas

Sheet Number	Sheet Title
T2-1B	1B Serving Zone Drawing
T2-CL	Copper Logical Drawing by Riser
T2-PL	Pathway Logical Drawing by Riser

T3 Drawings
T3 drawings shall provide a detailed look at telecommunications rooms. Drawings indicate technology layout (equipment racks, ladder rack, MEP layout, equipment rack elevations, and backboard elevations. These could also be an enlargement of congested areas of T1 and T2 drawings.

Sheet Number	Sheet Title
T3-1B	Telecommunications Equipment Room 1B
T3-APB	Access Points for "B" Riser

T4 Drawings
T4 drawings shall include detailed drawings of typical symbols such as faceplate labeling, faceplate types, installation procedures, etc.

Sheet Number	Sheet Title
T4-SYM	Sample Symbols Drawing

MISC. Drawings
Additional drawings that may be used in conjunction with the other "T" drawings listed.

Sheet Number	Sheet Title
T5-1	Schedules/spreadsheets to show cutover information and cable plant management
T1-RP	Building Reference Plan/Same Concept as Site Plan
TS-1	On drawing Specifications (Specs. Pasted to a drawing sheet)
T-COVER	Drawing set cover page listing all drawings in the "T" set

1.8.3 Required Specifications

The telecommunications section of the "specifications" manual shall be numbered separately and distinctly from other sections**. The new 2004 CSI format has been approved and is required**.

1.9 Low Voltage Designer and Contractor Qualifications

1.9.1 Telecommunications Designer

A. It is required that the telecommunications design firm of record shall have a BICSI Registered Communications Distribution Designer (RCDD) on staff.

B. All drawings and specifications shall be reviewed by the RCDD employed by the design firm and carry that RCDD registration stamp on all drawings and specifications.

1.9.2 Telecommunications Contractor

A. The telecommunications contractor shall be licensed in the State of Georgia as a Telecommunications Class or Unrestricted Class Low-Voltage Contractor (LVL). GSFIC, SPC, GTA and the Using Agency shall be responsible for notifying the Secretary of State of any person acting as an LVLTC without a license.

Note: An Electrical Contractors license does not supersede a Low Voltage License (LVL) and any person engaged in this shall be committing an unlawful act. When an Electrical Contractor company performs telecommunications work they must also hold an active Georgia Low Voltage License to legally perform the work. Subcontracting work by an Electrical Contractor who does not hold an active LVL to a Low Voltage Licensed Contractor is not allowed. The prime LVLTC contractor to the General Contractor must be the license holder. The entire installation must be performed by the LVLTC, no sharing of work between Electrical Contractors and LVLTC's is allowed. (i.e. LVLTC must place cable, terminate and test, etc.)

B. The Low-Voltage Licensed Telecommunications Contractor (LVLTC) shall be based in the State of Georgia.

C. The installation of the SCS shall be performed by a LVLTC company that is currently a Manufacturer's Certified Structured Cabling System (SCS) installer in good standing.

D. The LVLTC installation company shall have an RCDD on staff performing the role of Project Manager and be available for consultation and to attend project meetings.

E. A full-time LVLTC manager shall be on site whenever work is being performed or workers are present.

References

The state may, with full cooperation of the LVLTC, visit installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through the LVLTC; however, the LVLTC personnel shall not be present during discussions with references. The LVLTC must provide a minimum of three (3) reference accounts at which similar work, both in scope and design, have been completed by the LVLTC within the last two (2) years.

Telecommunications is defined as building systems including voice/data services (to include wireless), distribution and work area outlets, environmental controls, security, audio, cable television, closed circuit television, sensing, alarms and paging.

Section Two:

The following are requirements and are in addition to the above guidelines:

- A minimum of two walls in each Telecommunications space shall be covered with rigidly fixed, ¾", A-C grade, void free plywood, capable of supporting wall mounted telecommunications devices.
- All communications equipment rooms shall be equipped with one emergency powered luminaire. The luminaire shall be on in the event of loss of normal power.
- Ridged steel conduit or concrete encased PVC conduit shall be used when routed beneath paved parking lots and/or roadways or under high load areas for all outside plant telecommunications installations.
- The average maintained illumination measured 3 feet AFF in the space shall be 50 foot–candles
- At least one lighting fixture within the room shall be connected to the emergency lighting circuit for the facility or provided with emergency battery ballast.
- Cables within telecommunications equipment rooms shall be secured to the cable racking using Velcro cable wraps to arrange cable bundles.
- Equipment not related to the support telecommunications spaces (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, enter or pass through the room.
- Distribution conduits shall be minimum 1" trade size (27 mm) or larger as required to accommodate the proper fill ratio.
- A minimum 15 year warranty shall be provided for the installed voice/data telecommunications systems.
- PVC conduit shall transition to rigid metal conduit a minimum of 10 feet from the building foundation. Rigid metal conduit shall route from that point to the building Entrance Facility Room. The rigid metal conduit is required to compensate for the shearing effect of excavated ground settling around the building foundation, and to provide protection from any future landscaping activities near the building.
- False ceiling shall not be provided in the ER. Floors shall be covered with light colored, anti-static vinyl tile. Walls and ceiling shall be painted. Finishes shall be light in color to enhance lighting.

- J-hooks are allowed for new construction and may be required in retrofit construction but should be rated to carry the category of cable to be installed, spaced as per the manufacturer's recommendation and sized not to exceed the J-hook manufacturer's recommended quantity of cables. Cable hangers of the "Arlington Loop" type (e.g.: TL20 2" or TL50 5") are the accepted cable hangers for all new construction and retrofitted cable installations.

Appendices

APPENDIX A

Glossary of Cabling and Telecommunications Terms and Concepts

AEC – Architects, Engineers, and Consultants.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) – ANSI is the umbrella organization in the United States for the repository and definition of standards. ANSI represents the U.S. in the International Standards Organization (ISO).

AMERICAN WIRE GAUGE (AWG) – The standard gauge for measuring the diameter of copper, aluminum, and other conductors.

ANSI/EIA/TIA 568 – Approved in 1991, this document specifies the standards for commercial building telecommunications cabling in North America. The standard specifically addresses the type of cabling to use, cabling practices, terminations and connections, and cable performance standards. The current version of this standard is the ANSI/TIA/EIA–568–B series and addenda.

ANSI/EIA/TIA 569 – North American commercial building standard for telecommunications pathways and spaces. Its purpose is to standardize specific design and construction practices within and between buildings which are in support of telecommunications media and equipment. The current version of this standard is ANSI/TIA/EIA–569–B–2004.

ASYNCHRONOUS TRANSFER MODE (ATM) – A high speed cell–based switching and multiplexing technology based on segmentation of voice, data and video into fixed packets (cells).

ATTENUATION – A reduction in strength or deterioration of an electrical signal as it passes through a transmission medium. Attenuation generally increases with frequency, cable length and the number of connections in a circuit. Attenuation is measured in decibels (dB). In optical fiber, a diminution of the signal as a function of length traveled.

AUTOTEST – A pre–programmed series of tests and pass/fail criteria used by a hand–held cable test device to determine and certify the category of performance of data cabling.

BACKBONE – The part of a premises distribution system that carries the heaviest traffic. Includes a main cable route and facilities for supporting the cable from the MC to IC; IC to HC; or ER to MC, IC, or TR.

BANDWIDTH – In electrical transmission systems, the range between the highest and lowest frequencies of a transmission channel. A measure of the information capacity of the transmission channel. The measured difference at some frequency between cross–talk and attenuation. Bandwidth varies with the type and method of transmission. Bandwidth is measured in hertz.

BARRIER – A permanent partition installed in a cable raceway or housing that provides complete separation of the adjacent compartment.

BASEBAND – A network in which the entire bandwidth of the transmission medium is used as a single digital signal.

BEND RADIUS – The radius a cable can bend before the risk of breakage or increase in attenuation occurs. Or, the allowable radius a cable can be bent per a particular standard.

BER – Bit Error Rate is calculated as follows: The data packet sent, minus the data packet received, divided by the data packet transmitted.

BICSI – Building Industry Consulting Services International. BICSI, a not–for–profit telecommunications association, is a world–wide resource for technical publications, training, conferences, and registration programs for information transport design and installation.

BIT – A contraction of the term binary digit. A bit can be either 0 or 1 and is the smallest possible unit of information in digital code.

BIT/S (BPS) – Bits per second. A measure of speed or data rate. Often combined with metric prefixes such as Kbps (kilo or thousands of bits per second) and Mbps (mega or millions of bits per second).

BNC – A bayonet–locking connector used to terminate coaxial cables. There is some disagreement as to whether BNC is an acronym for Bayonet–Neill–Concelman or Bayonet Nut Coupler.

BONDING – The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

BROADBAND – A network in which the bandwidth can be shared by multiple simultaneous signals that are encoded with radio frequency modulations.

BUFFER COATING – Protective material applied to optical fibers.

BUILDING ENTRANCE FACILITY – The area inside a building where telecommunications cables enter and leave (see Telecommunications Entrance).

BUS – 1) A data path shared by many devices. 2) A linear network topology in which all workstations are connected to a single cable. On a bus network, such as Ethernet, all workstations receive all transmissions; only the workstation that the information is addressed to will use the information.

BYTE – A collection of bits operated upon as a unit, usually 8 bits long. Often used to represent one character. Also used to measure the capacity of storage devices.

CABLE – A bound or sheathed group of mutually insulated conductors.

CABLE TESTER – A handheld electronic device that is used to measure the electrical and physical properties of network cabling. Used commonly to certify cabling to known standards, or as a troubleshooting tool.

CAMPUS – A premises containing more than one building adjacent or near to one another.

CAMPUS BACKBONE CABLE – The communications cable that is part of the Campus Backbone Subsystem and that is placed between buildings. There are four methods of installing campus backbone cable: in–conduit (in underground conduit), direct–burial (in trenches), aerial (on poles), and in–tunnel (in steam tunnels).

CAPACITANCE – The property of a system of conductors and dielectrics that permits the storage of electrically separated charges when potential differences exist between the conductors.

CATEGORY OF PERFORMANCE – Copper cable and connector hardware components, as well as link and channels, are rated to performance categories as defined by TIA. The ANSI/TIA/EIA 568–B series of standards defines the categories of performance for new construction.

CATV (COMMUNITY ANTENNA TELEVISION) – A method of delivering high quality television reception by transmitting signals from a central antenna throughout the community via coaxial cable. CATV is a broadband transmission facility which generally uses a 75W coaxial cable to carry numerous frequency–divided TV channels simultaneously.

CCTV (CLOSED CIRCUIT TELEVISION) – In general, a video channel which is broadcast to a limited number of locations. Often used in security applications.

CHANNEL – The end–to–end transmission path from equipment cable end in the TR to the patch cable end in the WA. Per ANSI/TIA/EIA 568–B.1 the channel includes up to 328' of horizontal cable; a work area cable; a telecommunications outlet or connector; an optional transition point or consolidation connector; and two connection (cross–connect) connected by a patch cable and an equipment cable in the telecommunications room. When a maximum horizontal length of 328' is used, then the total length of the equipment cable, patch cable and work area cable shall not exceed 33'.

CHARACTERISTIC IMPEDANCE – The impedance that an infinitely long transmission line would have at its input terminal. If a transmission line is terminated in its characteristic impedance, it will appear (electrically) to be infinitely long, thus minimizing signal reflections from the end of the line.

CIRCUIT – 1) (Communications) A bi–directional communications path between two pieces of associated equipment. 2) (Power) An arrangement of conductors, devices and utilization equipment (loads) such that current will pass through them.

CLADDING – The material surrounding the core of an optical fiber cable. The cladding must have a lower index of refraction than the core in order to contain the light in the core.

CLOSED ARCHITECTURE – An architecture that is compatible only with hardware and software from a single vendor. Contrast with Open Architecture.

COAXIAL CABLE – A type of communication transmission cable in which a solid center conductor is surrounded by an insulating spacer which in turn is surrounded by a tubular outer conductor (usually a braid, foil or both). The entire assembly is then covered with an insulating and protective outer layer. Coaxial cables have a wide bandwidth and can carry many data, voice and video conversations simultaneously. Commonly used for Cable TV (CATV) or older computer networks.

CONDUIT – A rigid or flexible metallic or nonmetallic raceway of circular cross section in which cables are housed for protection and to prevent burning cable from spreading flames or smoke in the event of a fire.

CONNECTOR – A device that connects wire or fiber in cable to equipment, other wires or fibers. A receptacle used with a plug to make electrical connection between communication circuits. Connectors are considered the female component of a connector/plug connector. Connectors are typically used at the work area.

CONNECTING BLOCK – A plastic block that houses metal cabling terminals to provide a connection between two groups of wires. Connecting blocks have Insulation Displacement Connectors so insulation removed prior to termination is not required. Major block types are 110 and 66.

CONSOLIDATION POINT – An interconnection between horizontal cables that extends from building pathways to the work area, typically used to support frequent rearrangement of open office furniture clusters.

CORE – The central region of an optical fiber through which light is transmitted.

CROSS CONNECT – A facility enabling the termination of cable elements and their interconnection and/or cross–connection, primarily by means of a patch cable or jumper.

CROSS CONNECTION – A connection scheme between cabling runs, subsystems, and equipment using patch cables or jumpers that attach to connecting hardware on each end.

CROSSTALK – The phenomenon in which a signal transmitted on one circuit or channel of a transmission system creates an unwanted signal in another circuit or channel, generally related to wire placement, shielding, and transmission techniques. Crosstalk interferes with the desired data signal. The level of unwanted crosstalk in network cabling can be determined by the use of handheld testers.

DECIBEL (dB) – A unit for measuring the relative strength of a signal. Usually expressed as the logarithmic ratio of the strength of a transmitted signal to the strength of the original signal. A 3 dB increase in signal strength is twice the original signal. A 3 dB decrease is half the original signal.

DELAY – In data communications, the time between transmission and reception of a signal. Usually expressed in nanoseconds. Also see Propagation Delay.

DELAY SKEW – The difference in time between the arrival (reception) of a data signal and subsequent related data signals. Usually expressed in nanoseconds.

DEMARCATION – A point at which two services may interface and identify the division of responsibility, such as the point of interconnection between telephone company facilities and the user's terminal equipment.

DUPLEX – Simultaneous bi–directional transmission over the same wire pair.

EIA (ELECTRONIC INDUSTRIES ASSOCIATION) – A consultative group of manufacturers recognized as the standards writing group in the United States for electronic equipment.

ELFEXT – Equal Level Far End Crosstalk; a measure of the unwanted signal coupling, expressed in dB relative to the received (attenuated) signal level, from a transmitter at the far end into the neighboring pairs measured at the near end. Characterizing ELFEXT is important for cabling links intended to support 4 pair, full–duplex network transmissions.

EMI/RFI (ELECTROMAGNETIC INTERFERENCE/RADIO FREQUENCY INTERFERENCE) – The interference in signal transmission or reception resulting from the radiation of undesirable electrical or magnetic fields.

ENTRANCE FACILITY – The Entrance Facility is an entrance to the building for both public and private network service cables, including the entrance point at the building wall and continuing to the entrance room or space.

EQUIPMENT ROOM (ER) – An Equipment Room is a centralized space for housing telecommunications equipment. It is differentiated from the Telecommunications Room by the type of equipment used; the room serves a building or multiple buildings in a campus environment.

ETHERNET – A baseband local area network used for connecting computers and terminals, etc., within the same building. Ethernet was marketed (and trademarked) by Xerox and developed jointly by Digital Equipment Corporation, Intel and Xerox. It is the basis for the IEEE Standard 802.3. It employs CSMA/CD as the network access method, and is popularly deployed as 10BASET, 100BASET, and 1000BASET, where 10, 100, or 1000 is the data transfer rate in megabits/second, BASE indicates Baseband transmission, and T signifies Twisted Pair as the medium.

FAR END CROSSTALK (FEXT) – Measure of unwanted signal coupling from a transmitter at the far end into neighboring pairs measured at the near end.

FERRULE – A component of an optical fiber connection that aligns and protects the stripped end of a fiber.

FIBER LOSS (Optical Loss) – The attenuation (decrease) of the light signal in optical fiber transmission. Optical loss is directly related to the length of fiber and the quality and number of connections and splices in a fiber segment.

FIRE–RATED POKE–THROUGH – A cable distribution device which is fitted through a pre–drilled core hole in the floor and allows cables to be fed from the floor below.

FLOOR BOX – A cast iron, stamped steel or nonmetallic box placed in the concrete floor (prior to pouring the concrete slab) of a building which is fed via conduit and used to house voice, data, power and video connections.

FULL DUPLEX – Simultaneous bi–directional signal transmission.

FURNITURE CLUSTER – A contiguous group of personal work areas, usually constructed from furniture, typically including partitions of other space division, work surfaces, storage and seating. The work area cluster does not span aisles; all components are in contact or close proximity.

GSFIC – Georgia State Finance and Investment Commission

GHz (GIGAHERTZ) – A unit of frequency equal to one billion hertz (1,000,000,000 cycles per second).

GROUNDING CONDUCTOR – The conductor used to connect the grounding electrode to the building's main grounding busbar.

GROUNDING ELECTRODE – A conductor of a group of conductors (usually a rod, pipe or plate) in direct contact with the earth providing a low impedance connection to the earth.

HALF DUPLEX – A circuit which provides transmission alternately in either direction.

HEADROOM – The number of decibels by which a system exceeds the minimum defined requirements.

HERTZ (Hz) – A unit of frequency or bandwidth equal to one cycle per second.

HOME RUNS – A pathway or cable between two locations without a point of access in between. Characterized in star topologies.

HORIZONTAL CABLING – The cabling between and including the telecommunications outlet/connector and the horizontal cross connect.

HORIZONTAL CROSS CONNECT (HC) – A cross connect of horizontal cabling to other cabling, i.e., horizontal, backbone, equipment.

HUB – Connection point for circuits or a network. Hubs may be active or passive

HYBRID CABLE – An assembly of 2 or more cables of the same or different types or categories covered by one overall sheath.

IEEE – Institute of Electrical and Electronics Engineers.

IMPEDANCE – A unit of measure, expressed in ohms, of the total opposition (resistance, capacitance and inductance) offered to the flow of an alternating current.

INFRASTRUCTURE, TELECOMMUNICATIONS – A collection of those telecommunications components, excluding equipment that together provides the basic support for the distribution of all information within a building or campus.

ISO – International Standards Organization. The body which promotes the development of worldwide commercial and industrial standards.

INSERTION LOSS – The reduction in the amount of power received before and after the insertion of a component (i.e., connector, coupler or splice) into a previously continuous transmission line. Optical fiber insertion loss is referred to as 'power loss'.

INSULATION DISPLACEMENT – A type of wire terminal that requires no wire stripping; when the wire is correctly attached, its insulation is displaced (pierced) to form a connection. A popular form of insulation displacement termination is the 110 system.

INTERCONNECTION – A connection scheme that provides for the direct connection of a cable to another cable or to an equipment cable without a patch cable or jumper.

INTERMEDIATE CROSS CONNECT (IC) – A cross connect between first level and second level backbone cabling.

ISDN – Integrated Services Digital Network: an international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires.

JACKET – The flexible covering of a cable, used to protect the color–coded conductors inside. Also referred to as a cable's "sheath".

JUMPER – An assembly of two twisted wires without connectors used to join telecommunications circuits/links at the cross connect.

LEC (LOCAL EXCHANGE CARRIER) – A private communications utility company or a government organization that furnishes services to the general public. It is typically licensed or regulated by a state or federal government agency.

LED (LIGHT EMITTING DIODE) – A semiconductor diode which emits light when a current is passed through it. In lightwave transmission systems, LEDs or lasers are used as light sources.

LINK – The link is regarded as the permanent portion of the cabling system. A test configuration for the link consists of up to 90m (295') of horizontal cabling, a telecommunications outlet/connector, and up to two cross connect connections in a telecommunications room. The link specifically excludes patch cables and equipment cables.

LOCAL AREA NETWORK (LAN) – A non–public data communications network confined to a limited geographic area used to provide communication between computers and peripherals.

LOOPBACK – A type of diagnostic test in which a transmitted signal is returned to the sending device after passing through a data communications link or network. This test allows the comparison of a returned signal with the transmitted signal.

LOSS – Reduction in signal strength, expressed in decibels (dB). Opposite of gain.

MAIN CROSS CONNECT (MC) – A cross connect for first level backbone cables, entrance cables, and equipment cables.

MHz (MEGA HERTZ) – A unit of frequency equal to one million hertz (1,000,000 hertz).

METROPOLITAN AREA NETWORK (MAN) – An extended LAN operating within a metropolitan area and providing an integrated set of services for real–time data, voice and image transmission.

MICRON – A unit of length equal to one millionth of a meter (.000001 meter). Short for micrometer.

MIPS – Millions of Instructions Per Second. A measure of processing power.

MODEM (MODULATOR DEMODULATOR) – A device which converts digital signals to analog signals (and vice–versa) for transmission over the telephone network, which usually is analog.

MT–RJ – A small form factor fiber connector that features a high–density design and RJ45 locking mechanism.

MULTIFIBER CABLE – An optical fiber cable containing two or more fibers, each providing a separate information channel.

MULTIMEDIA – A means of conveying information with components in different media such as voice, music, text, graphics, image and video.

MULTIMODE OPTICAL FIBER – An optical fiber that will allow many bound modes to propagate. The fiber may be either a grade–index or step–index fiber. Typically used in premise environments only. Multimode Fiber cores are typically either 62.5 or 50 microns in diameter. See Single Mode Fiber.

MUTOA – A Multi–User Telecommunications Outlet Assembly, used to facilitate furniture rearrangement in open office areas. Defined by ANSI/TIA/EIA 568B–1.

NANOSECOND (NS) – One billionth of a second.

NATIONAL ELECTRICAL CODE (NEC) – A nationally recognized safety standard for the design, construction, and maintenance of electrical circuits.

NETWORK – A formalized definition of the structure and protocols of a computer network.

NETWORK INTERFACE – The point of interconnection between telephone company facilities and terminal equipment, protective apparatus or cabling at a subscriber's premises.

NEXT (NEAR END CROSSTALK) – Electrical noise coupled from different wire pairs within a common sheath.

NODE – In general, any point of interconnection to a network where service is provided, used or communication channels are interconnected.

NOISE – Random electrical signals, introduced by circuit components or natural disturbances, which degrade the performance of a communication channel.

OPEN ARCHITECTURE – An architecture that is compatible with hardware and software from any of many vendors.

OPEN OFFICE – An office where a floor space division is provided by furniture, furniture partitions, or both instead of by building walls.

OPEN SYSYTEM INTERCONNECTION (OSI) – An internationally accepted framework of standards developed by the International Standards Association, for communication between two systems made by different vendors.

OPTICAL FIBERS – The technology in which communication signals in the form of modulated light beams are transmitted over a glass or plastic fiber transmission medium, and then demodulated to electrical signals by a light sensitive receiver.

OPTICAL TIME–DOMAIN REFLECTOMETER (OTDR) – An instrument that characterizes cable loss by measuring the backscatter and reflecting of injected light as a function of time. It is most useful for locating splices, connections, and breaks. It is *not* as useful as an optical fiber test set for accurately measuring cable attenuation, and shall therefore *not* be used to certify an optical link.

PASSIVE EQUIPMENT – Components and/or equipment that pass active signals without conversion.

PATCH CABLE – A short length of copper or optical fiber cable with connectors on each end used to join communications circuits as a cross connect.

PATCH PANEL – A cross connect system of mateable connectors, utilizing patch cables, that facilitates administration.

PATHWAY – A facility for the placement of telecommunications cable.

PEDESTAL – A device usually mounted on the floor, which is used to house voice/data jacks or power outlets at the point of use.

PERSONAL COMPUTER (PC) – A computer for personal, single–user use, as opposed to mainframes or minicomputers which are shared by many users.

PERMANENT LINK – The transmission path between two mated interfaces of cabling, excluding equipment cables, work area cables and cross–connections.

PHYSICAL LAYER – Within the OSI Model, the lowest level (Level 1) of network processing, below the link layer, concerned with the electrical, mechanical, and handshaking procedures over the interface that connects a device to a transmission medium.

PLENUM – In building construction, the space that is used for air circulation in heating and air conditioning systems, typically between the structural ceiling and the suspended ceiling or under a raised floor. The plenum space is often used to house the communication cables for the building's telecommunications network. In those instances, plenum cable must be used.

PLENUM CABLE – Plenum cable is coated with a fire–retardant coating (usually Teflon) so that in case of a fire it does not give off toxic gasses and smoke as it burns. Required for cables used in plenum areas.

PLUG – The male component of a connection. It is typically used on one or both ends of equipment cables or on cabling for interconnect or cross connect.

POINT–TO–POINT TRANSMISSION – An uninterrupted connection between two pieces of equipment.

PORT – A functional unit of a node through which data can enter or leave a data network.

POWER METER – The most effective tool to measure light loss in an optical fiber link. Typically used to describe a test set used to accurately measure optical loss in an optical fiber link. Comprised of a light source, capable of injecting light at different frequencies into the fiber link; and the power meter itself, which when properly calibrated will display the amount of optical loss for that link.

POWER/COMMUNICATIONS POLE – A raceway placed between the ceiling and floor used in conjunction with a ceiling distribution system for the purpose of distributing communication and power service to a work area. Also called Utility Pole, Service Pole or Tele–power Pole.

POWERSUM CROSSTALK – A measure of the combined crosstalk on a receive pair from all near–end disturbers operating simultaneously.

PREMISES CABLING – The entire cabling system on the user's premises used for transmission of voice, data, video and power.

PRINTED CIRCUIT – A copper foil circuit formed on one or both faces of an insulating board to which circuit components are soldered. The copper foil pattern serves to connect components and is produced either by etching or plating.

PRIVATE BRANCH EXCHANGE (PBX) – A private telephone switching system, usually located on a customer's premises connecting a common group of lines from one or more central offices to provide service to a number of individual phones. Now used interchangeably with PABX (Private Automatic Branch Exchange).

PROPAGATION DELAY – The time it takes for a signal to travel from one point on a circuit to another.

PROTOCOL – A formal set of conventions governing the format and control of inputs and outputs between two communication devices or processes.

PVC – Polyvinyl Chloride. A type of plastic commonly used for cladding telecommunications cable.

PUBLIC SWITCHED NETWORK – Any common carrier network that provides circuit switching between public users, such as the public telephone network, telex or MCI's Execunet (long distance telephone service).

RACEWAY – Any channel designed for holding wires, cables or busbars such as conduit, surface raceways, cellular floors or cable troughs.

RCDD – The Registered Communications Distribution Designer is a professional engineering status granted by BICSI based on knowledge of the telecommunications cabling industry.

REPEATER – In digital transmission, equipment that receives a pulse train, amplifies it, re–times it, and then reconstructs the signal for retransmission.

RETURN LOSS – The measure of the reflected energy caused by impedance mismatches in a cabling system.

RISER – The conduit or path between floors of a building into which telephone and other utility cables are placed to bring service from one floor to another.

RJ (REGISTERED JACK) – Registered Jack (RJ) cabling configurations developed by the Bell System for connection of customer premises equipment to the public network. Registered jacks serve telephone and data applications and are registered with the FCC. The most common types are: RJ45 and RJ11.

SC – Designation for an optical connector featuring a 2.5mm physically contacting ferrule with a push–pull mating design. This connector is recommended in the ANSI/TIA/EIA–568B–1 Standard for structured cabling.

SFF (SMALL FORM FACTOR) – An ANSI/TIA/EIA approved fiber adapter/connector system that provides two fiber strands in a surface area similar to UTP (RJ–style) connection.

SHIELD (SCREEN) – A metallic layer usually in the form of a braid or foil surrounding one or more electrical conductors to insulate them from electromagnetic interference.

SINGLEMODE OPTICAL FIBER – An optical fiber that will allow only one mode to propagate. This fiber is typically a step index fiber and typically has a core diameter of 8.3 microns.

SLEEVES – Short lengths of rigid metal pipe, approximately 4 in. (10.1 cm) in diameter, located in the telecommunications room (TR), which allow cables to pass from floor to floor when TRs are vertically aligned. Sleeves also provide for easy pulling of cable.

SLOTS – Openings in the floor of riser telecommunications closets that allow cables to pass thorough from floor to floor when closets are vertically aligned. A slot accommodates more cables than an individual sleeve.

SPLICE – The joining of two or more cables by connecting the conductors pair to pair. Not allowed with twisted pair cables per the 568B Standard.

ST – Designation for the "straight tip" connector developed by AT&T. This optical connector features a physically contacting non–rotating 2.5mm ferrule design and bayonet connector–to–adapter mating.

STAR – A physical point-to-point network topology.

STRUCTURED CABLING SYSTEM – A telecommunications cabling system, capable of supporting a wide range of applications. Generic cabling can be installed without prior knowledge of the required applications. Application–specific hardware is not a part of generic cabling.

SUBMINATURE D CONNECTOR – A family of multi–pin data connectors used in RS232–C communications. The connectors are available in 9, 15, 25 and 37 pin configurations; sometimes referred to as DB9, DB15, DB25 and DB37 connectors respectively.

SURGE SUPPRESSION – The process by which transient voltage surges are prevented from reaching sensitive electronic equipment.

SURFACE RACEWAY – A cable distribution method in which channels containing cables are run along or within the baseboards of a building.

SWITCHING – A function carried out by a switching hub, alleviating traffic by making virtual connections between transmitting and receiving nodes.

T1 – A digital transmission link with 1.544 Mbps bandwidth. T1 operates on two twisted pairs and can handle 24 voice conversations, each digitized at 64 Kbps. More voice channels are available with advanced digital voice encoding techniques.

T1 CARRIER – The AT&T digital transmission system which transmits data at 1.544 Mbps (See also T1).

TELECOMMUNICATIONS – For the purposes of this Glossary, a term encompassing voice, audio/visual, and data communications in the form of coded signals transmitted over media.

TELECOMMUNICATIONS OUTLET – A device where the horizontal cable terminates in the Work Area (WA). The telecommunications outlet provides the interface to the work area cabling.

TELECOMMUNICATIONS ROOM (TR) – A Telecommunications Room is an enclosed space for housing telecommunications equipment, cable terminations and cross–connect cabling. Typically, the room serves a floor and is the location of horizontal cross–connects.

TELECOMMUNICATIONS ENTRANCE – The point where telecommunications lines enter or leave the building.

TERMINATION – The act of attaching connectors to bare cabling. In the case of data cabling, terminations must be in accordance with standard cabling codes and standards.

TOPOLOGY – The geometric description of the physical or logical connections of a telecommunications system; typically described as bus, ring or star.

TRANSCEIVER – A single device capable of both sending and receiving information.

TRANSIENT – An abrupt change in voltage, of short duration, which may cause signal impairments, loss of memory or physical damage to equipment.

TRANSMISSION MEDIA – Anything such as wire, coaxial cable, optical fibers, air or vacuum that is used to carry an electrical signal.

TRUNK – A specialized communications path between two points, one of them usually being a telephone company central office or switching center.

TWISTED PAIR CABLE – A type of communication transmission cable in which two individually insulated wires are twisted around each other to reduce induction (thus interference) from one wire to the other. The pair may be surrounded by a shield, insulating jacket or additional pairs of wires.

USOC – Universal Service Ordering Codes (USOC) are a series of Registered Jack (RJ) cabling configurations developed by the Bell System for connection of customer premises single line equipment to the public network.

UTP – Unshielded twisted pair copper cable.

WAVELENGTH – The length of an electromagnetic waveform as measured from any point on one wave to the corresponding point on an adjacent wave, such as from crest to crest. Wavelength is inversely proportional to frequency.

WIDE AREA NETWORK (WAN) – A communications network designed to serve hundreds or thousands of miles using common carrier–provided lines, such as the nationwide telephone network. Compare with LAN.

WIDEBAND – A communications channel or medium having a bandwidth sufficient to carry multiple voice/video or data signals simultaneously.

WIRE – A single copper conductor/wire covered with a plastic jacket.

WORK AREA / WORK STATION (WA) – A building space where the occupants interact with telecommunications equipment.

APPENDIX B – REFERENCES

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Occupational Safety and Health Administration (OSHA) – Worker Safety

National Electric Code (NEC) – Intrabuilding electrical safety

National Electric Safety Code (NESC) – Interbuilding electrical safety

Building Industry Consulting Service International (BICSI) – Telecom trade association & developer of TDM manuals

American National Standards Institute (ANSI) – Standards

American Insurance Association (AIA) – Insurance standards for buildings and infrastructure

Insulated Cable Engineers Association (ICEA) – Manufacturer's organization that writes specifications for cable

Building officials and Code Administration (BOCA) – Building Codes

National Fire Protection Association (NFPA) – Fire safety codes

National Institute of Standards and Technology (NIST) – Technology Standards

ATM Forum – Standards body for ATM standards

International Organization for Standards (ISO) – Produces standards documents

Institute of Electrical and Electronics Engineers (IEEE) – Electronics, Telecom, and Electrical standards

Federal Communications Commission (FCC)

The Americans Disabilities Act (ADA) – Federal Regulation

Bell Operations and Construction Standards (BOCS) – Outside/Entrance Plant/USOC

AT&T Plant Standards – Outside/Entrance Plant

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