COLORADO STATE UNIVERSITY | TELECOMMUNICATIONS

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Telecommunications Design Standards

Revision 21.5 – October 4, 2017

Colorado State University

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Chapter 1: Introduction

1. Departments Involved in Design Process

This document provides design specifications for voice, video and data communications infrastructure at Colorado State University (CSU), otherwise referred to as the University. Several departments are responsible for this communications infrastructure and should be involved in the design process. These include 1) CSU Telecommunications for the physical infrastructure, 2) Academic Computing and Networking Services (ACNS) for the network equipment and video and 3) Classroom Support Services for Smart classrooms. Contacts for these departments are given below.

Table 1. Contacts

Department	Name	Phone
Academic Computing & Networking Services (ACNS)	Greg Redder	(970) 491-7222
Classroom Support Services	Al Powell	(970) 491-6226
Telecommunications Project Planner	Pat Demchok	(970) 491-1148

The individuals above shall be consulted initially during all phases of design. As questions arise during the construction phase, the above individuals are also to be consulted.

2. Applicable Standards

Telecommunications physical infrastructure as defined by the Telecommunications Industry Association/Electronics Industry Association, or TIA/EIA, consists of six elements: 1) building entrance, 2) building main telecommunications room or Main Distribution Frame (MDF), 3) backbone cabling, 4) telecommunications closets or Intermediate Distribution Frames (IDFs), 5) horizontal cabling, and 6) work area. These elements will be augmented by a seventh element, networking equipment, required to provide a minimum level of data service for the building. Also included are basic specifications for the delivery of broadband television services via a hybrid single-mode fiber optics and coaxial cable system.

In general, the following standards at a minimum shall be observed for telecommunications infrastructure and are incorporated herein by reference:

-- TIA/EIA 568A Commercial Building Telecommunications Cabling Standard
– TIA/EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces
– TIA/EIA 607-A-2002 Commercial Building Grounding and Bonding Requirements for Telecommunications
– Most current edition NEC

– BICSI DD 120-Grounding Fundamentals for TELCO Facilities Chapter 4 Telecommunications Systems Grounding (as reference)
– IEEE 802.3-1993
– Systimax Structured Cabling System (SCS) standards

This document provides interpretation of the standards referenced in the previous paragraph and provides additional detail, in some cases superseding those standards. Where Systimax guidelines differ from TIA/EIA standards, the Systimax guidelines supersede the TIA/EIA standard. Should the contractor require additional interpretation of these design guidelines, the contractor shall contact the designated University representative (Table 1).

Table 2. Standards Hierarchy

System	Purpose	Substitutions
TIA/EIA/NEC/BICSI	Grounding, Bonding, and Fire-stopping	None
Corning	Fiber Optics Glass	None
Systimax Structured System (SCS)	Category 5e Copper Cabling	None
TIA/EIA	Data	None
TIA/EIA	Voice	Must be pre-approved in writing

3. General Guidelines

Integral to the telecommunications infrastructure in buildings are the secure communications rooms, consisting of the MDF and, generally, one or more IDFs. These rooms must be secure, environmentally conditioned and clean before Telecommunications can work in them, especially as fiber must be terminated in these rooms requiring a very clean environment. Expensive and delicate networking devices, requiring environmental conditioning, also are housed in these rooms. In this regard, the MDF and IDFs shall be completed including environmental conditioning and completed early in the project timetable. In particular, all penetrations shall be completed and sealed (e.g., capped) before Telecommunications work can continue in these environments.

4. Equipment and Materials Specifications

Check with Telecommunications Contact, Table 1, to ensure use of the latest materials list.

Note that there are some materials for which no substitutions are allowed. Where substitutions are allowed, these must be pre-approved in writing in an addendum prior to the final design bid. Questions about substitutions of these materials should be referred to the University designated representative (Table 1 Contacts).

5. Contractor Certifications

CSU requires contractors to be a Systimax Solutions Premier or Select Installation Partner, and listed on commscope.com. Approval of certification must be submitted to Telecommunications. In addition, Telecommunications requires that contractor provide Technicians and Installers certified by the Building Industry Consulting Service International, Inc. (BICSI) permanently assigned for the duration of the CSU project. Telecommunications requires a minimum of one (1) BICSI certified technician and a ratio of one (1) BICSI certified installer to three (3) installation workers.

Please refer to Table 1 Contacts for the Telecommunications contact person for questions regarding this section.

Chapter 2: Horizontal Infrastructure

Systimax Structured Cabling System (SCS) Category 5e cable, connectors, and fixtures shall be used for horizontal data cabling. Data cable runs shall be strictly limited to 90 meters in total length, according to standards. In particular, IDFs are to be located so as to maintain less than a total 90-meter cable run.

Cable Colors – The following is the color standard for all horizontal cable on campus

	Cat. 5e plenum	Cat. 5e non-plenum	Cat. 6 plenum	Cat. 6 non-plenum	Cat. 6a plenum	Cat. 6a non-plenum
Cable	Orange	Gray	White	Yellow	Red	Blue
Jack	Orange	Orange	Red	Red	Blue	Blue

Cat. 3 (no longer being installed) data jacks are Ivory

Plenum Spaces - Plenum cabling or conduit shall be used in plenum spaces, this includes under floor space. Contractor shall determine prior to work being started, in consultation with CSU Telecommunications and CSU Facilities, whether the space is a plenum space.

Under Ground Cable – All cable placed in raceways installed underground shall be rated for wet locations.

Patch Cords – the following is the standard color code for MDF/IDF Patch Cords

- Data - Red/Gray
- VoIP - White
- Security Cameras, Card Key, Meters, EMS, Facilities - Green
- Wireless -Yellow
- A/V - Violet
- Switch to Switch Link - Orange
- Department Specific - Light Blue

Patch cords must be of proper length to eliminate “Jump Rope” and “Banjo” style of patching.

Asbestos – Buildings to be wired shall be inspected by CSU Environmental Health Services for Asbestos Containing Material (ACM). Where ACM exists, the University will decide whether to abate the asbestos or circumvent the asbestos by, for example, installing telecommunications infrastructure under the ceiling tiles.

Conduit – Please refer to; Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual 11th Edition v. 1,Section 1 – Horizontal Pathway Systems, Chapter 4 – Horizontal Distribution Systems, p. 4.5 - 4.27 and Telecommunications Distribution Methods Manual v. II, Appendix A –

Codes, Standards and Regulations, p. A7-A8 for details on the installation of conduit.

Installation of Cable Trays – Install cable trays with sufficient space to permit access for installing the cables. Clear space shall be provided above the top rail equal to the loading depth but not less than 12 inches. Provide lateral clearance of 24 inches on at least 1 side of the trapeze hung tray. CSU prefers aluminum ladder type cable tray with 9" spacing on rungs. All cable trays must be trapeze hung. The use of wire baskets is discouraged. If wire baskets are to be used, please contact the Telecommunications Contact, Table 1, to discuss installation requirements.

Table 3. Conduit Fill Capacity

Number of Cables	Percentage Fill
1	53%
2	31%
>2	40%

Cables shall be pulled with no more than a 25-pound pull force applied at any time during installation.

Testing and Reporting of Test Results – Each Category 5e, 6, or 6a cable installed shall be tested using a calibrated Fluke Series DSX-5000 Tester or higher version in accordance with the latest EIA/TIA 568 standards, and the results recorded on a separate USB stick for each building and provided to Telecommunications.

The Telecommunications contact from Table 1 shall be notified prior to any testing so that the representative or designate may be present during the testing. If the circuit testing is conducted in the absence of the University representative or designate, then the University may request a retest with the University representative present at the tester's expense.

Systimax Certification – CSU requires that upon completion and testing of each building/project, Systimax certification be obtained. The Telecommunications contact person is responsible for coordinating the Systimax certification and facilitating any remedies. Please refer to Table 1 – Contacts for the name of the Telecommunications contact.

As-Builds Upon completion of termination and testing, as-built drawings of all Category 5e, 6 and/or 6a drops shall be provided within seven work days for each major phase of work; such as 1) floors, 2) wings, or 3) entire buildings. The as-built drawings shall be provided in AutoCAD version 2013 or higher format. These files are to be on a separate USB stick for each building.

Drop (Circuit) Labeling – Each Category 5e, 6 and/or 6a drop installed shall be labeled per CSU labeling scheme. Each drop shall be labeled on the front of the jack faceplate, on the patch panel in the IDF or MDF, and on both ends of the cable.

Four labels per fiber cable, two for the cable and two for the fiber patch panel, shall be prepared for all fiber cables. The University may elect to install the labels.

Invasive Work and Work Schedules Invasive work (e.g., core drilling, hammer drilling or work that is noisy, dusty, etc.) shall be conducted during off-business hours. Other work shall be coordinated with the University designated representative (e.g., to pull cables during off-hours), and these arrangements shall be determined by mutual agreement.

Chapter 3: Communications Rooms

Telecommunications room space, MDF and IDF, shall be dedicated to the telecommunications function and related support facilities. Equipment not related to the support of the telecommunications function shall not be installed, passed through, or entered in the telecommunications rooms without review by Telecommunications and Academic Computing and Networking Services (ACNS) and consideration in the sizing of the space, environmental requirements, etc.

ACNS/Telecommunications CANNOT install equipment in communications rooms prior to the completion of the following items; (a) permanent dedicated power, (b) proper grounding and lighting, and (c) secure permanent door and two keys provided to the Telecommunications Contact. ACNS/Telecommunications REQUIRES a minimum of three (3) weeks from the completion of the aforementioned items until the service data for the following services; (a) elevator telephones, (b) fire alarm(s), (c) door security, (d) environmental controls, and (e) voice, data and/or video services.

ACNS/Telecommunications strongly recommend that early in the design phase ALL parties desiring to install equipment in the MDF and/or IDFs be collectively engaged to discuss placement of equipment and determine size requirements for the communications rooms.

1. Main Distribution Room – MDF

Telecommunications and ACNS shall provide customized communication room designs based on the requirements of each project. Please contact the Telecommunications Contact Table 1 page 3.

The following are general guidelines in the absence of a custom communications room design.

Buildings shall have a MDF where voice, video and data enter the building. The MDF also serves as the distribution point for voice, video and data and shall be secure to protect the integrity of these systems, particularly E911 services.

Grounding and bonding shall be provided in the MDF that includes bonding to equipment racks, cable trays and telecommunications conduits in strict accordance with the TIA/EIA 607 standard, the most current edition NEC, and as a reference *BICSI DD 120-Grounding Fundamentals for TELCO Facilities, Chapter 4 Telecommunications System Grounding* and extended to all IDFs as described therein. All penetrations of the MDF envelope shall be fire-stopped.

In buildings of size 5,000 square feet or greater, a secure room dedicated to telecommunications, shall be provided for the MDF. In smaller buildings, a secure wall-mounted Hoffman box may be an option in lieu of a separate, dedicated room.

TIA/EIA 569 shall be strictly observed for the MDF, especially as to location (away from electromagnetic interference), perimeters (no false ceilings), limited access (i.e., security), HVAC, lighting and electrical.

MDF Power Requirements:

MDF shall be provided with four dedicated and one general use circuits.

5-20R

Two 20 amp, 120 volts NEMA 5-20 terminated on double duplex outlets,

L6-30R

and two 30 amp, 208 volts NEMA L6-30 outlet on the wall adjacent to the telecommunications racks. The general use outlet shall be near the door for ease of access – these locations shall be determined in consultation with CSU Telecommunications.

Provisioning of power and receptacles for non-Telecommunications/ACNS equipment requiring power installed in the MDF or IDFs is the responsibility and at the expense of the entity responsible for the equipment. No extension cords are acceptable loose on the floor or tied to the infrastructure.

No piping, ductwork, mechanical equipment, or power cabling or similar shall be allowed to pass through a MDF that is not associated with the communications services in that specific MDF. Switched lighting of 50-foot candles shall not be sourced from the same circuit as the telecommunications equipment.

MDFs shall be environmentally conditioned to accommodate network equipment loads up to 10,000 BTU/hr/. Temperature in MDFs shall not exceed 80°F.

The MDF shall have 3/4" A/C fire treated plywood backboards to be installed on all walls, 8’ high, painted with matte white paint.

The MDF serves as the fiber distribution point for the building and houses the network switches. ACNS will design the network-switching infrastructure.

In a multi-story building, there should a phone room on each floor, centrally located. CSU requires that the MDF be located on the ground floor. All data cable runs are to be limited to 90 meters in length.

The MDF shall be large enough to accommodate at least two 7'x19" relay racks and 3 - 12" vertical organizers; one rack for the building fiber and copper distribution and the other for the building data switches and associated UPS. The MDF shall also accommodate the voice and video distribution systems which may be wall or rack mounted.

All raceways into the MDF envelope shall be a fire barrier pathway.

Table 5. MDF Sizes

Building Size (ASF)	MDF Size (Length x width - ft)
Less than 5,000	Hoffman Box
5,000 to 10,000	10x8
10,000 to 50,000	10x12
50.000 to 100,000	12x12
100,000 to 150,000	14x14
150,000 to 200,000	14x16

Doors shall open outward and adhere to all fire codes. It may be necessary to install double opening doors for this purpose. Self-closing locksets shall be used to ensure doors are secure upon their closure.

2. Intermediate Distribution Room (IDF)

Telecommunications and ACNS shall provide customized communication room designs based on the requirements of each project. Please contact the Telecommunications Contact Table 1.

The following are general guidelines in the absence of a custom communications room design.

Grounding and bonding shall be provided in the IDF that includes bonding to equipment racks, cable trays and telecommunications conduits in strict accordance with TIA/EIA J-STD-607-A-2002 standard, the most current edition NEC, and as a reference *BICSI DD 120-Grounding Fundamentals for TELCO Facilities, Chapter 4 Telecommunications System Grounding* and extended to all IDFs as described therein. All penetrations of the IDF envelope shall be fire-stopped.

TIA/EIA 569 shall be strictly observed for the MDF, especially as to location (away from electromagnetic interference), perimeters (no false ceilings), limited access (i.e., security), HVAC, lighting and electrical.

IDF Power Requirements:

IDF shall be provided with four dedicated and one general use circuits.

Two 20 amp, 120 volts NEMA 5-20 terminated on double duplex outlets

and two 30 amp, 208 volts NEMA L6-30 outlet on the wall adjacent to the telecommunications racks. The general use outlet shall be near the door for ease of access – these locations shall be determined in consultation with CSU Telecommunications.

Provisioning of power and receptacles for non-Telecommunications/ACNS equipment requiring power installed in the MDF or IDFs is the responsibility and at the expense of the entity responsible for the equipment. No extension cords are acceptable either “loose” on the floor or tied to the infrastructure.

No piping, ductwork, mechanical equipment, or power cabling or similar shall be allowed to pass through an IDF that is not associated with the communications services in that specific IDF. IDFs shall be supplied with 50 foot-candle of switched lighting, which shall not be sourced from the same circuit as the telecommunications equipment.

Each floor shall have a dedicated IDF. IDFs shall be environmentally conditioned to accommodate network equipment loads up to 7,000 BTU/hr/. Temperature in IDFs shall not exceed 80°F.

The IDF shall have 3/4" A/C fire treated plywood backboards to be installed on all walls in the IDF, 8’ high, painted with matte white paint.

The IDF serves as the fiber access point for the building and houses the network switches. ACNS will design the network-switching infrastructure.

IDFs shall be located at points that minimize the runs of the data network to the end user, typically in the center of wings of buildings. Data cable runs are to be limited to 90 meters, and this may affect placement of the IDF or require additional IDFs to be added.

IDFs shall be sized such that there is ample room to install racks to house the equipment. The IDF shall be sized to accommodate a minimum of two vertical 7'x19"

relay racks and 3 - 12” vertical organizers: one for the fiber, an IDF switch, and UPS; and another for edge network switches. Ideally, there shall be 48” of space on each side of the rack lineup. Preferably, the MDF and IDF shall be vertically stacked within the building.

IDFs shall be sized to accommodate all connections that may potentially be used from that room. In a typical scenario, an IDF would serve an area of approximately 10,000-15,000 Assignable Square Feet (ASF), depending on density of connections deployed from the IDF.

Table 6. IDF Specifications

Serving Area	Number of Jacks	Room Size
10,000 sq. ft.	361-480	10x12
8000 sq. ft.	241-360	10x10
5000 sq. ft.	0-240	10x8

TIA/EIA 569-B 7.11.5.1.1
Additional rooms, one for each area up to 10,000 square feet or the horizontal distance to the work area exceeds 250 feet, shall be required.
Doors shall open outward, adhere to all fire codes, and secured with self-locking locksets. It may be necessary to install double opening doors for this purpose.
The communications rooms shall not be located below water level unless preventive measures against water infiltration are employed. The communications rooms shall be free of water or drain pipes not directly required in support of the equipment within the communications rooms. A floor drain shall be provided within the room if risk of water ingress exists.

3. Campus Room Types

Several generic types of rooms have been defined for categorization purposes. Except for minimum numbers of jacks, the following are suggested configurations. In all cases, the final numbers of jacks should be determined in consultation with CSU Telecommunications and the building occupant.

Offices – In every office there shall be a minimum of two data locations, located on opposite walls, each location will have at least two data jacks.

Where conduit is used, 1” conduit with a 4 11/16” square box 2 1/8” deep shall be placed to each communications outlet.

Classrooms – classrooms shall have a minimum of one quad outlet, located at the front of the room, with four data jacks. A podium will have a minimum of six data jacks. Three conduits with long radius sweeps shall be run to each podium, one conduit for electrical power, one 1" conduit dedicated to central data and voice communications, and one 1 1/4" conduit run from the podium to the computer projector in the ceiling. The projector shall be centrally located below the room’s false ceiling with the wiring and conduit permanently attached to the ceiling

structure. The projector shall have one data jack. Electrical power shall also be run to the ceiling-mounted projection system.

4. Grounding and Bonding

The telecommunications bonding backbone (TBB) shall be a copper conductor. The minimum TBB conductor size shall be a No. 6 AWG. The TBB should be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil. The TBB may be insulated. If the TBB is insulated, the insulation shall meet the fire ratings of its pathway. The sizing of the TBB is not intended to account for the reduction or control of electromagnetic interface.

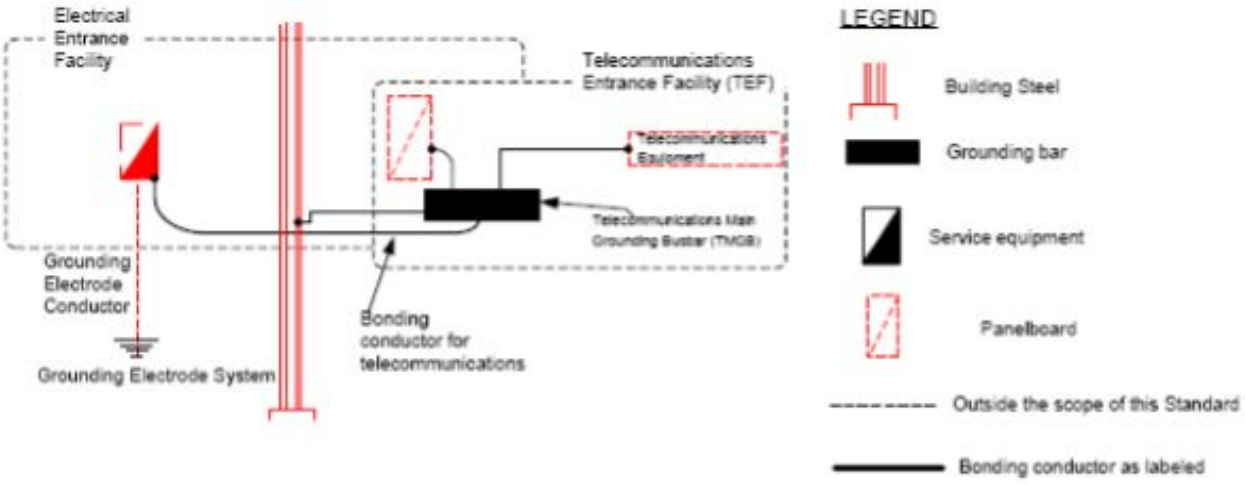
Note: The previous edition of this Standard sized the TBB conductor up to 3/0 AWG. This Standard allows the TBB conductor to be sized up to 750 kcmil. Bonding conductors used for telecommunications should be sized using engineered calculations.

Table 7. TBB Sizing

TBB length linear ft.	TBB Size (AWG)
Less 13	6
14 – 20	4
21 – 26	3
27 – 33	2
34 – 41	1
42 – 52	1/0
53 – 66	2/0
67—84	3/0
85—105	4/0
106—125	250 kcmil
126—150	300 kcmil
151—175	350 kcmil
176—250	500 kcmil
251—300	600 kcmil
Greater than 301	750 kcmil

TIA/EIA J-STD-607-B 6.3.2

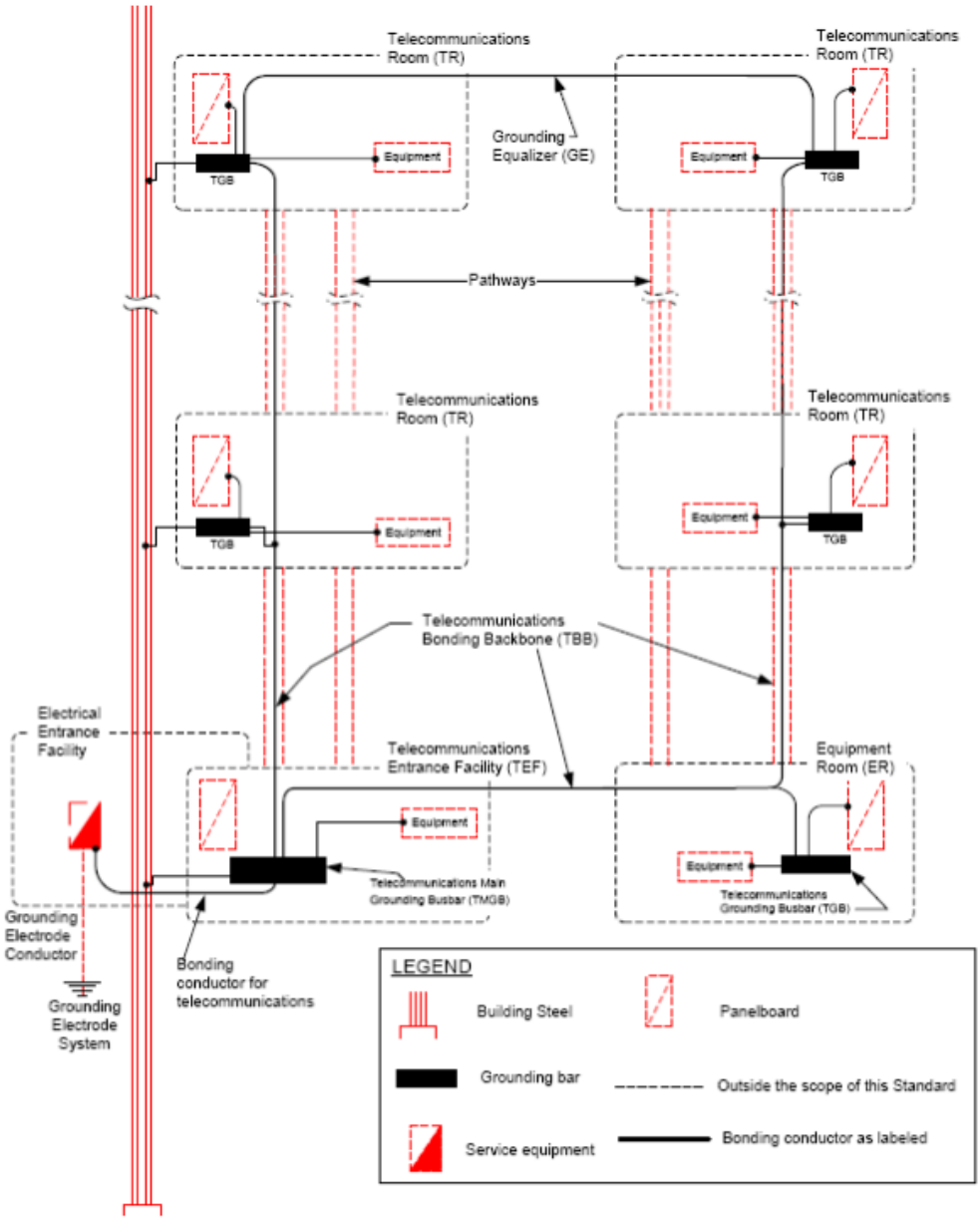
Figure 2
Main Building Ground



TIA/EIA J-STD-607-B
5.2.1

Figure 3, below, depicts a typical grounding and bounding scheme for a multistory building. It is intended as a guide rather than explicit instructions.

Figure 3
Building Ground



Chapter 4: Riser/Building Backbone Infrastructure

The building backbone cabling consists of fiber cable for data and video and copper cable for voice. These cables shall be run between the MDF to all the IDFs in a star topology. Check with the Telecommunications contact from Table 1.

The infrastructure for the building backbone cabling shall consist of conduit between the MDF and each IDFs where the run is vertical, or ladders racks (not hooks or rings) where the run is horizontal. Where conduits are run, separate conduits shall be used for copper cables (voice) and fiber cables (data and video). However, where runs are horizontal and ladder racks are used, both types of cables shall be run in a ladder rack.

EIA/TIA 569 shall be observed for the building backbone pathways. Conduits shall be sized to be no more than 40% full by volume. Long-radius metal sweeps shall be used instead of 90° fittings. No more than 180 degrees of bends between pull points shall exist in conduits without inclusion of a readily accessible and adequately sized pull box, the location of which shall be clearly marked on drawings. In situations where cable tray, conduit, or sleeves extend outside the MDF/IDF into occupied portions of the building, they shall be fire-stopped.

Both single-mode and 50-micron OM4 multimode fiber cable shall be run between the MDF and each IDF in a star configuration. At minimum, there shall be no less than 12 single-mode and 12 multimode fibers installed. A higher fiber optic pair count shall be permissible in consultation with Telecommunications. Fiber cables shall be run in conduit or in interduct if cable tray distribution method is selected. The fiber count depends on the number of data jacks in each IDF. One pair of multimode fibers is required for every 48 active data jacks with a 30% allowance for growth. Each number shall be rounded up to the next integer. Table 8 below illustrates fiber counts for a variety of situations:

Table 8. Multimode Fiber Counts

Number of active data jacks	**Base fiber count**	**30% allowance**	**Total fiber count**
96	2 pair	1 pair	3 pair
144	3 pair	1 pair	4 pair
240	5 pair	2 pair	7 pair
336	7 pair	3 pair	10 pair

Note that fiber bundles are available only in certain numbers of pairs. As an example, consider the example where bundles with 12 fibers (6 pairs) are used. For the second example above, 144 active jacks, one 12-count (6-pair) cable would be required. For the last example above, 336 active jacks, two 12-count cables would be required. On a typical installation of a composite 12 single mode and 12 OM4 multi-mode fibers installed between the MDF and IDF a minimum of two single mode

fibers shall have factory terminated APC (Angle Polished) connectors to a accommodate video transfer.

Single-mode fiber shall be pre-tested with an Optical Time Domain Reflectometer (OTDR) at 1310 nm & 1550 nm, upon cable delivery.

Multimode fiber shall be tested post installation at 850 nm and 1300 nm.

A bidirectional end-to-end test shall be conducted at dual wavelength for each fiber installed.

Prior to acceptance by the University, the OTDR and end-to-end test shall be randomly sampled and retested by the University.

Test results shall be electronically documented and submitted to the Telecommunications contact from Table 1 on a USB stick.

Cable ladder racks shall be hung in a manner that ensures a minimum of 12" vertical clearance and 18" horizontal clearance on at least one side to allow for sufficient access to the ladder rack for cable installation and maintenance. Mount cable ladder racks between 7 and 8 feet AFF (above the finished floor) so as to be accessible by cable handlers using standard 6-foot ladders. Transitions where changes in height are unavoidable shall be gradually sloping. The cable ladder rack shall be routed so as not to interfere with installation of other systems or access to those systems for maintenance. Coordination with other systems shall be maintained so that, where these systems traverse above or below the ladder rack, access shall not be blocked or interfered with. Cable ladder racks shall not pass through firewalls. Instead, the ladder rack shall stop on either side of the firewall and be interconnected via multiple fire barrier pathways passing through the firewall. The bottom of these pass-through devices shall be aligned with the top of the cable ladder to ensure proper cable support and unrestricted passage. These pass-through conduits shall be no more than 40% full.

Chapter 5: Building Entrance Infrastructure

1. General

At the University, telecommunications typically enter the building into the Main Distribution Frame or MDF. Thus, generally at the University, the Building Entrance and the MDF are one and the same. In certain venues, Telecommunications may require the addition of an Entrance Facility to accommodate an interface between non-CSU service providers. Buildings are required to have physically diverse paths to the campus fiber infrastructure from the MDF.

EIA/TIA 569 shall be observed for the building entrance. Underground conduits entering a building shall be dedicated for the exclusive use of Telecommunications and no more than 25% full by volume.

Telecommunications may request removal of unauthorized cable(s) within Telecommunication's entrance conduits. Copper and fiber cables shall be brought into the building in separate conduit systems. There shall be no more than a total of 180 degrees of bends between pull points, using only large radius PVC coated GRC or fiberglass sweeps, shall be used in conduit runs between pulling points.

2. University Policy Governing Entrance Infrastructure

ACNS/Telecommunications must be contacted, refer to Table 1 – Contacts, during the early planning stages for new constructions or remodels that will require new or modification of entrance infrastructure.

Chapter 6: Outside Plant Infrastructure

1. Introduction and Project Conditions

The following specifications govern services contracted by Colorado State University (CSU). Contractors shall fully adhere to these specifications, unless the University designated representative authorizes a waiver or modification in writing.

The contractor shall be responsible for conducting all potholing and/or locates of all utilities along the prescribed route. The contractor is responsible for contacting UNCC at 811. In addition, it is the contractor's responsibility to ensure that all utilities are located including CSU's utilities. Facilities Management telephone number is 970-491-0077.

Locate and protect existing utilities and other underground work in a manner that will insure that no damage or service interruption will result from excavating and backfilling.

When applicable, the contractor shall be responsible for acquiring all relevant permits for street, alleys, easements, utility corridors, etc. from the City of Fort Collins.

When utilities are damaged, the contractor shall immediately contact CSU Telecommunications (970-491-5881) and CSU Facilities Management (9704910077).

The contractor agrees to remedy all defects identified by CSU during the final inspection of the contractor's work. The scheduling of the remedies shall be approved by CSU. The contractor shall be responsible for obtaining a final work acceptance signature, from the University designated representative, on a mutually agreed upon "punch list" to indicate acceptance of the contractor's work by CSU.

The contractor is responsible for adhering to all applicable industry and personal safety standards, including, but not limited to OSCHA standards.

The contractor shall be responsible for providing an as-build drawing. Please refer to As-Builds section in Chapter 2 for details. However, for outside plant infrastructure projects, the contractor in addition shall illustrate route(s), depth and benchmark measurements from existing landmarks and fixtures.

The contractor shall report on the progress of the work to the Telecommunications contact from Table 1 on a mutually agreed-upon schedule.

2. Landscaping, Irrigation Systems, Site Protection and Excavation

Contact CSU Facilities Management at 970-491-0077 for all requirements.

3. Directional Boring Specifications

Materials - Installed two-inch (2”) inner duct, quantity to be determined. The inner duct shall have a No. 12 UF type tracer wire installed outside the duct along the entire path of the duct. The Telecommunications contact from Table 1 shall approve any deviation.
Conduit shall only have new 1800 lb. Sequential Mule Tape, supplied and installed by the contractor, in each duct without knots and splices. The mule tape shall be exposed at least six feet (6’) for aiding in tying on to cable. Polyrope shall not be accepted within the duct.

Installation - The inner duct shall be installed a minimum of forty-eight inches (48”) in depth. The inner duct shall have a gradual 2” sweep into the J-box or a location marked by CSU prior to start of work (e.g., manhole). The inner ducts shall have duct plugs installed and secured around cable to prevent any debris from entering the conduit. All vacant inner ducts shall have a duct plug installed and secured.
Building Entrance Only: Inner ducts exposed on the exterior of a building shall have installed GRC fittings to National Electrical Code (NEC) specifications attached for building entry conduit and approved by CSU. Plenum and non-plenum areas may require additional consideration.
Splices, where applicable, shall be dug to the depth of the bore and be in a straight line with the two (2) adjoining bores.

Manholes - shall be pumped and cleaned before and after work is completed. Shall have sufficient racking drilled and mounted for cable attachment and service coil support. CSU shall be consulted for determination of service coil length and racking requirements. Inner duct entering through the manhole or concrete foundations shall be core drilled and have link seals installed.

Traffic Control - The contractor shall be responsible for providing traffic control commensurate with the requirements of the work it is conducting, and adheres to all municipal, State, and Federal guidelines and standards.

4. Trenching

Materials - The contractor shall coordinate with the Telecommunications contact from Table 1 and they shall specify and approve the vault(s) for each project
The contractor shall install a four-inch (4”) Yellow Caution Tape labeled “Caution” twelve inches (12”) from the bottom of the trench.
Conduit duct shall have a No. 12 UF type tracer wire installed outside the conduit. The Telecommunications contact shall approve any deviation. Conduit shall have only new 1800 lb. Sequential Mule Tape, supplied and installed by the contractor, in each duct without knots and splices. The mule tape shall be exposed at least six feet (6’) for aiding in tying on to cable. Polyrope shall not be accepted within the duct.

Installation of Conduit and Vault - All conduits shall be installed a minimum of 48” in depth. When PVC conduit is placed in a trench, PVC coated GRC or fiberglass large radius sweeps shall be used.
Contractor shall ensure that the integrity of the vault is retained throughout its installation. To the extent necessary, the contractor shall internally brace the vault to ensure its integrity throughout installation and soil compaction. Also refer to Chapter 6 Section 6 – Excavation Backfill for more details.
Each newly installed or reinstalled vault shall be excavated 2’ deeper in order to accommodate for 2’ 1” minimum aggregate of rock to bring the vault to grade and maintain adequate drainage.
Each newly installed or reinstalled vault shall have a 3M 1401 – XR 4” Ball Marker installed inside the vault.
Vaults shall NOT be drilled or penetrated without prior approval.
Vaults shall be sized to neatly accommodate copper and/or fiber optic cables and service coils.
Conduits shall gradually sweep in below the bottom of the fiberglass vaults.
Ducts shall have duct plugs installed and secured around cable to prevent any debris from entering the conduit.

5. Steam Tunnel Cable Installation

Contact CSU Facilities Management at 970-491-0077 prior to commencing any work in the University steam tunnels.

Chapter 7: Network Switches

Buildings shall be supplied with a building data switch and sufficient edge switches to provide network access to current users.
ACNS shall be responsible for specifying the specific brand and model for network equipment. Using this standard equipment will ensure that the network equipment is compatible with campus backbone network equipment. This is the only way to ensure that performance, advanced features such as Quality of Service (QoS), multicast, security, and manageability, will exist and interoperate with campus networking infrastructure.

General switch standards:

- If more than two 1U switches are required to provide sufficient connectivity, a chassis based switch shall be used in place of 3 or more 1U switches.
- All switches are to provide 10G uplinks capability.
- All switches are to provide 1G connections on all edge ports.
- All switches are to provide PoE+ on all ports at all times.
- In general, a 70% activation rate is to be assumed, that is a 30% allowance shall be made for ports that are not initially activated.
- Switches shall meet all operational standards as listed in Appendix A.
- Switches housed in outdoor locations shall be enclosed in a Hoffman box with environmental controls of heating and cooling.
- Temperatures are not to exceed 80 degrees F nor go below 32 degrees F.

MDF switches additional standards:

- The primary MDF switch is to connect to the campus core with two 10G connections preferably on disparate routes out of the building.
- The primary MDF switch is to have redundant power supplies.
- MDF switches with multiple power supplies are to be able to provide power on all ports at PoE+ levels even if one power supplies fails.
- A primary MDF chassis base switches is to have the first two modules reserved for central services and uplinks. User data jacks are not to be terminated out of these ports.

Please refer to the ACNS contact from Table 1.

Chapter 8: Wireless Access Points and Devices

- Wireless access points are defined as any device adhering to the IEEE 802.11 WiFi specifications for network access.
- Wireless devices are all other devices operating in the same spectrums as the IEEE 802.11 WiFi specifications, i.g.: 2.4Ghz, 5GHz
- Two cat6a cables shall be provided to every access point location.
- PoE+ will be provided over each of the cat6a cables to wireless access points.
- ACNS will specify the type, count and location of all access points.
- No additional access points or devices acting as an access point can be connected to the campus network per campus IT Security Policy.
- ACNS must approve the use of any wireless device that will connect into the data network. This is to ensure proper balance of devices within the available spectrums.
- ACNS will specify locations on DD prints for locations of access points. It is the contractor's responsibility to ensure that these access points are placed within a 1' diameter of the specified location. If the access points are not placed as specified, it is the contractor's responsibility to move and pay for putting the access point in the position specified.
- Wall mounted access points shall be mounted between 7'6" and 10'0" above finished floor. There shall be a minimum clearance of 12" from the center of the mounting box to the ceiling or other obstructions.

Chapter 9: VOIP

Phone service for University locations is provided by the Telecommunications and ACNS. All installations are to support current VOIP standards. Consultation with ACNS contact as listed in table 1 is required to ensure compliance with all current standards. Contractor is required to provide drawing to the ACNS contact as listed in table 1 so comments can be provided for the DD phase.

Chapter 10: TV/Video

A fiber optic television splitter shall be provided in the MDF for video distribution to the IDFs. Each IDF shall have its own fiber optic splitter and coaxial splitters.

Network electronic and video equipment specifications shall be respectively provided on a case-by-case basis to ensure that the latest technology and lowest price is applied to the project. Please refer to the ACNS contact in Table 1.

Chapter 11: Emergency and Inter/Intra Building Life and Safety Infrastructure

Colorado State University has contracted with Rave Wireless for Rave Alert. Rave Alert is an emergency text notification service that delivers emergency notification to subscriber's cellular devices. Emergency text notifications will be composed by CSU emergency/police and/or public relations personnel in case of an emergency on campus and/or an outside event that affects the campus community. Rave Alert is an optional subscription service for registered students and faculty and staff.

Appendix A – Network Switch Protocol Specifications

Spanning-Tree: 802.1W (RSTP)

- Switch is not set as a root switch nor is the default priority reduced
- No loop or BPDU protect settings on feed port to campus switch. Campus switch port should be configured as a regular data port

LLDP

- LLDP supported and enabled

SNMP

- SNMP v3 support
- SNMP community changed from the default
- Read/write disabled unless necessary

VLANs

- 802.1q support
- No central VLANs are to be configured on exempt switches
- Trunking
- LACP

Username/password and switch access

- username/password Changed from the default
- RADIUS authentication support
- SSH support
- https support

Multicast/IGMP

- Enabled for all VLANs and port connecting to campus switch

Naming/labeling

- Switch description defined in switch configuration including Building name, room number

Routing

- Disabled

IPV6

- Supported

Revision History

- 21.1 (8/10/17) – Clarified needing redundant fiber paths into buildings.
- 21.2 (8/10/17) – Removed “Communications” from title
- 21.3 (8/10/17) – Reformatting to generate automatic table of contents
- 21.4 (8/21/17) - Added wall mount specification for Wireless Aps
- 21.5 (10/04/17) – Updated TBB chart and diagrams in Chapter 3