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CHABOT-LAS POSITAS COMMUNITY COLLEGE DISTRICT

CABLING INFRASTRUCTURE STANDARDS

Guidelines for the Design of
Telecommunication Infrastructure at
CLPCCD Sites

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1 Executive Summary

The Information Technology Services (ITS) Department at the Chabot-Las Positas Community College District is responsible for the cabling and network equipment infrastructure at all CLPCCD campuses and locations. Any information that is moved from one point on the Campus to another by TCP/IP protocols (cabled or wireless networking) uses infrastructure is operated and supported by CLPCCD ITS.

This Standard specifies components and installation methods for a generic telecommunications cabling system that will support a multi-product, multi-vendor environment. It also provides detailed information from which new systems that adhere to CLPCCD standards can be designed.

This Standard provides a uniform approach that is independent of applications, which may change several times throughout the life of the telecommunications cabling infrastructure. The following devices and applications are known to connect via wired or wireless infrastructure, and communicate across TCP/IP networks:

- Building Management Systems (BMS), HVAC controls
- Security panels, including IP cameras, access control panels, etc.
- Audio-Visual Systems: projectors, switchers, controllers, LCD displays, TVs.
- Electrical panels for power monitoring
- Kitchen stoves, hoods and discrete appliances
- Paper towel dispensers
- Irrigation systems: distributed controllers and servers
- Clock systems: servers and devices
- Solar panel and monitoring control panels
- Lighting control systems
- Health monitoring devices, PE equipment
- Computer controlled machining tools
- Swimming Pool controls

This document is intended to provide the Architect and Engineering team with the requirements and standards for network cabling infrastructure in a new or remodeled facility at a CLPCCD site. It is the expectation of CLPCCD ITS that the information provided in this Standard, shall be incorporated into the Construction Documents for each project, beginning with the Basis of Design. CLPCCD ITS expects any design process to be an iterative process, where the design team will engage the CLPCCD ITS staff in review and discussions during the Schematic, Design Development and Construction Documents steps of the design process. CLPCCD ITS will act as the coordination point to involve College Technology staff as needed.

The Chief Technology Officer (CTO) at CLPCCD ITS retains the right to review and approve all construction documents. CLPCCD ITS also retains the right to be the final reviewer and approval authority for all construction submittals and project acceptance of Communication and

Network Infrastructure systems. This includes, but is not limited to, pathways, cabling, the quality of workmanship and acceptance testing of any or all cable plant installed.

The objective is for the design team to use these standards, so as to provide the greatest longevity and function for current and future application areas. Consistency of components, installation methods and labeling will ensure that all cabling installation projects have a standard functionality, and operational appearance. This will allow CLPCCD ITS staff to effectively understand, operate and support the cabling infrastructure and network services traversing that infrastructure.

The CLPCCD ITS standard for cabling infrastructure product is Commscope SYSTIMAX Category 6A UTP cabling for copper station cabling and Commscope TERASPEED single mode fiber cabling for fiber backbones. This is established as a DISTRICT STANDARD and shall be specified as such with no substitutions allowed.

The criteria contained in this Standard are subject to revisions and updating as warranted by advances in building construction techniques and telecommunications technology. As warranted by technology changes, the manufacturer and their product line will be re-evaluated before the beginning of any large deployment. If new standards are established, this document will be updated in a timely manner.

2 Introduction

2.1 Responsibilities of CLPCCD ITS

CLPCCD ITS is responsible for provisioning and operating a robust Telecommunication Infrastructure in all CLPCCD buildings. It is expected that the infrastructure will support the connectivity needs and bandwidth requirements of voice, data, video, and multimedia communication, with capacity available for applications such as Intelligent Building Monitoring Systems (BMS), Security, meters and controls, etc. CLPCCD ITS owns the responsibility for the transport of all TCP/IP based traffic on the CLPCCD campuses/sites, both within campus and between locations.

The design process is streamlined and efficient when the Architect engages CLPCCD ITS in design meetings and coordination sessions beginning with the Basis of Design phase. CLPCCD ITS staff is available to assist in providing a detailed list of requirements that will aid in designing the required connectivity to rooms and Telecommunication IDF spaces.

CLPCCD ITS staff or its designated representative, in conjunction with the College Technology Staff, will activity participate in the design process. This includes attending architectural and engineering meetings that in any way will affect the provisioning of any and all network or communication systems during the course of the project.

CLPCCD ITS retains the right to review and approve all design and construction documents pertaining to, or affecting, the telecommunication infrastructure. CLPCCD ITS also retains the right to be the final reviewer and approval authority for all construction submittals, provide input to RFIs and provide the final project acceptance of Telecommunication Infrastructure systems. This includes pathways, cabling, the quality of workmanship and acceptance testing of any or all cable plant installed, and any other aspect of the construction/renovation project that could affect the Telecommunication Infrastructure operation. It is the expectation of CLPCCD ITS that the information provided in this document shall be used for the basis of the design of the cabling infrastructure and included in the drawings and specifications for the project.

2.2 Network Cabling Infrastructure Scope

In any construction project, the following Information Technology Infrastructure components shall be included in the construction design and budget:

Within the Building:

- ❒ Telecommunication BDF/IDF Room components, including room size, centralized location, construction (walls, floors, lighting, ceiling, doors, security), cable runway, racks, cabinets, cable management, backboards, grounding, electrical service, UPS, HVAC, access control, etc.
- ❒ Voice and Data Station cabling to outlets in all types of rooms, and as needed in support of Building Automation systems and network equipment installation.

- ❒ Termination components including patch panels, jacks, faceplates, patch cords, etc.
- ❒ Pathway components, including pullboxes, conduits, chases, sleeves, J-hooks/slings, basket/cable tray, etc.
- ❒ Riser cables such as multi-pair copper (voice) and single mode fiber backbones.
- ❒ Access infrastructure, such as hatches, panels, doors, device mounts, etc.

Between Buildings

- ❒ Pathways including conduits, maintenance holes, pull boxes, grounding, drainage, pull ropes, innerduct, sleeves, etc. Typically, this pathway infrastructure is provided to the closest point of interconnection to the site outside plant.
- ❒ Backbone cables such as multi-pair copper (voice) and single mode fiber backbones.
- ❒ Termination hardware such as Building Entrance protection blocks (BET), fiber and copper patch panels, slack loop storage, suspension and routing apparatus, grounding.

For all new and modernized buildings, the design team shall assume a complete installation of new infrastructure, within the building and to the point of connection on the campus.

Note that active equipment components such as computers, network switches, access points, telephones, voice and voicemail systems, etc. are NOT part of the construction package, but shall be purchased and deployed by CLPCCD ITS and College Technology staff during building turn-up.

2.3 CLPCCD PARTICIPATION

When a new building or building renovation is planned, the Architect will ensure that CLPCCD ITS or its designated representative, and College Technology staff are involved in the entire design process, including:

Design Phase	**Telecommunication Infrastructure Considerations**
Programming (Basis of Design)- Definition of building function and usage.	Definition of room purpose and the technology infrastructure required to achieve that purpose.
Schematic Design – These are the initial planning documents and design drawings which assist departments in the early stage of the project.	Establishment of Telecommunication spaces. Space allocation of Telecommunication BDF/IDF Rooms, sizing of Telecommunication BDF/IDF Rooms, cabling distances and riser paths. Scoping Outside Plant conduit routes from campus MPOE/MDF.
Design Development—As the architectural design process progresses, overlays are developed to show the various structures and systems planned for the building.	Outlet placement per room requirements, horizontal cable pathway space for cable tray in major corridors.

Construction Documents—These documents depict the final design before bid submittal is undertaken.	Detailed drawings and specifications for all outlets, pathways, Telecommunication IDF Room designs, cabling terminations, workmanship, testing.
Construction Phase *	
Submittals, Shop drawings, RFIs – These documents are provided by the contractor to clarify the construction scope.	Review of paper and electronic documents to ensure that field conditions and minor changes will still maintain a resultant infrastructure that meets the CLPCCD standards.
"Record Document" Drawings – These drawings and documents represent the project as it is finally constructed ("as-builts") and are deliverable prior to final inspection of the project.	Actual cabling as constructed, drawings with cable numbers/labels, test results, supplied in editable format on electronic media.

* Refer to Section 12 for a comprehensive discussion of how CLPCCD ITS participates in the construction phase.

The Architect is the focal point for coordinating the various engineering consultants during the design process. In order to provide an effective architectural design, the Architect needs to understand what the specific requirements are to support current and future telecommunication connectivity and services. The Architect will engage CLPCCD ITS in design meetings and coordination sessions, beginning with the programming phase. CLPCCD ITS will provide a detailed list of requirements that will aid in programming the required connectivity and communication spaces.

The Architect will ensure that where other Design Engineers or Consultants need a separate wiring infrastructure to support their systems, that those consultants coordinate their design and infrastructure requirements with the CLPCCD ITS staff. This includes, but not limited to design items such as cable type, cable color, use of supplemental or common pathways and support systems. For any Design Engineers or Consultants that need any data (Ethernet) or voice communication connection of any sort from the building to any other place on or off the Campus, the Architect will ensure that these Engineers/Consultants request and coordinate with CLPCCD ITS for this connectivity. No communication system that is included in the building will be allowed to install any inter-building cable(s) in separate pathway or to use the pathway under CLPCCD ITS control without prior design review and approval.

CLPCCD ITS relies on the Architect to provide coordination with the Design Engineers or Consultants for the support of any other low voltage systems, such as EMS control, BAS or Security. Of particular concern is that the installation of other low voltage systems, such as Security, do not conflict with installation or potential installation of telecommunication infrastructure. This document does not include a standard for AV cabling, and only references AV installations as they may impact the voice/data infrastructure.

As full participants in the design process, comments and requests submitted by CLPCCD ITS must be incorporated into the reviewed documents in full for the next review of documents, or discussed as needed.

2.4 TELECOMMUNICATION CONSULTANT/DESIGNER ROLE

CLPCCD ITS requires that the Architect retain the services of a Telecommunication Consultant with current BICSI RCDD (Registered Communication Distribution Designer) credentials. The design input from the qualified Telecommunications Consultant is part of each phase of the design process. The Architect is expected to incorporate comments, communication drawings and or specifications from CLPCCD ITS routed through the Telecommunication Consultant into the various document packages.

2.5 TELECOMMUNICATION DESIGN APPROACH

The telecommunications system design approach calls for a forward-looking view into the cabling and pathway requirements that will provide service for 20 to 30 years. CLPCCD has selected a wiring standard based on the most current cabling standards: Category 6A unshielded twisted pair copper for voice and data station cabling, multi-pair copper for voice backbone and zero-water peak single mode fiber for data backbone interconnection. The distribution of this cabling throughout a building is made possible by ensuring the cabling pathways are designed to support the required quantity and type of cabling (including additional future expansion). The cabling pathways must also be compatible with the stringent installation requirements for the cabling type.

The design and procurement of the information technology equipment will always be performed outside of the construction phase. This includes network switches and routers, access points, desktop systems, telephones and other equipment. The equipment and associated installation costs will be procured separately by CLPCCD ITS, and NOT be included in any specification or bid package particular to a specific building construction project. Architect and Engineering teams are required to take into account space, power and cooling requirements particular to the equipment that will be housed in the communications rooms.

3 Telecommunication Rooms

Telecommunication Rooms are special-purpose rooms that provide an operating environment for network, telecommunications and/or computer equipment. THE TELECOMMUNICATION ROOMS ARE TO DES DESIGNED FOR THE PRIMARY PURPOSE OF VOICE AND DATA CONNECTIVITY. Other building technologies (Security, HVAC) have specific functions and may need its own individual room within a building. However, depending on the building size and design, one or more of these technologies may also reside in the Telecommunications Room.

A campus will contain three difference kinds of Telecommunication IDF Rooms.

3.1 Main Telecommunications MDF Room

The Main Telecommunications MDF Room is the central connection point between the Campus and the Local Exchange Carrier (LEC), Competitive Local Exchange Carriers (CLEC) or Internet Service Provides (ISP). This room or space is considered by the carriers as the Minimum Point of Entry (MPOE) and demarcation point for communication services delivered to the Campus from external service providers.

The Main Telecommunication IDF Rooms for the CLPCCD campuses are:

Chabot Campus, B307 – MPOE and MDF
Las Positas Campus, B1900A – MPOE and MDF

Communication services are extended from the Main Telecommunications IDF Room location to campus facilities by the Outside Plant (OSP) backbone cabling. An outside plant pathway infrastructure system is provided to all campus buildings. The underground outside plant pathway will be extended for every new or modernized building project. Direct-buried methods or overhead methods for cable installation are not acceptable.

3.2 Building Telecommunications Room (BDF)

The Building Telecommunications Room is the main point of connectivity from the building to the outside plant infrastructure. The number of conduits to be installed into the BDF room will depend on the building size, function and telecommunications services to be provided to the building. Buildings require a minimum of three (3) 4” conduits from the campus OSP system.

The BDF room typically houses:

- Racks or cabinets for equipment and cable ladder system to support cable and connections to various pieces of equipment with supporting grounding infrastructure and electrical outlets.
- LAN equipment, such as routers, switches or fiber optic interface equipment for within-building or campus communications.
- Voice copper backbones, protectors, terminations and patch panels.
- Fiber backbones, terminations and patch panels.

At CLPCCD sites, the BDF may, but do not always, include wall-mount Security (access control) panels and EMS control panels. Close coordination is required in the design phase to ensure that adequate room size is allocated for voice/data racks and wall space for other subsystems. Fire Alarm panels are NOT permitted in the BDF rooms.

3.3 TELECOMMUNICATIONS IDF ROOMS

The Telecommunications IDF Room is located on each floor or building quadrant, and houses telecommunications equipment, cable terminations, and network equipment. IDF rooms differ from Building Telecommunications rooms in that they are generally considered floor-serving (as opposed to building-serving) facilities that provide a connection point between backbone and horizontal distribution pathways. IDF Rooms provide a safe, environmentally-suitable area for installing:

- Station and backbone cabling.
- Termination fields.
- Premises electronic equipment.
- Related support structures

The number and locations of the Telecommunication rooms depends on the:

- Size of the building.
- Number of floors. Minimum of one (1) IDF is required for each floor.

Depending on the dimensions and cabling distances required in a particular building, a floor may house multiple Telecommunication IDF Rooms, each serving a quadrant of the building. This is based on a maximum cable *design* length of 250 feet from wall outlet to termination point.

The best placement of Telecommunication IDF Room is to centralize it in the area it is serving, to maximize the number of adjacent rooms that can be reached within the 250 foot cable length requirements.

At CLPCCD Sites, the BDF will also house the IDF functions for station cabling terminations in the area of the building within distance.

3.4 TELECOMMUNICATION ROOM LOCATION

There are a number of factors that need to be considered when placing Telecommunication Rooms within new or remodeled facility, as documented below.

- Telecommunications Rooms will be **centralized** in the building. CLPCCD ITS prefers fewer rooms, that are larger, rather than multiple rooms of smaller size. This provides for cost and space efficiency for the cabling, network equipment and operations staff.
- The Telecommunication Room **must be** placed to maximize the number of outlets that the room can service.

- The Telecommunication Room **must be** placed to that a maximum cable length of **250** feet is designed between the outlet and the patch panel.
- The Telecommunication Room **must be** located so building entrance cables will not be exposed for a cable length distance of more than 50 feet from the point of building entrance per the California Electrical Code, Articles 770-50 and 800-50.2. This cable distance includes service loops and termination slack.
- Doorways must open outward into the corridor to allow the effective use of space inside the room. Access must be directly from hallways, not through offices, classrooms or utility spaces.
- The Telecommunication Rooms **must be** vertically stacked in multi-storey buildings.
- The Telecommunication Rooms **must not** be located in any place that may be subject to water or steam infiltration, humidity from nearby sources, heat, and any other corrosive atmospheric or environmental conditions.
- The Telecommunication Rooms **must not** be located near electrical power supply transformers, elevator or pump motors, generators, x-ray equipment, radio transmitters, radar transmitters, induction heating devices, and other potential sources of electromagnetic interference (EMI).
- The Telecommunication Rooms **must not** share space in electrical closets, boiler rooms, washrooms, janitorial closets, and storage rooms, nor have hatches that lead to other maintenance spaces.
- The Telecommunication Rooms **must** be situated in a building in such a way that the walls of the Telecommunication Room are on the building structural support systems. Such placement facilitates the installation of the cable riser backbone system.
- The Telecommunication Rooms **must not** be located near sources of mechanical vibration that could be conveyed to the room and the sensitive network equipment via the building structure.
- The Telecommunication Rooms **must not** be located below water level unless preventive measures against water infiltration are employed. The room shall be free of water or drain pipes.
- The walls of the Telecommunication Rooms must be of sufficient construction to insulate adjacent offices from noise made by the network equipment.
- Telecommunications Rooms **must be** constructed as fire-rated rooms. Penetrations through Telecommunication Room walls must supply sufficient pathway for cabling, with appropriate fire-stopping materials to restore the rating of the walls.

In addition to the general requirements for Telecommunication Rooms, the Building Telecommunications Room **shall**:

- Avoid locations that limit expansion such as structural steel, stairwells, and elevator shafts, outside walls or other fixed building walls.
- Have easy access to distribution cable pathways.
- Be easily accessible for the delivery of large equipment (3’6” door width, no stairs).
- Minimize the size and length of the backbone and horizontal distribution cables.

3.5 TELECOMMUNICATION ROOM SIZING

The size of a Telecommunication Room is determined by the amount of connectivity that is required. CLPCCD ITS has standardized on specific sizes for the Telecommunications IDF Rooms:

- Basic – 10’ long x 12’deep, for up to five 48-port station patch panels and backbone cabling installed on one relay rack.
- Standard – 14’ long x 12’ deep, for up to ten 48-port station patch panels and backbone cabling, terminated on three relay racks.
- Large – 20’ long x 12’deep, for up to twenty 48-port station patch panels and backbone cabling, terminated on five relay racks

These room sizes take into account the space required for operating clearances, wall panels, OSP conduit stub-ups, cabling terminations and network switch and UPS equipment installation. The shape of the room is very relevant because a rectangular room offers the greatest efficiency and minimum space. It is not acceptable to assign an equivalent square footage to the room, because the racks and network equipment may not fit.

3.6 TELECOMMUNICATION ROOM LIGHTING

It is important that proper work lighting be provided in all Telecommunication Rooms. Lighting shall:

- Have a minimum of 50 foot candles measured 3' above the finished floor in the middle of all aisles between racks or cabinets.
- Be controlled by one or more switches located near the entrance door(s) to the Telecommunication Rooms.
- Not be connected to any timing devices. Dimmer switches shall not be used in the Telecommunication Rooms

Refer to section 5.9.4 for additional design details.

3.7 FLOOR

It is preferred that the floors of all Telecommunication Rooms shall be covered with an anti-static tile, or rolled goods. Sealed concrete may be accepted if a clean floor surface is provided. Flooring shall be installed and completed before racks are built. Floor loading capacity in the Telecommunication Rooms shall be sufficient to bear both the distributed and concentrated load of the installed equipment. The distributed loading shall be at least 250-lbs/sq. ft. and the concentrated loading shall be at least 1,000 lbs over the area of greatest stress.

3.8 DOORS

All single doors to any Telecommunication Rooms shall be a minimum of 3’6" wide and 80" high, without doorsill, and be fitted with a lock and security card reader/keypad. Doors will swing completely open (180 degrees) towards the corridor to avoid restricting usable space in the room.

3.9 INTERIOR FINISHES

The floor, wall and ceiling shall be sealed to reduce dust. Finishes shall be light in color to enhance room lighting. All walls shall have backing to support the plywood telecommunication backboard and wall mounted equipment. The walls shall be capable of supporting up to 200 lbs per linear foot of wall space.

Walls will be covered with rigidly fixed with 3/4" void free, fire-rated A-C plywood. The visible side of the plywood shall be painted with two coats of white (or other light-colored) paint. At least one (1) Fire-Rated stamp must be visible per sheet or partial sheet of plywood when painting is completed. Plywood shall be installed from flush to the ceiling line, usually +2-feet to +10-feet AFF, but dependent on the ceiling height.

Open ceilings are preferred to facilitate cable installation and management.

3.10 CLEARANCE

The minimum clearance height in the room shall be 10 feet without obstructions.

Provide the following clearances for equipment and cross- connect fields in the Telecommunication Rooms:

- Allow a minimum of three feet of clear working space in front of racks, equipment and cross-connect fields as measured from rack foot flange, vertical wire manager door, or front of equipment cabinets, whichever protrudes more.
- Allow for twelve-inch depth on wall for wall-mounted equipment.
- Provide Front aisle at least three feet wide (clear). Provide Back aisle of five feet, measured from the front rails of the rack. Additional clearances to avoid conduit stub ups as required.
- Racks may align against one wall with a unobstructed clearance of 6” from the wall to permit opening of the VWM door. Minimum clearance of three feet is required around the other end of the rack line.

3.11 SECURITY

The doors to Telecommunication Rooms shall have individual locks and are controlled by the campus card key access with keypad control system. The locks must be commonly keyed to match other existing Telecommunication Rooms on the campuses/sites.

4.0 TELECOMMUNICATION OUTLET STANDARDS

Telecommunications Outlets are provisioned with 5" square style Randl Telecommunications backboxes and single gang faceplates. Each Telecommunications outlet will have one (1) 1-1/4-inch conduit for every four cables that extends from the backbox to the accessible ceiling space. The following telecommunication outlet standards are in use:

Type A – one voice, one data (1V1D) in four-port faceplate, unused ports blanked.
Type B – two data (2D) in four-port faceplate, unused ports blanked.
Type C – two voice, two data (2V2D) in four-port faceplate.
Type D – four data (4D) in four-port faceplate.
Type E – one voice (1V) in one port metal faceplate with knobs for hanging wall phones.

These outlet standards shall be used in all construction drawings. Design engineer shall not make up their own outlet definitions. See Section 9 for further details about the telecommunication outlet standards.

Telecommunications outlet locations shall be placed in locations to facilitate changing furniture layouts. In offices and conference rooms, the typical outlet placement is +18" above the finished floor (AFF) and within 24-inches of a general-purpose, single-gang electrical outlet. In rooms with built-in counters, work surfaces and cupboards, the outlets shall be placed at +6" above counter/surface height, coordinated with the placement of the electrical outlets.

In office spaces with built-in work surfaces, computers can be tower or floor-standing. The telecommunications and electrical outlets will still be located at +18" A.F.F., so as to preserve a clean wall surface. However, this will require the Architect to arrange for the drilling of routing holes in the work surface, installed with grommets, to facilitate the clean routing of patch cords and electrical cables. The grommet will be:

- a minimum of two inches in diameter
- made of plastic or rubber
- oval or circular in shape
- fitted to the hole drilled in the work surface
- with a replaceable cover that can hold the cabling snug after routing

Outlets will not be placed such that they are located inside of cupboards and cabinets unless this specific purpose is desired (such as for a concealed fax machine, printer, TV or computer).

Refer to Section 10 for drawings of telecommunication outlet placement in various room types. Additional details are described below.

4.1 Single-Person Office

A minimum of two Type C (2V2D) telecommunications outlets shall be installed on opposing walls per single-person office. If the office is large enough to support a visitor/conference table,

an additional Type C (2V2D) telecommunication outlet shall be installed, normally at +18" A.F.F. Electrical outlets shall be placed consistent with the data outlet height.

CLPCCD ITS will maintain the responsibility to place the outlets on wall locations in the offices. The placement will provide flexibility for connectivity to planned and future furniture configurations. If changes are required during construction that differ from the drawings, CLPCCD ITS will approve the new placements.

4.2 Conference Rooms

Conference Rooms will require one Type A (1V1D) telecommunication outlet for every 10-feet of wall space on each wall of the room. If the conference room is large enough to be equipped with AV, the following **additional** telecommunication outlets are required:

- Type B (2D) outlet above ceiling by projector (if provided)
- Type B (2D) outlet on wall behind LCD display (if provided)
- Type C (2V2D) outlet in floorboxes, with power

In addition, the design shall be include a Type D (4D) outlet above the ceiling for possible installation of a wireless access point.

Note: conference room telecom outlets will vary with the placement of cameras and LCD screens, in lieu of projectors.

4.3 Instructional Classrooms

Instructional Classrooms that have a specific teaching wall orientation will be provided with a communication outlets on each of the three non-teaching walls. At the instructor's desk, a Type C (2V2D) outlet will be required. For AV connectivity at the instructor's desk, a Type D (4D) outlet will be provided. In each classroom, telecommunication outlets shall be provided above the ceiling to support wireless access points and projectors, as documented for the conference room above.

At the main entrance to the classroom, a Type E (1V) telecommunication outlet for a wall mounted telephone will be provided. This outlet shall be positioned such that it does not interfere with light switches, fire devices or access to the door. Clearance of 12" from the center jack, in each direction to allow for different telephone shapes is required. Coordinate height so that the telecommunications outlet and other device outlets are aligned to meet ADA.

4.4 Cubicle/Partitioned Offices (Modular furniture)

Each modular furniture office space will be provisioned with one Type C (2V2D) communications outlet. One additional Type C (2V2D) communications outlet shall be added for every four cubicles to accommodate networked printers, fax machines and other devices.

Cabling that routes through modular furniture will be installed as home runs from the faceplate to the Telecommunications Room. Modular furniture systems with integral raceways for data/voice cables are required. Cubicle and partitioned furniture will require "feed points". A feed point is a large (usually a two-inch conduit or 4-gang box) used to route communication cables into the raceway system of modular furniture. Multiple conduits will be installed to provide sufficient space for the required number of cables/outlets. The mounting height and exact location of the feed points will depend upon modular furniture system to be installed. Furniture pathways may be entered from building walls, columns, ceilings, or floors. Cabling must be completely concealed from the building-pathway to furniture outlet.

The telecommunication contractor must provide custom modular furniture fittings for the outlet jacks. No surface mount boxes installed over the furniture raceway will be permitted.

4.5 Wall Mounted Telephones

In addition to classrooms described above, wall-mount telephones may be placed in corridors, storage rooms, electrical/mechanical rooms. The mounting height of the Type E (1V) outlet for Wall Mounted Telephones shall be +42 inches AFF. If a wall mounted telephone is to be installed above a counter top, the clearance for the box shall be 8 inches above the counter top.

Coordinate height so that the telecommunications outlet for the wall-mount telephone and any other device outlets nearby are aligned to meet ADA at the same height. Clearance of 12" in each direction to allow for different telephone shapes is required.

4.6 Work Rooms

Faculty or Administrative workrooms will vary in size and function. These workrooms may be equipped with shared departmental resources including:

- Facsimile machines
- Laser Printers
- Desktop computers
- Copiers
- Postage machines

To facilitate the use of these devices, numerous communication and power outlets are needed. Workrooms are typically configured with counters and storage cupboards. Along counter tops where facsimile and printers may be placed Type C (2V2D) communication outlets, with appropriate electrical outlets, will be distributed every six feet. These will be placed at +6" above counter height. For self-standing copier machines, a Type C (2V2D) communication outlet will be provided with appropriate dedicated electrical outlets. At the entrance to the workroom, a Type E (1V) wall-mount telephone outlet will be required. This outlet will be situated to avoid space conflict with door-swings, cupboards, fire extinguishers, water coolers, panels and any other fixture or device that could interfere with the accessibility of the telephone.

4.7 Computer Labs – standard floor

CLPCCD College Technology staff provides wired network connections for its computer labs for PC/laptop/device connectivity. Permanent computer labs will NOT use wireless for connectivity.

Computer labs vary depending on the type of activity conducted in the lab. Since computer labs may be rearranged, it is important that the telecommunication outlet placement provides as much flexibility as possible. Although computer labs will be custom designed with the participation of CLPCCD ITS and College staff, the following basic design elements will apply:

- At the entrance to any lab, a wall-mount telephone Type E outlet will be provided.
- At the instructor's desk, a Type C and Type D outlet shall be provisioned.
- At the projector location(s), a Type B outlet shall be provisioned.
- At access point location(s), a Type D outlet shall be provisioned.
- For connectivity efficiency, computer lab that have desks extending in rows from the walls will be provisioned with outlets on the walls. Type D outlets, flush mounted into the wall, are required. The number of jacks provided will include one for every possible student seat in the row, plus 1-2 extra jacks for printers or other network apparatus that may be placed on the tables.
- For new construction, wall-mounted surface raceway shall not be used. In general, surface mount raceway shall be avoided.
- All rooms which support islands of tables or kiosks will be configured with flush-mount floor boxes.
    - Dual purpose floor boxes (telecommunication and power) are acceptable providing that there is adequate separation maintained so that all power outlets and all telecommunication jacks can be used simultaneously without the cords interfering with each other's access.
    - Each data compartment will be provisioned with fittings that center the jack for easy patch cord access. Fittings using 106 frames that provide two jacks per hole are UNACCEPTABLE.
    - Fittings will accept the Commscope SYSTIMAX jacks.
    - Sufficient floorboxes will be provided to support the required number of computers, plus supplemental printers, scanners and other networkable devices.
    - In certain rooms, cables will route up the furniture inside cavity to the table side for flush-mount faceplate finish. In this design, a 2" conduit stub into the furniture cavity for cable routing. All cables will be completely concealed.
- In addition to floorboxes and wall outlets for computers, there will be supplemental Type C or D outlets designed for print stations as needed.
- No cabling will extend across the floor. Floor mounted raceway (pancake raceway) is not acceptable.

In upper floors of a multi-storey building, the use of poke-thrus will replace floorboxes. Poke-thrus will be flush to the floor with recessed outlets.

4.8 Computer Lab – raised floor

In certain buildings, computer labs may be designed with raised floor (or depressed slab). In these situations, the following additional design guidelines apply.

- The raised floor will provide a depth of up to 4 inches, with removable floor tiles to grant unhindered access to the floor space.
- Within the raised floor there will be a matrix of power and telecommunication outlets that provides sufficient density to computer tables. Typically, this will include telecommunication outlets each equipped with four data jacks, spaced every four feet, and equivalent power plugs and circuits to power computers and network devices plugged in to every network jack and powered on concurrently. The number and location of telecommunication and power outlets will vary with room size and orientation.
- The removable floor tiles will be provided with notched access or imbedded jacks so that patch and power cords can be routed from the raised floor to the computer tables. Floor tiles will be relocatable so that as room configurations change, cable notches can be positioned underneath tables and avoiding circulation paths.
- Each raised floor outlet design will be custom designed with CLPCCD ITS and College Technology according to room requirements.

4.9 Corridor Digital Signage and Displays

CLPCCD equips corridors, foyers and other circulation spaces in buildings with LCD displays. These provide services such as digital signage, electronic announcement boards, queuing updates, general information query stations, etc. Each of these locations will be provided with a Type B outlet, terminated at a height such that the outlet and patch cords are concealed behind the LCD, but accessible for maintenance.

4.10 Storage Areas

All storage areas that will be accessed by CLPCCD staff on a daily basis will be provided with a Type E outlet for a wall-mount telephone. If the storage area will be provisioned with general purpose electrical outlets, at least one Type C telecommunications outlet will be provisioned on each wall where there is an electrical outlet. Frequently, storage areas are redefined in purpose and may change into small meeting rooms, offices or other work areas requiring connectivity.

4.11 Wireless

For support of wireless access points and DAS, a ceiling Type D telecommunications outlet shall be installed adjacent to a power outlet +6-12” above T-bar type finished ceilings. T-bar shall be labeled on support beam, black lettering on white background, with the outlet location, in a location of the nearest tile that would be lifted to get to the Type D outlet. For rooms with hard ceilings, this outlet shall be provisioned as a flush-mount outlet.

Wireless and DAS equipment is OFOI after owner occupancy. Drawings will not reference and access point equipment or installation.

4.12 Security Devices

Security panels that connect to the campus security system are provisioned with one Type D data outlet, terminated on an adjacent backbox/faceplate. This allows the connection of control panels and a contractor test connection for a programming laptop. If multiple panels are installed needing multiple network connections, data jacks are provisioned for each required connection. Cascaded mini-switches installed in panels to provide additional connections are strictly prohibited.

Additional TCP/IP-enabled security devices, such as cameras, will be connected to the network with dedicated Type B outlets. These devices may be located on building exteriors, light poles or other internal and external structures. For building mounted exterior cameras, the typical installation will include data jacks terminated inside the building on a surface mount block located adjacent to a conduit leading to the camera. An manufacturer-supplied OSP rated patch cord of required length then extends to the exterior device. No field crimping of cables is allowed.

As determined by the site security requirements, there is a distribution of Emergency call stations that provide ring-down connectivity to campus police and campus-wide paging. These phones may be implemented along corridors/hallways, in foyers, at bus stops or parking lots. A Type B telecom connection is required for these devices. Depending on the distance, cabling to these devices may require copper or fiber cable, possibly with OSP or indoor-outdoor sheaths. A powered fiber connection will be custom-designed as needed.

4.13 Specialty Locations

The campus will have specialty locations that will require custom configuration at the time of building design. These locations include but are not limited to:

- Theatres
- Lecture Halls (seating capacity > 200)
- Auditoriums
- Athletic Broadcasting Control Rooms
- Scoreboards, Electronic Advertising Boards, etc.
- Outdoor areas

For provisioning to outdoor “classrooms” or presentation locations, outdoor wireless or security camera installations, the following guidelines will be followed:

- The most important aspect of the design is the outside plant pathway to any location requiring voice, wired data, wireless data or audio-visual connectivity.

- The minimum conduit size to the connection location will be a two-inch conduit for data. If AV connectivity routes to the same location, a separate two-inch conduit will be provisioned.
- Conduits will finish in an appropriately sized pull box, minimum size 18”x24”
- Conduits will be 30” below grade.
- If a large amount of connectivity is needed, such as for an amphitheatre, a pedestal or outdoor NEMA enclosure shall be provisioned to contain an outdoor rated IDF.
- All cabling materials shall be outdoor-rated.

At the time of design, the requirements for each of these locations will be individually determined with CLPCCD ITS.

4.14 Maintenance Spaces

A Maintenance space is defined as any room that contains materials, supplies, equipment or tools used for the performance of maintaining systems on campus. These can include but may not be limited to:

- Janitorial Closets
- Electrical Rooms
- Mechanical Rooms
- Control Rooms
- Boiler Rooms
- Garages

In these spaces, the minimum communications outlet shall be a Type E outlet for a wall-mount telephone. This outlet will be located on the same wall as the doorway to the space, with sufficient clearance so that the outlet is not obstructed by light switches, equipment or storage shelves. If the door swings into the room, the outlet will be located on the wall beside the door lock, i.e NOT beside the door hinges, so that the door can swing open and damage the telephone.

If the Maintenance Space will also be used as an office for maintenance personnel, the space will be equipped with at least one Type C telecommunication outlet, located on the wall within two feet of a general purpose electrical outlet. One Type C telecommunications outlet will be provided for each desk area assigned to the Maintenance Space.

If the Maintenance Space contains panels, control systems or other devices that need to remotely communicate status and operation via modem or network connection, each of these devices will be separately equipped with a dedicated Type B outlet. The definition of which devices/panels need cabling will be done in conjunction with engineering specialists for each device type. These can include: HVAC monitors, elevators, EMS panels, etc. Typical outlet provisioning is:

- Elevator: Two (1) Type E and one (1) Type B outlet
- EMS system: One Type B outlet
- Electrical panels, lighting control panels: One Type B outlet per panel

Note that these outlets are terminated on a faceplate near the controller that needs the network connection. A patch cord will route from the outlet to the device. No cabling will be terminated inside any panels.

4.15 Building Rooftops

Control equipment that is located on building rooftops frequently requires special provisioning of communications connectivity. This equipment can include HVAC monitors, cellular/wireless antennas, broadcasting equipment, telescopes, communication relays, etc. Some of these systems may be added after the building is built. It is more important to provide a clear pathway through which connections can be added later. Any control systems that require network connectivity need to be located within 250 feet of a Telecommunication Room.

From each IDF, a 2" stub up to the roof top, finished with a 12"x12" NEMA can will be provided. This will be fully sealed to prevent intrusion of water, dirt/dust and critters into the IDF. This stub-up is a temporary provisioning, to be extended as needed to rooftop devices. Outdoor rated cabling will be run to roof top connections.

5 Electrical

The following information is the basic guidelines for the Electrical Design Consultant. These design guidelines are to the minimum requirements. The Electrical Design Consultant shall contact CLPCCD ITS in the Schematic Design phase to determine if there are any special requirements. It is the expectation of CLPCCD ITS that the information from this Guideline shall be included in drawings and specifications. Unless otherwise noted, it is CLPCCD ITS' expectation that the work listed in this section will be installed by an electrical contactor.

5.1 General Power Requirements

Power outlets shall be mounted within 24-inches of telecommunication outlets and at the same mounting height. These may be single (duplex) or double gang (quad) depending on the number of devices to be connected. Typically, the number of electrical plug locations should equal the number of data jacks, i.e. two data jacks with an adjacent duplex, four data jacks with an adjacent quad.

The plentiful assignment of electrical circuits is critical to ensuring that equipment can be properly supported. A dedicated circuit will be installed for every six (6) computer devices (computer/laptop/printer/scanner). Additional circuits will be installed for shared use between offices for supplemental office devices.

5.2 Telecommunication Outlets

The typical communication outlet shall consist of a 5" square RANDL telecommunications backbox with one (1) 1-1/4" inch trade size conduit for up to four Category 6A cables. The

conduit will stub out to the closest accessible ceiling space, communications J-Hook or within 6" of a cable tray run. The outlet box shall have a single gang mud ring. Typical mounting height shall be +6 inches above counter/desk surface in offices and workrooms and +18 inches AFF for outlets in classrooms, offices, conference rooms, etc.

5.3 INSIDE CONDUITS

The Electrical Engineer will design conduits conforming to EIA/TIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces and the following:

- Run in the most direct route possible (parallel to building lines), with no more than two 90 degree bends (or cumulative 180 degrees) any dimensional plane between pull points or pull boxes (PBs).
- Pullboxes will be accessible.
- Contain no straight through or 90 degree condulets (also known as LBs).
- Contain no flex-conduit material.
- Contain no continuous sections longer than 100 ft. For runs that exceed 100 ft in length, insert pull points or PBs so that no segment between points/ boxes exceeds the 100 ft limit.
- All conduits shall have a minimum bend radius 10-times the diameter of the conduit.
- Equip all conduits with a plastic or nylon line (also called a fishtape or pull cord) with a minimum test rating of 200 lb.
- Minimum trade size for telecommunication EMT conduits is 1 ¼" inch for use with all telecommunication back boxes.
- All communication conduits from communication outlet or J-boxes shall stub up and out to the communication within 6-inches of J-Hooks or cable tray run.
- Conduits will stub up to an accessible ceiling area. No communication conduit is to stub out in a hard ceiling area unless ceiling access panels are installed.
- The conduits shall be reamed at both ends and have a bushing on the stub up end.
- Conduits which feed modular furniture are considered "feed points". These conduits are sized according to the number of cables and outlets served, typically as 2-inch in diameter. These conduits may terminate on backboxes for use as a pull point during cabling installation. Conduit access into the modular furniture shall be completely concealed, but accessible for adds, moves and reconfigurations.

The electrical designer will use the following guidelines for conduit sizing:

- 1-1/4" conduit – four (4) Category 6A cables
- 2" conduit – twelve (12) Category 6A cables
- 4" conduit – forty-eight (48) Category 6A cables

In addition to the pathway for the telecommunications outlet, multiple 2" conduits will be needed to route AV connectivity. Refer to AV design standards.

5.4 TELECOMMUNICATIONS CABLE TRAY

Buildings will be provided with cable basket tray to route consolidated bundles of cables. Cable basket tray is required when cable bundles exceed 100 cables. Cable basket tray will typically be a wire mesh design, with 2”x4” openings. Cable basket trays shall be typically 18”x4”, but sizes may vary with quantities of cabling. Cable basket trays shall be sized for 25% fill according to the manufacturer’s fill guidelines. If cable basket trays are routed through open ceiling, they will be provided with a solid bottom and/or sides, so cables will not be visible. Buildings will be provided with the same size cable tray throughout the entire building, regardless of fill.

Cable basket tray routing will be determined in conjunction with other above-ceiling systems include HVAC ductwork, fire sprinkler and other wet piping, electrical conduits, etc. The cable tray routing is typically through corridors or main circulation pathways to facilitate access without disruption to the adjacent rooms. Cable tray design will be coordinated in BIM sessions with other engineers so drawings of the cable tray pathway do not result in a conflict in the field. Cable trays will be designed for accessibility through the ceiling tiles, and not located above ductwork, piping or other obstructions.

The cable basket tray shall be placed in a ceiling space in such a manner that at least 12-inches of space exist above the top of the cable tray and a working space of at least 24-inches on one side of the tray to facilitate the installation of cable. Cable tray support shall be a trapeze support system. The support and trays shall be seismically braced as needed.

All metallic cable trays must be grounded, but shall not be used as grounding conductors for equipment. Clearly mark all cable trays and grounding conductors in accordance with ANSI/ TIA/ EIA- 606 and J-STD- 607.

The cable basket tray provided for Telecommunications routing is dedicated in purpose, and will not be shared with other cabling systems. Other cabling and support systems (cabling, devices, conduit, backboxes, etc.) shall not be attached to the sides/bottom of the tray or pass through the voice/data wire basket tray. The building ceiling design shall take into account all overhead pathways so conflicts do not occur during construction.

5.5 TELECOMMUNICATIONS J-HOOKS

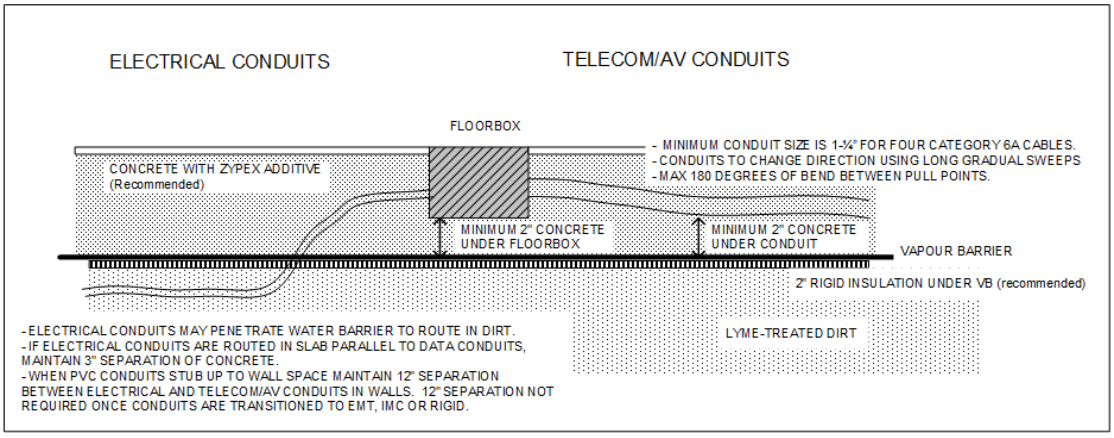
J-hooks shall be installed to route cables from outlets to basket tray. Since J-hooks are typically installed by the telecommunications contractor, additional J-hook installation information is described in the Telecommunications Consultant section. Like the cable basket tray, J-hooks installed for Telecommunications cable routing is dedicated in purpose, and will not be shared with other cabling systems.

In lieu of J-hooks, cable slings or saddles are acceptable. J-hooks, slings or saddles shall not exceed 50 cables.

5.6 FLOOR BOXES

Floor boxes will be used in limited locations where connectivity is needed for islands of computers/desks. Floorboxes shall meet the following minimum requirements:

- Floorboxes will be of metal construction to support the anticipated weight and travel.
- Floorboxes will have completely flush lids that can be screwed down to hinder unauthorized access.
- Supporting conduits shall run in the slab and shall be PVC schedule 40 or better.
- Supporting conduits shall be sized for 20% fill to allow for additional cabling.
- Conduits feeding floorboxes will be dedicated runs and not chain through multiple floorboxes. Conduits will stub up to the closest wall with no more that two (2) ninety-degree bends. Each data compartment will be provided with one (1) 1-1/4" conduit for up to four (4) category 6A cables. If multiple telecom outlets will terminate in a floorbox, additional or increased size conduits will be designed.
- Floorboxes may support a combination of data and electrical outlets. If so, the design of the floorbox must be such that all data and electrical ports can be fully connected with cables without causing any obstructions that would limit the use of any jacks/plugs. '
- Floorbox outlets shall be vertically mounted to reduce infiltration of liquids and particulate matter.
- At no time shall conduit feeding the data compartments in the floor boxes run below the water membrane barrier or be in the soil. Floorboxes will be built to preserve the dry-space rating of the channel according to the following design:



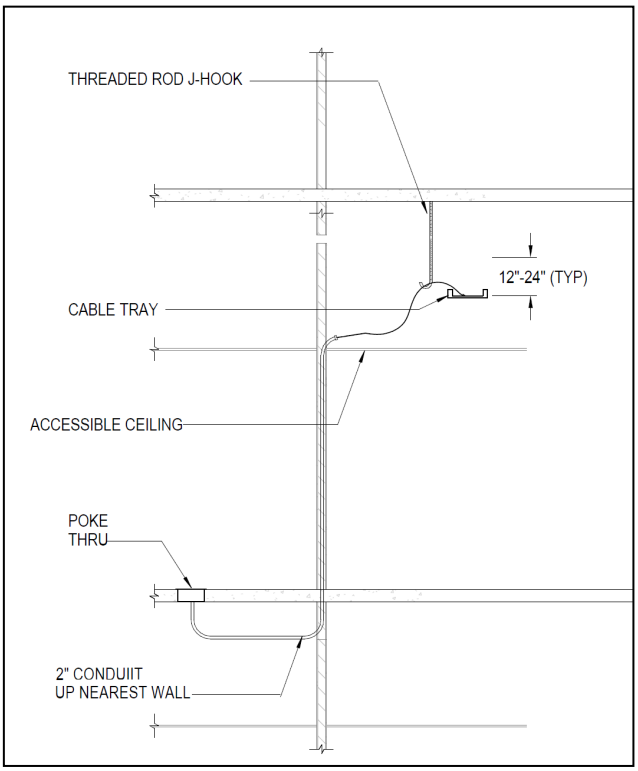
For each occurrence, a review of the connectivity density and need will determine the type of box to be used. Refer to Section 11 for preferred floorbox products. CLPCCD ITS will approve the floorbox product for specification in contract documents.

5.7 FLOOR POKE-THRUS

For multi-floor buildings that require floorbox type connectivity, poke-thru devices are required. The poke-thrus shall be constructed as follows:

- Poke-thrus shall provide discrete compartments for the voice/data cabling.

- Outlets shall be recessed in the poke-thrus. Poke-thrus that provide jack access flush with floor level are unacceptable.
- Poke-thrus shall be of metal construction to support the anticipated weight and foot traffic. This includes the lids, covers and top of the poke-thru that will be exposed to traffic. The choice of brass, brushed aluminum or other metallic finish shall be selected according to the floor type and room design.
- Poke-thrus lids shall be completely flush against the floor. Poke-thrus that provide even as much as a 1/4" protrusion above the floor are considered a tripping hazard.
- Poke-thrus shall provide fittings for the Commscope SYSTIMAX jacks.
- Poke-thrus lids shall provide an adjustable slot so that patch cords and power cords can be routed to equipment without the need for the lids to be left open.
- Poke-thrus shall be equipped with conduits that sleeve the cabling to the accessible ceiling space in the room below. Poke-thrus will not be provided if the lower floor does not have accessible ceiling space.
- Cables terminated in poke-thrus shall route through the ceiling space of the lower floor, and back up through 2" conduits or a chase nearest to the IDF on the same floor as the poke-thru. The drawings shall detail sufficient vertical riser conduits in accessible and separate chases to route the cables. The vertical riser conduit(s) will be placed in the nearest available wall to the IDF and as close to the poke-thrus.



It is not acceptable for the cables from a poke-thru to route to the lower floor, use the cable tray in the lower floor to route to the lower floor IDF, and then use riser conduits in the IDF to terminate in the upper floor IDF.

Refer to section 11 for preferred pokethru products.

5.8 WIRELESS ACCESS POINTS AND PROJECTOR SUPPORT

For support in conference rooms, classrooms and other specified areas, outlets will be installed in the ceiling space to support wireless access points. The telecommunication outlet boxes can be replaced with plenum-rated surface mount boxes (SMBs). The SMB and cable service loop will be suspended with a separate J-hook at the designed location. All components will be plenum-rated.

At ceiling-mounted projector locations, AV, telecommunications and power outlets will be required. These telecommunication outlet boxes will be of the same construction as the wall outlets. A power outlet, adjacent to the telecommunications outlet is required. Both power and telecom outlets will finish ABOVE the dropped ceiling. Outlets will NOT be installed on the surface of an accessible ceiling tile.

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5.9 TELECOMMUNICATION ROOM REQUIREMENTS

Telecommunications Rooms require specific elements for power to the devices in the room and pathway for the cabling that is terminated in the room.

5.9.1 Power outlets

Convenience outlets shall be mounted at +18-inches AFF (just below the plywood backboard) around the periphery of the room. Convenience wall outlets shall be split circuited, i.e. outlets on the same wall will be wired to the different circuits. No more than four (4) outlets shall be on the same circuit. Each outlet will be clearly marked with the circuit number. All convenience outlets shall be 120v 20 Amp, quad-plug outlets.

To provide power to equipment racks/cabinets, electrical outlets will be provisioned along cable runway and between racks/cabinets. Each rack/cabinet will be provisioned with one (1) dedicated 110v, 20amp circuit in a quad-plug outlet and two (2) L6-20 twistlock outlets. In addition, the center rack will be provided with an L5-30 outlet. Electrical outlets will be independently suspended and NOT attached to the cable runway.

Specialty electrical outlets may be required to support rack-mount UPS systems. This need will be coordinated with CLPCCD ITS during the design phase.

5.9.2 Pathway into Telecommunication Rooms

Each Telecommunications Room will require multiple four-inch sleeves through the wall(s), suitably fire-stopped around and inside the sleeves with intumescent materials that will preserve the fire rating of the wall. For large cable densities, the room shall be provisioned with sufficient four-inch conduits to route the cabling and provide one unused sleeve. As a rule of thumb, each four-inch conduit shall route no more than 48 cables. In lieu of conduits, custom fire-rated pathways, such as EZ-paths, are acceptable.

Cabling from other systems that must enter the Telecommunications Room shall be provisioned with its own conduit pathway and discretely fire-stopped.

Each Telecommunications room will require a minimum of three (3) 4-inch sleeves to be used for risers through the floor. The exact requirements will be coordinated with CLPCCD ITS for final quantities.

The electrical drawings shall show the location and type of Fire Stop Penetration systems to be used. All systems are to be sealed at the completion of the cabling installation. If the cable contractor returns to run additional cable, the seal will be broken, cable installed and then the systems will be re-sealed by the cable contractor.

5.9.3 Grounding

Besides the building electrical ground system for the building, a Telecommunications Ground System will be designed per J-STD- 607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications. This Telecommunications Ground System shall be installed to support the telecommunication infrastructure and equipment.

A Telecommunications Main Grounding Busbar (TMGB) shall be located in the Building Telecommunications Room (BDF). The TMGB shall be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing. The TMGB shall be electrotin-plated for reduced contract resistance. The TMGB shall be a minimum size of 5 mm thick, 100 mm wide and 300 mm in length. The TMGB shall be insulated from its support by a two (2) inch separation.

The TMGB will be bonded to the electrical panel ground bus bar and to building steel or ground rod by conventional welds, exothermic welds clamp-and-braze method, or UL approved compression type connectors where practical. Exothermic welds are the preferred method. Because of the high temperatures involved, copper materials may be bonded to iron or steel. The mold size must match the cable or conductor cross section. The size of the weld metal charge must match the size of the mold being used. The connection between the TMGB and the bonding point is to be 3/0 insulated copper ground wire.

In each Telecommunications room (IDF), a Telecommunications Grounding Busbar (TGB) shall be installed. The TGB shall be a minimum size of 5 mm thick and 50 mm wide and 150 mm long. The TGBs shall be bonded to the electrical panel serving the rooms were the TGB is installed, bonded to building steel, and bonded in series to the main TMGB.

All metallic structures will ground to the TMGB/TGB busbars, Rack or cabinet busbars, horizontal or vertical, shall not be used.

5.9.4 Lighting

It is important that proper work lighting be provide in all Telecommunication. Lighting shall:

- Have a minimum of 50 foot candles measured 3' above the finished floor in the middle of all aisles between racks or cabinets.
- Be provided as two discrete banks, one on each side of the racks. At least one bank of lights, the nearest to the door, shall be emergency powered.
- Be controlled by one or more switches located near the entrance door(s) to the Telecommunication Rooms.
- Not be powered from the same electrical distribution panel as the telecommunications or network equipment in the Telecommunication Rooms.
- **Not be connected to any timing devices or light sensors** which would shut the lights off while work is in progress. Dimmer switches shall not be used in the Telecommunication Rooms.
- One bank of Emergency lighting by the doorway is to be provided to facilitate an emergency exit.
- Be located a minimum of 9’ above finished floor.
- Be placed so the fixture is parallel to the rack or cabinets layouts, and banks of lights are provided to illuminate both the front and back sides of the racks.

5.10 Surface Mount Raceways

Surface mount raceways for telecom cabling shall be avoided wherever possible. Surface mount raceways are not approved for new construction, and may only be considered in remodel projects.

If surface mount raceways are being installed, the telecommunication raceway section shall be above the power. The design of the telecommunication raceway shall be based upon the following:

- Only metallic raceway is acceptable. Wiremold G6000 metal raceway is the preferred product.
- In outlet locations, the jacks will protrude into the raceway cavity and pinch the cable connections. Raceways shall not be filled greater than 20% to avoid cable pinching at outlet locations.
- Multiple conduit stub-ups along the raceway must be sized to support the maximum number of cables in that segment of the raceway plus 40% for additional (future) cabling.
- The mounting height of the raceway should be +6” above the table top, typically +36”AFF.
- Raceways will be provided with custom fittings to Commscope SYSTIMAX data jacks. 106 frames that mount jacks in the circular outlet are UNACCEPTABLE.

5.11 BUILDING ROOFTOPS

Each roof shall have at least one location for potential network-enabled rooftop systems. The location must be such that the distance from the location to the nearest Telecommunications room does not exceed 250 feet of conduit. This location shall be built with an electrical weatherproof box sized to support one electrical quad-plug outlet, and space for a data outlet.

Two (2) 2" conduits need to be provisioned for data. The two conduits shall stub into the ceiling space and be sealed to prevent moisture or insect ingress.

5.12 UNDERGROUND CONDUITS

It is the expectation of CLPCCD ITS that the following information will be placed on the Electrical or Telecom Site Plan.

- Each building shall be provided with a minimum of three (3) four-inch conduits that route to the campus outside plant system.
- OSP Conduits are to be 4" in diameter, schedule 40 PVC or equivalent.
- The conduit runs will contain no more than cumulatively, 180 degrees of bend between pull boxes, vaults/manholes or the Building Telecommunications Room. This includes the turn from horizontal to vertical when entering the Building Telecommunications Room from below. Vaults will be provided as needed to maintain 180 degrees of bend or less. The minimum vault size is 3'x5', but may be upsized for consistency with campus plant standards.
- OSP conduit lengths between vaults will not exceed 400'.
- Conduits will penetrate the narrow end of a handhole or maintenance holes. Changes in direction for conduits will occur outside of the maintenance or handhole at a minimum of 20 feet from the maintenance or handhole.
- Conduit bends shall be sweeps. All conduits shall have a minimum bend radius 10-times the diameter of the conduit.
- If the conduits penetrate into the Telecommunications Room from below, the conduits will stub up at least 4-inches.
- The conduits will have plastic bushings at the building side end.
- A pull rope with a minimum of 200 pounds of pulling tension will be installed in all conduits. Measurement (true tape) in one conduit in a multi-conduit run.
- All conduits, empty or in use, shall be sealed at the building end to prevent rodents, dirt, water, or gases from entering the building.

Drawings showing new underground routes must include the following information:

- A scale drawing showing location ties to existing structures, cable, conduit, utility boxes, and any conflicting substructures and profile drawings of congested areas where vertical and horizontal separation from other utilities is critical during cutting and placing operations and any other areas as requested by the CLPCCD ITS.
- Warning tape containing metallic tracings must be placed a minimum of 12 inches above the underground conduit/duct structure to minimize any chance of an accidental excavation. Both ends of the metallic warning tape will be accessible after installation.
- The minimum depth of a trench must allow 30 inches of cover from the top of the conduit/cable to final grade for conduits that traverse areas with no vehicular traffic. Conduits that route underneath pedestrian pathways that also support vehicular traffic must be buried with appropriate depths, so that maintenance vehicles or Fire trucks driving over the pathways will not inadvertently crush the underground conduits.

- Conduit penetration of a building must be located so that the outside plant cable termination area is within 50 feet of the point of penetration. OSP conduits will stub up directly into the BDF. The maximum OSP cable length, includes routing and service loop lengths in the building, will not exceed 50 feet. .
- Per ANSI/TIA-758 a drain slope of 0.125 inches per foot toward the manhole/handhole shall be provided.
- The following table shows the vertical or horizontal separations that must be maintained between telecommunications facilities and other facilities sharing a common trench.

Adjacent Structure	Minimum Separation
Power or other foreign conduit	3 inches of concrete, or 4 inches of masonry, or 12 inches of well-tamped earth
Pipes (gas, oil, water, etc.)	6 inches when crossing perpendicular 12 inches when parallel

Wherever possible, telecom conduits will be slurry capped.

Vaults and Maintenance Holes shall be located such that they:

- Provides a safe work area when accessed.
- Allows for proper traffic control during operations at the vault or MH.
- Provides proper space for cable reel dollies, winch trucks, etc.
- Does not impede the flow of vehicular or pedestrian traffic when closed.
- Be located out of the road way whenever possible.
- Be located out of the landscaping (grass, planting) so as to avoid water/dirt intrusion.
- The distance between vaults or MH shall not exceed 400 feet.

All maintenance and handholes must be sized for the current conduit need with a minimum of 30% spare capacity. Conduits will be added to maintenance and handholes when additional buildings are constructed on campus and as such, maintenance and handholes must not be sized so that they are at their maximum during the initial installation. Stub-outs that extend 5-10 feet from the maintenance and handholes should be included in all new installations to facilitate future conduit additions.

Vaults, maintenance holes and handholes that are located in pedestrian pathways that are designated as emergency Fire Routes or routes for maintenance vehicles must be constructed with H-20 traffic-rated boxes.

Nameplates on vaults, maintenance holes and handholes will be labeled. CLPCCD ITS will provide the name for each lid. Vaults and maintenance holes will also be equipped with rails for cable suspension.

5.13 Fire Alarm Backbone

At each campus, the Fire Alarm panels are connected by fiber. If a new or modernized building requires a new backbone, the fiber is specified in the telecom drawings and installed by the telecom contractor. For more information, see Section 13.

6 Mechanical (HVAC)

The following information is the basic guidelines for the Mechanical Design Consultant. These design guidelines describe the minimum requirements. Sheet notes calling out the mounting specifics shall be incorporated into the HVAC drawing set. The HVAC Consultant shall contact CLPCCD ITS to determine if there are any other or special requirements.

6.1 General

- All Telecommunications Rooms require HVAC 24 hours per day and 365 days per year, separately controlled from adjacent rooms. If the building's HVAC system cannot meet this requirement, then stand-alone HVAC systems with independent controls for the various Telecommunication Rooms shall be installed.
- BTUs/hr load estimates will be provided by CLPCCD ITS when the BDF/IDF and cable estimates 25,000 BTUs/hr per BDF/IDF.
- If the BDF/IDF in a building is connected into a backup generator system, the HVAC system will be similarly wired to the generator so the telecommunications or network equipment in the BDF/IDFs will not be exposed to excessive operating temperatures. This shall be coordinated with CLPCCD ITS.
- A positive pressure differential with respect to the surrounding areas shall be provided.
- The ambient temperature and humidity shall be measured at the distance of 5 feet above the floor level. The normal temperature range is 64^{O}F to 74^{O}F with a humidity range of 35% to 55% relative.
- If a wall-mounted HVAC system is installed, the drain for the HVAC will route out of the Telecommunications Room. Power for the wall-mounted system will be adjacent to the unit, and not plugged into convenience electrical, so that the HVAC system could be accidentally unplugged.
- The air supply ducts for the HVAC system will be oriented to blow onto the front of the relay racks. The HVAC will be placed at a height to effectively blow air onto the equipment, and not be blocked with cable runway, lighting or other overhead obstructions.
- Drip or overflow pans for the HVAC system shall be oriented so that condensation or excess water will flow onto the floor, and not on top of equipment or cabling.

7 Telecommunication

7.1 Telecommunication Consultant

The primary role of the Telecommunication Consultant is to act on the behalf and at the direction of CLPCCD ITS to provide a Telecommunication Cabling Design for CLPCCD building and

infrastructure projects. The Telecommunication Consultant shall be retained by the Architect as part of the design team. The Consultant shall:

- Ensure all information in this Standard is followed by the Architect and other consultants. If the discrepancies are not corrected by the Architect or other consultants, the discrepancy is to be brought to the attention of CLPCCD ITS.
- Develop a Telecommunication Cabling Design based upon the current, published TIA Standards, the latest BICSI Manuals and other Standards produced by CLPCCD ITS. The Design Documents shall include, but may not be limited to:
  - Telecom Drawings consisting of:

  NOTE: This is a separate set of drawings and not part of the electrical E sheets.
    - Legend
    - Site Plan showing OSP conduits and boxes, etc. (can also be part of the electrical site plan)
    - Floor plans showing the type and number of communication cable(s) to be installed at each outlet. Separate RCP sheets for above ceiling outlets.
    - Cable Infrastructure (cable pathway, outlet boxes locations, conduit, cable tray or J-Hook routing)
    - Telecommunication Room detailed drawings
    - Single Line Drawing for backbones
    - Other construction details
  - Project Manual Specifications documentation. Multiple division 27 sections per MasterFormat.
- Provide the point of coordination between the Architect and Engineering team and CLPCCD ITS.

The Telecommunications Consultant is responsible for advising the Architect and other consultants when multiple BDF/IDF rooms are needed in a specific building. Most frequently this will occur when the building is multiple floors, or when the Telecommunication Rooms are situated so that the wiring length will exceed 250 feet. Every building will be examined on an individual basis.

Before actual design work commences, the Telecommunication Consultant will meet with CLPCCD ITS to determine computer lab, server and telecommunication rooms in the building. Although the equipment will **never** be specified as part of a construction projects, it is important that a clear understanding of the electrical loading, space and connectivity requirements be understood as part of the design process for the Telecommunication Rooms.

7.2 ROLE OF CLPCCD ITS

As described at the beginning of section 2, CLPCCD ITS will take an active role in all aspects of the design, construction and acceptance of the network infrastructure. CLPCCD ITS will involve College Technology in all meetings, inspections and reviews as need be.

CLPCCD ITS expects to work with the Telecom Consultant in all phases of the project design. Once DSA approval, bidding and contract award have taken place, CLPCCD ITS will have an active role in the construction process. Refer to Section 12 for more details.

7.3 CLPCCD PRODUCT STANDARDS

The CLPCCD cabling materials standards were established in 1997, specifying data cabling components from AT&T, now branded as CommScope SYSTIMAX. This included fiber backbone cables, copper station cables, patch panels, termination blocks and jacks. Because the voice and data infrastructure must be constructed in a homogeneous, standardized fashion, the specification of one manufacturer's product line as the standard provides operational benefit, so across all buildings, the faceplates, patch panels and cabling will have the identical design, implementation, appearance, functionality and labeling. This will ensure a consistent functionality across all buildings. For any construction project, the Telecommunications Consultant will specify the most recent products of the CommScope SYSTIMAX project line. Note: As comcodes (product numbers) change, drawings and specifications should describe the product by name and function rather than reference a specific product number.

Refer to Section 11 for other product details.

7.4 OUTSIDE PLANT

The outside plant consists of the Outside Plant (OSP) cables and structures needed to inter-connect the new building to the campus. The supporting structure includes underground (in conduit) cables, conduits, maintenance holes (MH), hand holes (HH), pull boxes (PB), pedestals and outside terminals. The outside plant must be designed and installed to the NESC and ANSI/TIA-758 Standards for Outside Plant Construction. Direct buried cables and aerial cable runs are not acceptable.

The Telecommunications Consultant will work with CLPCCD ITS and other consultants and engineers in:

- Understanding the existing cable routes from building to building on campus.
- Specifying the underground cable requirements and identifying the types of cable used in the campus backbone.
- Adding conduits, maintenance holes, hand holes, and pull boxes as needed.

Note: OSP conduits will stub up directly into the BDF.

7.4.1 Single Mode Fiber Backbone Cables

CLPCCD ITS has specified that each building will be provisioned with single mode fiber backbones installed as a home run to the Main Telecommunications Room (MDF) on campus. The single mode fiber shall be CommScope zero-water peak TeraSPEED OS2 fiber.

For each building, outside plant backbone fiber will consist of, as a minimum, a 48-strand, single mode fiber. Riser fiber backbones between the BDF and IDFs shall be a minimum of 24-strand single mode fiber.

All fiber optic cable shall be installed in the following manner:

- Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate the cable or conduit.
- All cable/cabling shall be kept 30 inches away from any heat source; i.e., steam valves, etc.
- Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath.
- Cables shall not be pulled across sharp edges. All conduits and sleeve with rough edges will be provided with bushings on both ends. Cables shall not be forced or jammed between metal parts, assemblies, etc.
- Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.
- Cable splicing will not be permitted at any point within a cable run.
- Conduits will not be filled to greater than a 40% fill.
- Outside Plant Conduits must have appropriately sized pull-boxes every 300 feet. When the conduit routes through up to a total of two 90 degree bends (180 degrees total) in any dimension plane, additional pull-boxes are also required. Cabling will not be installed in conduits that do not meet these specifications.
- Backbone cables will be installed with a 30 foot service loop. The service loops will be coiled neatly in the nearest pull box or hand-hole to the building's exterior wall.
- Inside the BDF, an additional 30 foot service loop will be dressed on the wall.
- Cable mountings and service loops on backboards inside Telecommunication Rooms will be installed efficiently to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Cables will be tie-wrapped every 4 to 6 feet.
- All outside plant cables will be terminated within 50 feet of the entrance point. This is a maximum cable measurement and includes lengths for service loops, routing, backboard and patch panel mounting inside the building.
- All optical fiber cables shall be terminated on rack-mounted optical fiber patch panels.on SC connectors. No fiber will be left unterminated.

7.4.2 Copper Outside Plant Cables

Buildings will be cabled with UTP copper backbone cables for connectivity to analog/digital telephones, facsimile machines, modems and other devices. All pair counts for backbone UTP cabling will be verified with CLPCCD ITS during the design phase.

Physical Characteristics:

- Backbone UTP copper cables shall consist of a core of 24 AWG solid annealed copper conductors, color-coded in accordance with telephone industry standards.
- As a minimum, UTP copper backbone cables will be UL Verified Category 3 and will meet or exceed the Category 3 requirements in ANSI/TIA 568.

- Conductors shall be twisted to form pairs. Cable having more that 25 pairs shall be assembled in units, each individually identified by color-coded unit binders.
- The mutual capacitance of any pair shall not exceed 5.6 nF per 100 m at 1 kHz.
- The core shall be covered with a plastic tape.
- The cable will be designed for use in the outdoor environment, with a gel-filled design to be used in wet locations. This includes an aluminum steel with polyethylene (ASP) sheath and a core of solid-copper conductors, dual insulated with foam skin and plastic, and surrounded by a gel filling compound. ANMW cabling is preferred.
- Outside Plant Cable installations will meet all ISO/IEC 11801 requirements for a horizontal link. No more than four connections are allowed, including the protection devices at each end.

The pair counts for permanent buildings will be determined in conjunction with CLPCCD ITS and College staff. **CLPCCD sites do not use VoIP**. Pair counts will be sufficient to support the number of telephone lines to be used inside the building.

General installation guidelines for copper cables include:

- Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate cable or conduit. Adhere to all manufacturers' requirements regarding pulling tension and allowable lubricants.
- All cable/cabling shall be kept 30 inches away from any heat source; i.e., steam valves, etc.
- Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath.
- Cables shall not be pulled across sharp edges. All conduits and sleeve with rough edges will be provided with bushings on both ends. Cables shall not be forced or jammed between metal parts, assemblies, etc.
- Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.
- Cable splicing will not be permitted at any point within a cable run.
- All outside plant backbone cables will be installed in conduit. Aerial runs are not permitted.
- Conduits will not be filled to greater than a 40% fill.
- Conduits must have appropriately size pull-boxes every 400 feet. When the conduit routes through up to a total of two 90 degree bends (180 degrees total) in any dimensional plane, pull-boxes are also required. Cabling will not be installed in conduits that do not meet these specifications.
- Backbone cables will be installed with a 30 foot service loop. At each building , the service loops will be coiled neatly in the pull box or nearest hand hole on the building's exterior wall. Cable mountings and service loops on backboards will be installed efficiently to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Cables will be tie-wrapped every 4 to 6 feet.
- No service loops are required in the BDF.
- Cable shall be continuous and without splices (Splices imply same pair count cable splices: i.e.: 200-pair to 200-pair).
- Verify all actual cable distances.

- All outside plant cables will be terminated within 50 feet of the entrance point. This is a maximum cable measurement and includes lengths for service loops, routing, backboard and building entrance protector (BET) mounting inside the building.

All copper backbone cables that extend between buildings will be terminated at both ends on protector blocks.

- All pairs at both ends of the copper backbone cable shall be protected.
- The protector blocks will be housed within a covered case. Protectors will be sized for the termination of all pairs in the copper backbone cable.
- The protector blocks shall be fully populated with solid-state or gas-tube protection fuses.
- The protector blocks will contain an integrated 110 block for extension to the building cross connect fields or patch panels.
- The protection block shall have an integrated 26 AWG stub.
- The protection blocks shall be grounded with a #6 AWG copper bonding conductor between the protector ground lug and Telecommunications Grounding Busbar.
- Copper extension cables shall be installed from the protector blocks to the copper patch panels, extending one pair per jack.
- CLPCCD uses the Circa Systems BET with solid state fuses for its standard products in the buildings. Each building is provisioned with a wall-mount BET of sufficient quantity, fully-fused.
- In the MPOE room at each campus, a Porta Systems XLBET racking system is installed. The campuses use a tail-in, 110-out product where the output tails are already extended to 110 blocks. As part of the installation of a new copper backbone, the contractor will splice to available tails, providing a splice case and all splicing materials. If all tails are assigned, a new 300 pair tail-in, 110-out panel, fully-fused, will be provided by the construction project.

In the event that copper backbone cabling is added to building areas where existing cabling is not protected, the Contractor shall retrofit the existing cabling with protector blocks, according to this standard.

7.5 RISER SEGMENT

CLPCCD campuses have many multi-storey buildings. The layout of new buildings may also require several distributed closets on one floor, to allow station cabling to stay within the 250 foot length limitation, or to accommodate difficult or limited cabling pathways. As such, the installation of "riser" cabling includes vertically stacked Telecommunication IDF Rooms, or horizontally dispersed Telecommunication IDF Rooms.

7.5.1 Fiber Riser Cable

Buildings that contain multiple Telecommunication IDF Rooms will require fiber backbone cabling installed between the rooms and the BDF. All riser fiber backbones will consist of 24-strand single mode fiber, CommScope TeraSPEED. The riser cable will be OFNP rated. CLPCCD does not use innerduct for riser data fiber.

7.5.2 Copper Riser Cable

The riser pair count shall be equal to the number of voice stations served by the Telecommunications Room with a 20% growth factor. Cable sizes will be rounded to the next multiple of 25, 50 or 100 pairs.

The cable shall be Category 3 UL listed CMP rated. All pair counts for backbone UTP cabling will be verified with CLPCCD ITS during the design phase.

7.6 OPTICAL FIBER TERMINATIONS

Optical fiber patch panels shall meet or exceed the following specifications:

- Must be rack mounted.
- Must be configured in duplex SC style termination configurations.
- Must be available as a high-density 4U shelf for Main and Building Telecommunication Room installations, or 24-connector 2U trays for smaller Telecommunication room backbone terminations where fiber counts are less that 24 fibers.

Field termination is required for **all** fiber strands in the telecommunications closets. No fiber is to be left unterminated. Refer to Section 11 for product information.

7.7 COPPER BACKBONE TERMINATIONS

In the buildings, all OSP copper backbone cables will be terminated on building entrance protectors, and then extended to rack-mounted Category 5E patch panels, terminated one pair per RJ-45 jack with the 25-pair coiled as a test point. Riser backbone cables will be terminated directly on Category 5E patch panels, at each end. No 66-block or 110-block terminations will be used.

7.8 HORIZONTAL STATION CABLE

All cabling projects at the CLPCCD sites shall be installed with CommScope SYSTIMAX Category 6A cabling. To support a complete Category 6A channel, all cabling components will be certified for Category 6A transmission. This includes patch panels, jacks, and patch cords. Refer to Section 11 for specific products.

This document requires the specification of plenum cabling rated as “CMP” for all new installations of cabling at Campus sites. Although functionally identical, station cabling for different transmissions systems shall be cabled with different colors cable sheaths for ready identification. The cable sheaths will be blue for data and white for voice. Other low-voltage subsystems using UTP cabling **must** specify cabling with different color sheaths, so as to avoid confusion with voice/data cabling. The Telecommunications Consultant will coordinate with consultants and designers of other cabling systems to ensure that cable sheath colors are kept

discrete. Cable colors for non-telecom low voltage systems will be coordinated by CLPCCD District resources.

7.9 VOICE/DATA JACKS

Although the cabling infrastructure for voice and data jacks is functionally identical, at the work area outlet, the modular jacks shall be color coded to designate the preferred purpose of the jack. The jack colors are white for voice and blue for data.

Voice/Data jacks shall be 8-position modular jacks and shall be Category 6A performance as defined by the references in this document including ANSI/TIA -568 performance requirements. All pair combinations must be considered, with the worst-case measurement being the basis for compliance.

7.10 PATCH CORDS

Patch cords will be provided in each building project as follows:

- One 14’ blue patch cord for each data jack (station end)
- One 5’ patch cord for each voice jack: orange for Chabot, white for LPC. (IDF end)
- One 5’ blue patch cord for each data jack (IDF end)

The drawings shall include the following:

> CONTRACTOR WILL VERIFY PATCH CORD LENGTHS, COLORS AND QUANTITIES WITH CLPCCD ITS BEFORE ORDERING.

7.11 WORK AREA OUTLETS

The standard work area outlet configurations used on the Campus have been described in section 4. Refer to Section 9 for typical faceplate drawings.

7.12 FACEPLATES

The standard faceplate configuration is single-gang faceplate providing for four ports of connectivity. Configurations of any additional number of ports are subject to the approval of CLPCCD ITS.

- The faceplate housing the jacks shall provide a symmetrically centered appearance for the modules. Only four port faceplates shall be provided for wall connections.
- Snap-in inserts shall be provided to cover any unused openings in the faceplate. Inserts are removable for future installation of additional jacks.
- As needed in modular furniture locations, four-port modular furniture adapters will be used for terminations in the telecom section of the toeplate.

- The faceplate housing the jacks shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.
- The color of the faceplate shall be coordinated with the color of the surrounding electrical outlets, usually as Electric Ivory or Electric White. No metal faceplates will be allowed, except as required for extra durability at wall-mount telephone locations.

7.13 COPPER PATCH PANELS

Category 6A patch panels will be used for termination of all voice and data station cabling. Category 6A patch panels shall meet or exceed the following specifications:

- TIA Category 6A standard.
- Rack mounted with front-facing RJ-45 patch panels and rear-facing 110 blocks.
- Will be T568-B wired.
- Have a paired punch down sequence with termination managers to allow pair-twist within ½-inch of the termination.
- UL listed.
- For new buildings, must be **angled** 48-port panels with rear cable suspension racks.
- For expansion of existing buildings, match what is used (flat or angled) in the existing IDF.

Rear patch panel cable management should include the cable support bars. Category 6A requirements require the cable to enter perpendicular to the termination and the cable bar facilitates this requirement. All cable bundles on cable support bars will be managed with Velcro straps. Tie-wraps are not acceptable.

7.14 GROUNDING AND BONDING

As described in section 5.9.3 above, a Telecommunications Ground System shall be installed to support the Telecommunication Rooms and Infrastructure. The Telecommunication Consultant will work with the Electrical Designer to ensure a Telecommunication ground system is installed per TIA-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

The electrical contractor shall install and bond the main components of the system (busbar, ground rod, ground wire to grounding source, etc.) The cabling contractor shall install the connectivity to the metal components of the cabling system, including voice protectors, racks, cable runway, cabinets, patch panels, etc. The Telecommunication Consultant shall ensure that the communication specification/RFP calls for the bonding of all components within the Telecommunication Rooms.

7.15 RACK/CABINET LAYOUT (ELEVATION)

All equipment in racks must follow the general guidelines provided below for placement within the rack or cabinet. Refer to Section 11 for specific products.

Fiber Backbone/Riser Patch Panels: All fiber patch panels shall be placed at the highest point possible in the rack or cabinet. Fiber patch panels will have integrated cable management in the front and cable guides in the rear.

Copper Backbone/Riser Patch Panels: All copper backbone patch panels will be installed below the fiber patch panels. Patch panels will be angled.

Station Patch Panels: All station patch panels will be installed to a maximum of five panels per relay rack. At Chabot campus, separate patch panels are provided for the voice station jacks. At LPC campus, voice and data jacks are combined. All outlets are terminated in ascending room, outlet and jack order.

Wire Management: Vertical wire managers shall be provided on either side of the floor-mounted relay racks. These shall be 12" wide. Horizontal wire management is NOT required.

Network Equipment: For easy access, network equipment will be mounted between waist and neck height on the rack (3' to 5' A.F.F). **NOTE:** Network equipment will not be included as part of any construction bid, but are important considerations in the design of appropriate racking/cabinet layouts.

Power management: Rack-mount Uninterruptible Power Supplies (UPS) may be OFOI. UPS units shall be installed at the base of the rack. No power strips are required.

7.16 FLOOR MOUNTED RACKS

All racks will be floor-mounted, open, self-standing relay racks. Racks shall meet the following physical specifications:

- 19-inch wide rack mounting space.
- 84 inches high.
- Lightweight aluminum construction.
- Black polyurethane finish.
- Equipped with four (4) ¾-inch bolt-down holes with Zone 4 seismic kit.
- Each rack shall have double-sided tapped holes with standard EIA hole pattern.

Each rack will be supplied with a bag of 50 bolts matching rack color and threading. All racks will be installed with a minimum of 4' of clearance from the equipment mounting holes on front and 5' from the equipment mounting holes on the rear sides. All racks shall be properly anchored to the slab floor using all four (4) holes.

Rack placement and elevations shall be finalized and approved by CLPCCD ITS prior to final installation. In detailed IDF drawings, provide a sheet note stating this requirement.

7.17 FLOOR MOUNTED CABINETS

When Telecommunication rooms must coexist with infrastructure for other electrical or low voltage systems, the Telecommunication infrastructure will be completely concealed in lockable telecommunication cabinets. Floor-mounted cabinets are preferred. These cabinets will be

- Self-standing structures.
- Sized as a 24”W x 30”D x up to 84”H.
- 19-inch wide rack mounting space.
- Lockable, with common key set for all cabinets from one manufacturer.
- Black in color, with solid, removable front and back doors and vented side panels.
- Equipped with manufacturer provided seismic kit, rated for Zone 4, if floor standing.
- Contain internal adjustable rails upon which patch panels, wire managers and network equipment shall be installed.
- Contain knockouts for ceiling fans and cable routing. Any knockouts used for cable routing will be wrapped with bushings to prevent the rough edges of the knockout from damaging the cabling.

Cabinets will be typically installed with one side against a solid wall. The side panel may be removed for additional airflow. A backboard will be mounted on the wall of the open side. All cabinets shall be mounted with a minimum of 3 feet clear access in front, back and one side of cabinets. All cabinets shall be properly anchored to the slab floor using manufacturer-provided seismic bracing kit.

Per grounding described above, cabinets will be grounded to the TGB with a minimum #6 AWG copper wire. BET, electrical outlets and ground bus bar will be located inside the cabinet, providing a totally enclosed environment for IDF operation.

7.18 CABLE RUNWAY

All cabling run exposed horizontally in a Telecommunication Room must be routed using cable runway (ladder rack).

- Cable runway will be 18”-24” wide for typical IDFs.
- Cable runway shall be appropriately secured to walls and be independently suspended 6” above the top of equipment rack/cabinet. Stand-offs shall not be used.
- Cable runway shall be grounded to the telecom grounding busbar using a minimum #6AWG ground wire. Metallic straps shall be used to join individual segments of cable runway. All metallic structures will be stripped of the paint coating at the point of grounding connection to ensure that the metallic straps and ground wires mate to the metal structure with sufficient contact.
- In new construction, all cable runway will be black in color. In existing spaces, installation of additional ladder rack should match manufacturer and color of existing ladder, if any exists.

7.19 CABLE PATHWAYS

In accessible main corridors, the use of a wire basket tray system is the required method for the main cable path. At least 12" of clearance is needed above the cable tray and the cable tray must have a minimum clearance of 24" on one or both sides. Cable tray shall be appropriately secured to ceiling deck (not walls) and grounded per manufacturer recommended guidelines.

For distribution from the main cable path to discrete outlet locations, sleeves will be provided through walls, as needed. Cables shall be supported by J-hooks every 4 feet. A J-hook shall be installed above every outlet location, on which a 24" service loop of station cabling will be attached. J-hooks shall be independently supported using threaded rod and not attached to existing conduit, ceiling/lighting structures or other suspension apparatus. J-hooks shall be installed according to the manufacturer's instructions.

J-hooks will not be filled beyond 50 cables. Where dense cable runs create large bundles of cables and cable tray is not available, the cable bundles will be split and supported on multiple J-hook routes. J-hooks will be equipped with latch closures to prevent cables from spilling out in the event of an earthquake or other disturbance. J-Hook installation shall be made part of work of the cable installation contractor.

All cable pathways are dedicated to telecommunications cabling. Other cabling infrastructure for controls, security, etc. must provide their own pathway and suspension system.

7.20 CABLE INSTALLATION METHODS

The Contractor shall adhere to cable installations methods that will ensure that the cabling transmission is not adversely affected in any possible manner. This includes strictly adhering to the manufacturer's installation methods and workmanship described as follows:

1. When placing cable, the contractor shall maintain the following clearances from sources of electro-mechanical interference (EMI):
    - Main Power panel: 6 feet
    - Power cable - 12 inches
    - Fluorescent Lights - 12 inches
    - Heat source: 30 inches
    - Transformers – 6 feet
2. All power feeds crossing the path of the UTP cables at right angles must be a minimum of 12 inches in distance from the UTP cables.
3. The cables shall be placed at a minimum of 18 inches above the ceiling.
4. The cables are to be as accessible as possible.
5. Pull conductors together where more than one is being installed in a raceway. Cable bundles in suspension systems, or on wallboards must be velcro-wrapped every 4 feet. Strapping to any other wires (e.g. lighting ceiling grid, etc.) will not be permitted. Station wire cannot be attached to electrical conduit, gas or sprinkler piping, or other code-restricted items.
6. Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate cable sheath or conduit.

7. No cabling is allowed to rest on any ceiling tile or suspension system.
8. Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath.
9. Cables shall not be pulled across sharp edges. Bushings will be installed on rough sleeve or conduit edges before cable installation takes place. Cables shall not be forced or jammed between metal parts, assemblies, etc.
10. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.
11. Insulation shall be removed to expose shielding and conductors to the exact length required by the manufacturer for proper termination of plugs and pins and as specified in ANSI/TIA 568/569.
12. Pins and plugs, upon termination, shall not be damaged in any way.
13. Cable guides and suspensions (J-hooks, cable runway, waterfalls, etc.) shall be provided to ensure that the cable path is securely suspended and adheres to the manufacturer's bend radius.
14. Cable splicing will not be permitted at any point within a cable run.
15. In BDF/IDF rooms, cable routing on backboards will be installed efficiently, to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Cables will be velcro-wrapped every 4 to 6 feet and routed through D-rings for a neat appearance and manageability. For lengths longer than 10 feet, the contractor will provide cable runway support on walls.
16. In BDF/IDFs, CLPCCD ITS prefers the use of cable "sock" for a neat appearance and cable routing.

7.21 FIBER OPTIC CABLE TESTING AND TEST RESULTS

General Test Requirements

- The tester shall be capable of performing the tests required by ANSI/TIA-568.
- A manufacturer-certified calibration facility shall have calibrated the tester dated no more than 60 days prior to the start of testing.
- All testing procedures and testers shall comply with applicable requirements of ANSI/TIA 568.
- End-to-end attenuation testing using an approved Power Meter and Light Source per ANSI/TIA-568.
- Single mode fiber shall be tested at both 1310nm and 1550 nm in accordance with ANSI/TIA-568.
- The acceptable link attenuation for backbone 8.3 to 9/125 single mode fiber based on distance shall be 1.0 dB/km @ 1310 nm and 1550 nm for inside plant.

All fiber optic cables will be tested and results will be submitted for all fibers in an electronic format and provide one (1) electronic copy of the raw test files and .pdf formatted test results showing graphically the entire length of the fiber. The Contractor shall submit (1) copy of software capable of viewing the raw test result files.

7.22 BACKBONE COPPER CABLE TESTING AND TEST RESULTS

The Contractor will perform tests on the copper backbone cable (OSP and riser). The tests shall be performed from each termination block on each pair on 100% of the copper cable pairs. The end-to-end test shall include the following:

- DC Continuity
- Reversals
- Shorts
- Opens
- Overall loop resistance/cable length
- Attenuation
- Splits
- Transpositions
- Grounds
- Presence of AC voltage.

The technician will examine open and shorted pairs to determine if the error is a termination issue. If not correctable, the technician shall tag bad pairs at both ends, and make note on the as-built documentation. If copper backbone cable contains more than one percent (1%) bad pairs, the Contractor shall remove and replace the cable at the Contractor's expense.

7.23 STATION CABLE TESTING AND TEST RESULTS

General Test Requirements

All station cabling will be tested and certified to meet Category 6A standards when all pairs are terminated on a patch panel port and at an outlet port. The tests shall include:

- Testing shall conform to ANSI/TIA-568.
- Testing shall be accomplished using a UL certified Level III tester.
- Any cable failing the prescribed certification testing shall be removed and replaced at the Contractor's expense.

The Contractor shall provide Category 6A, channel test results on all pairs of cable, including but not limited to cable length, wire map, NEXT, Power Sum NEXT, ACR, Power Sum ACR, ELFEXT, Power Sum ELFEXT, Return Loss, Propagation Delay and Delay Skew.

All cables will be tested, and the results submitted in electronic format. Both the raw test files and .pdf formatted test results are required. If the test results are not pdf viewable, the Contractor shall submit (1) copy of software capable of viewing the electronic test result files.

7.24 CABLE TESTING VALIDATION

After installation is completed and the Telecommunication Contractor has completed testing, the CLPCCD ITS reserves the right to separately test the installed cables, up to 100% using the Telecommunication Contractor testing equipment or with CLPCCD-provided computer/network equipment. Cables that have been tested and fail to meet performance requirements as stated in the specifications shall be removed and replaced with all new material and re-tested at no cost to CLPCCD. The Telecommunication Consultant will verify that these requirements are reflected in the specification details.

7.25 IDENTIFICATION AND LABELING

CLPCCD ITS provides a consistent and unique labeling scheme across all buildings. During the Telecom Pre-construction project, all labeling details will be provided by CLPCCD ITS. Labeling methodology shall include:

- Station cables shall be marked at each end, on the sheath indicating the Telecommunications Room, outlet number and jack label for each cable.
- Backbone cables shall be marked at each endpoint and at all intermediate pull/ access points or junction boxes. Label shall indicate origination and destination Telecommunication Rooms, sheath ID and strand or pair range.
- Meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- Be pre-printed or laser printed type.
- Where used for cable marking, a label with a vinyl substrate and white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable shall be provided. The label color shall be different than that of the cable to which it is attached.
- Where insert type labels are used, provide clear plastic covers to go over label.
- The Contractor shall confirm specific labeling requirements with CLPCCD ITS prior to cable installation or termination.

Telecommunication Room Naming

Each Telecommunication Room will be named and numbered with an individual numeric identifier. Current room naming conventions at the Colleges use a unique room number that also correlates to the floor and building number. For example, in Building 300 at Chabot College, the second floor IDF is in room B358, indicating that it is in Building 300.

Fiber Backbone Cable Labels

All backbone fiber cables (riser cables) will be labeled with yellow labels at each end of the cable bundle at the furthest point where the sheath is intact (before breakout). If the riser cables pass through multiple pullboxes, Telecommunication rooms and riser openings, they will be labeled at each opening. CLPCCD prefers the labels that are secured on each end of the label, rather than "flags".

All outside plant backbone fiber cables will be labeled at each end and in each handhole/maintenance hole that they pass through. Labels will be heat and water-proof so they do not decay when exposed to the elements. All labels must be visible at point of access.

All cables will be labeled according to the guidelines as set forth in the TIA 606 standard. This shall include:

- The origination point
- The destination point
- The type of cable (SMF)
- The fiber strand count

Example: The-48 strand single mode backbone cable that runs between the building 500 and building 300 at Chabot College shall be labeled B500-B300-SMF-48.

Optical Fiber Patch Panel Labels

Fiber patch panels shall be marked using adhesive labels indicating the range of fibers installed in it. Each panel shall be labeled with the origination and destination Telecommunication Spaces and the strand count. Each fiber strand shall be labeled with a unique strand ID.

All fiber patch panels will be labeled according to the guidelines as set forth in the TIA 606 standard. This shall include:

- Name of destination Telecommunication space
- Fiber pair number

Riser/Backbone Copper Cable Labels

All riser copper cables will be labeled with white labels at each end of the cable bundle at the furthest point where the sheath is intact (before breakout). If the riser cables pass through multiple pull points, Telecommunication rooms and riser openings, the cables will be labeled at each opening.

All outside plant backbone copper cables will be labeled at each end and in each handhole/maintenance hole that they pass through. Labels will be heat and water-proof so they do not decay when exposed to the elements. All labels must be visible at every point of access.

All cables will be labeled according to the guidelines as set forth in the TIA 606 standard. This shall include:

- The origination point
- The destination point
- The type of cable
- The pair count

Example: The-50 pair copper backbone cable that runs between the B307 BDF and B358 IDF at Chabot College shall be labeled B302-B358-COPPER-50.

Faceplate/Outlet Labels

All faceplates/outlets for station cable terminations will be labeled. This includes wall outlets, wall phones, faceplates in floor boxes, above-ceiling SMBs and all other termination points. For faceplates equipped with a label trough and plastic cover, the Contractor shall include the IDF and outlet number designation in the label trough. Jacks will be individually labeled under each jack.

All faceplates/outlets will be labeled according to the following guidelines:

- Name of Telecommunication Space the cable routes to.
- Room number
- Unique faceplate/outlet number, assigned clockwise to all outlets in the room.

Refer to Section 9 for Outlet labeling examples.

Station Cable Labels

All station cables will be labeled at each end of the cable within 6 inches of the termination. At the patch panel end, all labels must be visible and not be placed inside wire management. Station cables will also be labeled on the faceplate. All cables will be labeled according to the guidelines as follows:

- Name of the Telecommunications Space where the cables terminate.
- Faceplate/outlet number - consists of the room number and the outlets numbered incrementing clockwise.
- Jack label – alpha (A, B, C, D) labeled left to right, top to bottom.

Example: The right jack, lower row, in the four-port outlet number in room 354 that routes to the room 358 IDF on the second floor of Building 300 is labeled 358-354-D.

Voice Copper Patch Panel Labels

Patch panels which provide cabling connection to voice riser and backbone pairs shall be labeled using a similar convention as the backbone/riser cable labeling. The patch panel will be labeled with the cable name including:

- The origination point
- The type of cable

Each jack will be labeled for each pair in the riser/backbone cable.

Data Station Patch Panel Labels

Patch panels for station cabling will be labeled with the outlet number and the jack label, If the label is long, it will be split between the upper and lower label areas on the patch panel. Refer to Section 9 for examples.

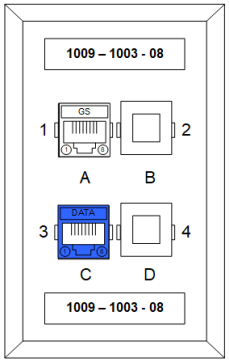
8 Industry Standards

The most current revisions of TIA. EIA, ANSI and BISCI standards shall apply. All codes shall apply according to jurisdiction. It is expected that the Telecommunication Consultant will have access and current knowledge of standards and codes that apply.

Where the CLPCCD ITS Cabling Infrastructure standards provide direction that differs from the standards, the CLPCCD ITS Cabling Infrastructure standards will take precedence.

9 CLPCCD Standard Outlets

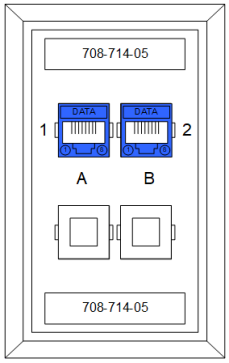
The standard outlet types are shown below. A&E design teams will use these replicate these in the drawings. No creation of new outlet types shall occur. Each outlet will be provisioned with a 1-1/4" conduit for routing a maximum of four Category 6A cables. All wall outlet locations shall be installed using a 5" square RANDL Telecommunications Outlet box. A 1-1/4" conduit shall stub up from each outlet box to the accessible ceiling space.



TYPE A OUTLET
- DUAL JACK FACEPLATE.
- ONE VOICE JACK (WHITE).
- ONE DATA JACK (BLUE).
- FACEPLATE LABEL IN UPPER AND LOWER LABELING WINDOW.
- JACKS LABELED INDIVIDUALLY.

A OR A

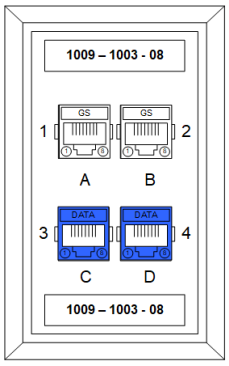
ACCEPTABLE SYMBOLS FOR TYPE A OUTLET



TYPE B OUTLET
- QUAD JACK FACEPLATE.
- TWO DATA JACKS (BLUE).
- FACEPLATE LABEL IN UPPER AND LOWER LABELING WINDOW.
- JACKS LABELED INDIVIDUALLY.

B OR B

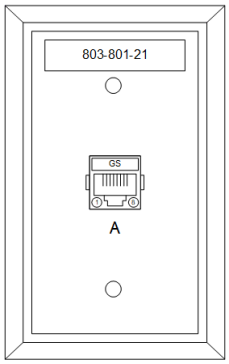
ACCEPTABLE SYMBOLS FOR TYPE B OUTLET



TYPE C OUTLET
- QUAD JACK FACEPLATE.
- TWO VOICE JACKS (WHITE).
- TWO DATA JACKS (BLUE).
- FACEPLATE LABEL IN UPPER AND LOWER LABELING WINDOW.
- JACKS LABELED INDIVIDUALLY.

C OR C

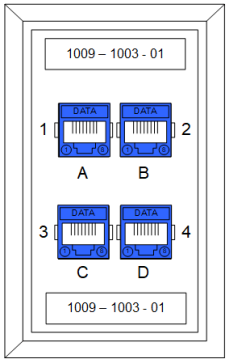
ACCEPTABLE SYMBOLS FOR TYPE C OUTLET



TYPE E OUTLET
- SINGLE JACK METAL FACEPLATE.
- ONE VOICE JACK (WHITE).

E OR E

ACCEPTABLE SYMBOLS FOR TYPE E OUTLET



TYPE D OUTLET
- QUAD JACK FACEPLATE.
- FOUR DATA JACKS (BLUE).
- FACEPLATE LABEL IN UPPER AND LOWER LABELING WINDOW.
- JACKS LABELED INDIVIDUALLY.

D OR D

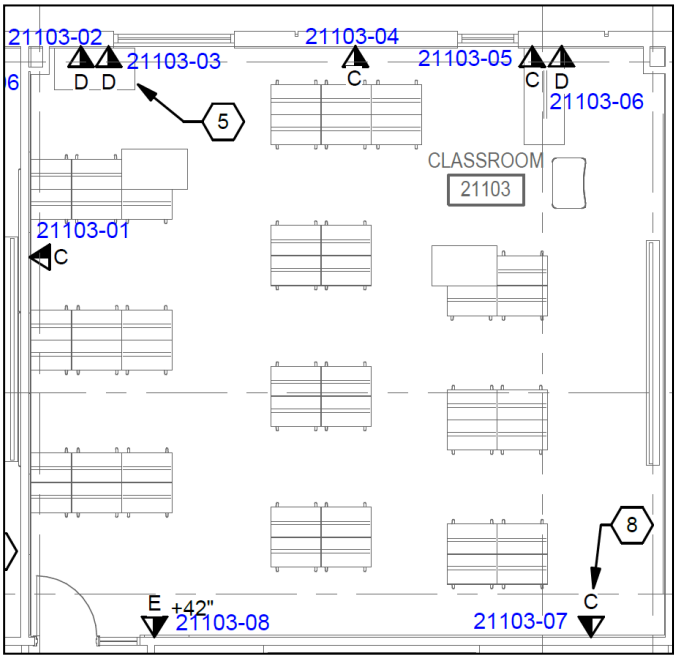
ACCEPTABLE SYMBOLS FOR TYPE D OUTLET

CLPCCD ITS has very defined labeling standards. A full outlet number consists of the IDF serving that outlet, the room number,, followed by a faceplate number starting with 01. See below for examples.

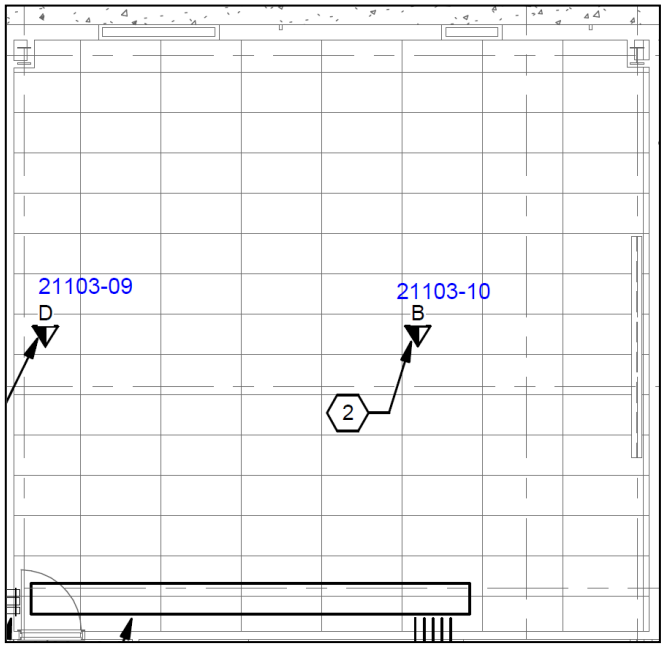
Room outlet labeling. Enter main door to room. Outlet number will consist of the room number followed by a number starting with 01 and incrementing clockwise for all +18" AFF outlets. Next floorbox outlets are assigned. Lastly, outlets terminated at heights above +18" AFF are assigned.

Labeling Example - This example is for room 21103 outlet 04 which cables back to IDF 21102B.

Room 21103 wall outlets



Room 21103 RCP outlets



Patch Panel Labeling

Because the room numbers are so long, faceplate/jack label is placed under the individual patch panel jack.

Faceplate Labeling

Labeling windows include IDF number, room number and outlet number .
Each jack is uniquely identified (A-D).

10 Typical Room Configurations

This section provides supplemental design information in addition to section 4.

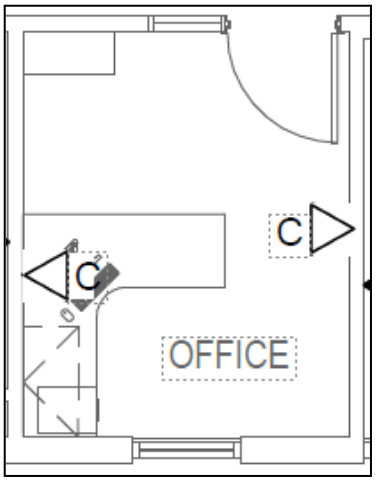
During the design phase, the telecom outlets will be placed in each room according to expected room usage, occupancy and shape. Rooms that will be custom-configured during the design process include:

- Reception areas
- Work/Copier/Lunch rooms
- Adjunct Faculty spaces
- Club rooms
- Special purpose lab rooms
- Conference/presentation rooms, gathering spaces
- Technology spaces (e.g. server, AV control rooms)
- Electrical/mechanical rooms

The sample configurations shown below are meant as a guideline for the most common room types.

Faculty/Small Office

The standard office is 100 square feet. An office is provisioned with two (2) Type C outlets, on facing side walls. The outlet placement is centered on the walls, within 24" of an electrical outlet. Telecom outlets are NOT coordinated to exactly match the furniture because the staff in each office can choose to reconfigure their office after movc-in. The telecom outlets are placed so that the desks can be moved but computers can be connected within a 10-foot patch cord length.

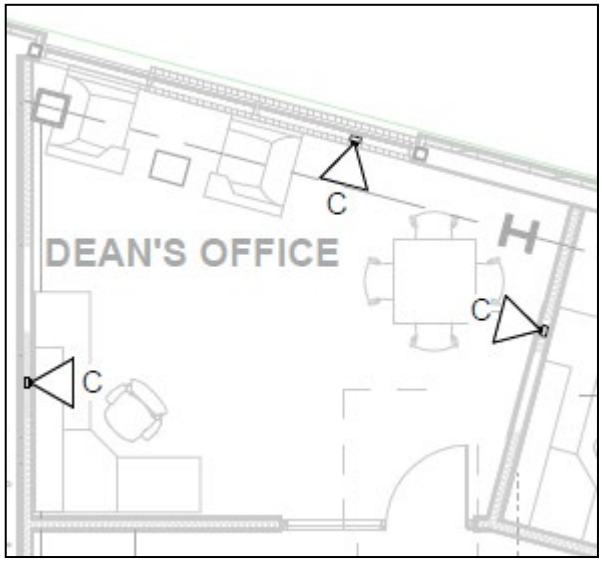


Outlets are never not placed on the wall with the door. Outlet locations are adjusted according to the placement of beams, windows and other obstructions. To accommodate these obstructions, outlets are moved towards the short wall opposite the door.

Dean's Office

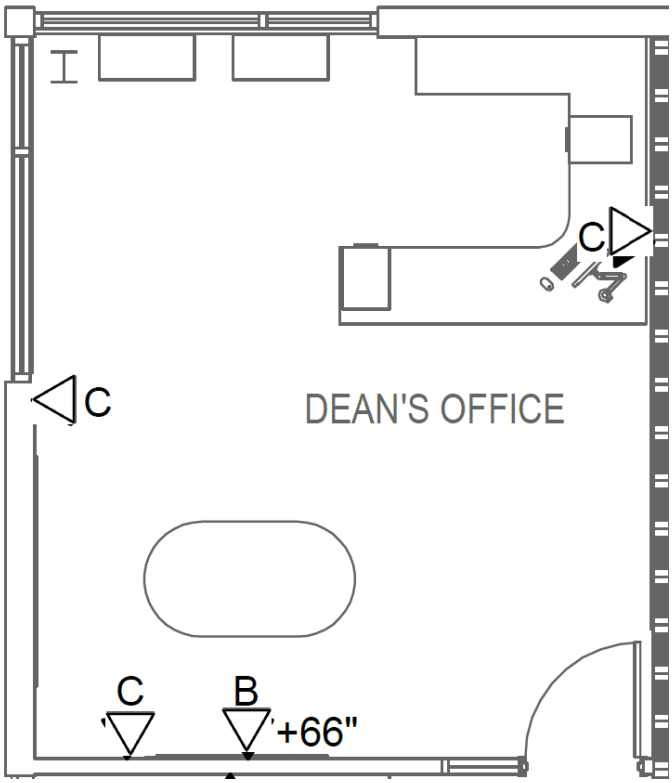
The Dean's office is a larger office space that is custom configured during the design process. The Dean's office is larger and typically equipped with a visitor's table with additional telecom. An LCD with AV connectivity may also be required.

Dean's Office (No AV)



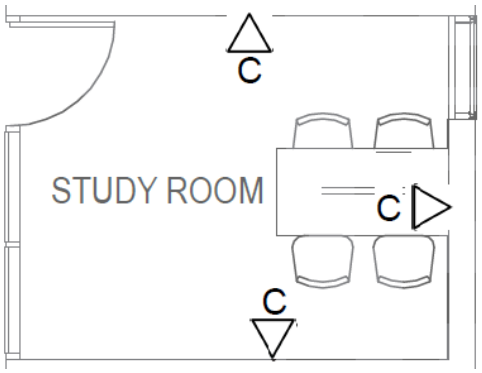
Dean's Office (with LCD)

Type B outlet is placed behind the LCD display. Height of this outlet is determined by the placement of the LCD display itself.



Group Study Room (no AV)

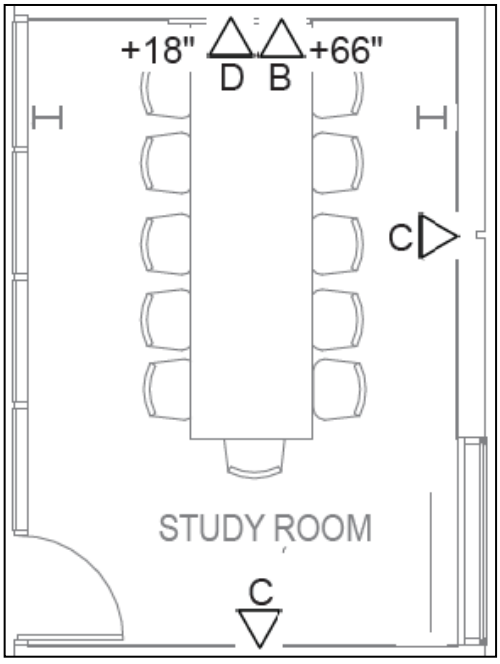
In a group study room or collaboration space for 4-6 persons, telecom outlets are placed on three walls. Tables may be moved around in the room, and the location of the telecom outlets allows for connectivity in various configurations.



As needed, study rooms are converted to offices. This telecom outlet configution accomodates that change.

Group Study Room (with AV)

A Group Study Room that can seat more than six will be equipped with outlets to support AV connectivity, similar to what is shown below.

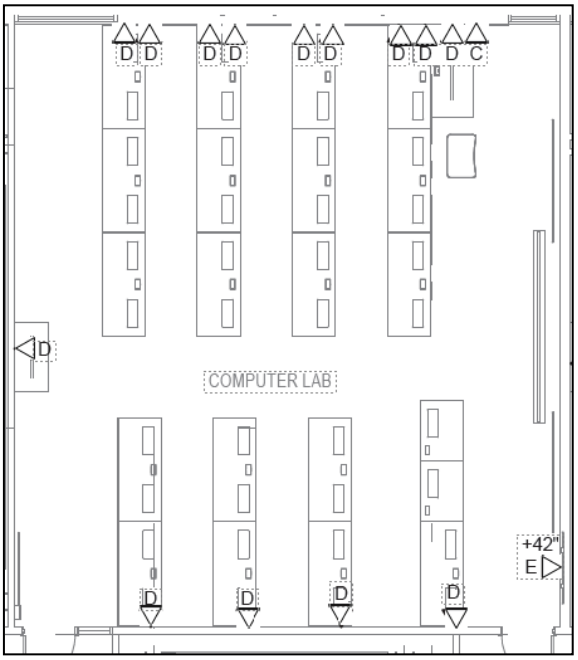


This room has an LCD and AV connectivity for group presentations. The Type B outlet is placed behind the LCD display. Height of this outlet is determined by the placement of the LCD display itself. The Type D outlet is for computer connections as needed.

Computer Labs

Computer labs are provided with wired connections for desktop computers. Cables are terminated in wall or floor outlets. Outlets are may be provisioned to allow for a limited number of additional connections at computer tables. In addition to the computer connections, the room will be provisioned with the following outlets:

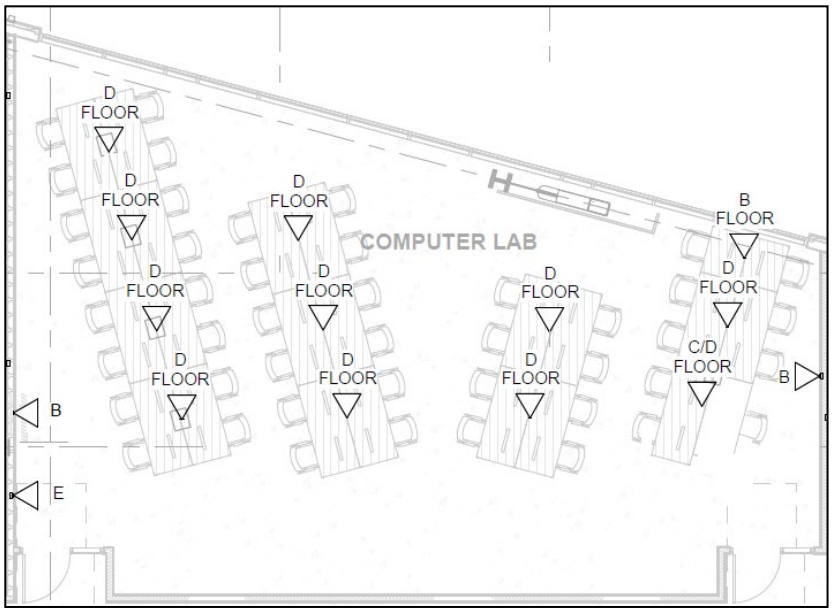
- Instructor's location – One (1) Type C and one (1) Type D, at teacher's desk
- Wall-phone – One (1) Type E, at entrance door.
- Printer station –One (1) Type D or B, typically at the rear, for printer station.
- Projector – One (1) Type B outlet, located at projector, +12" AFC.(not shown).
- Access Point – One (1) Type D outlet, centered in room ceiling, +12" AFC. (not shown)



CLPCCD prefers computer lab configurations with wall outlets at +18" AFF. Patch cords are dressed from the outlet jack through the table. trough for connection to the computer.

Depending on the building/room design, outlets may be located in floorboxes (ground floor) or pokethrus (upper floors). As with wall outlets, patch cords route from the outlet jack to the computer through the table trough.

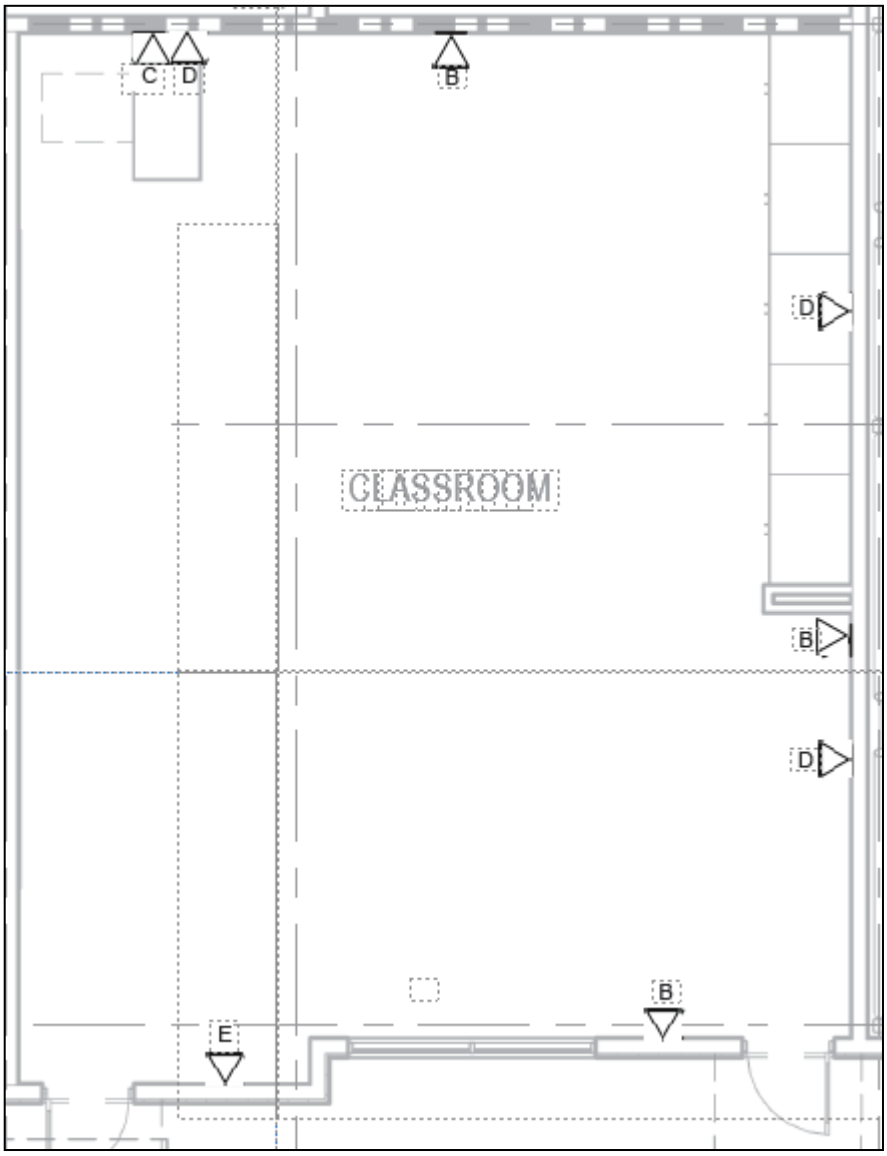
*



Standard Classroom

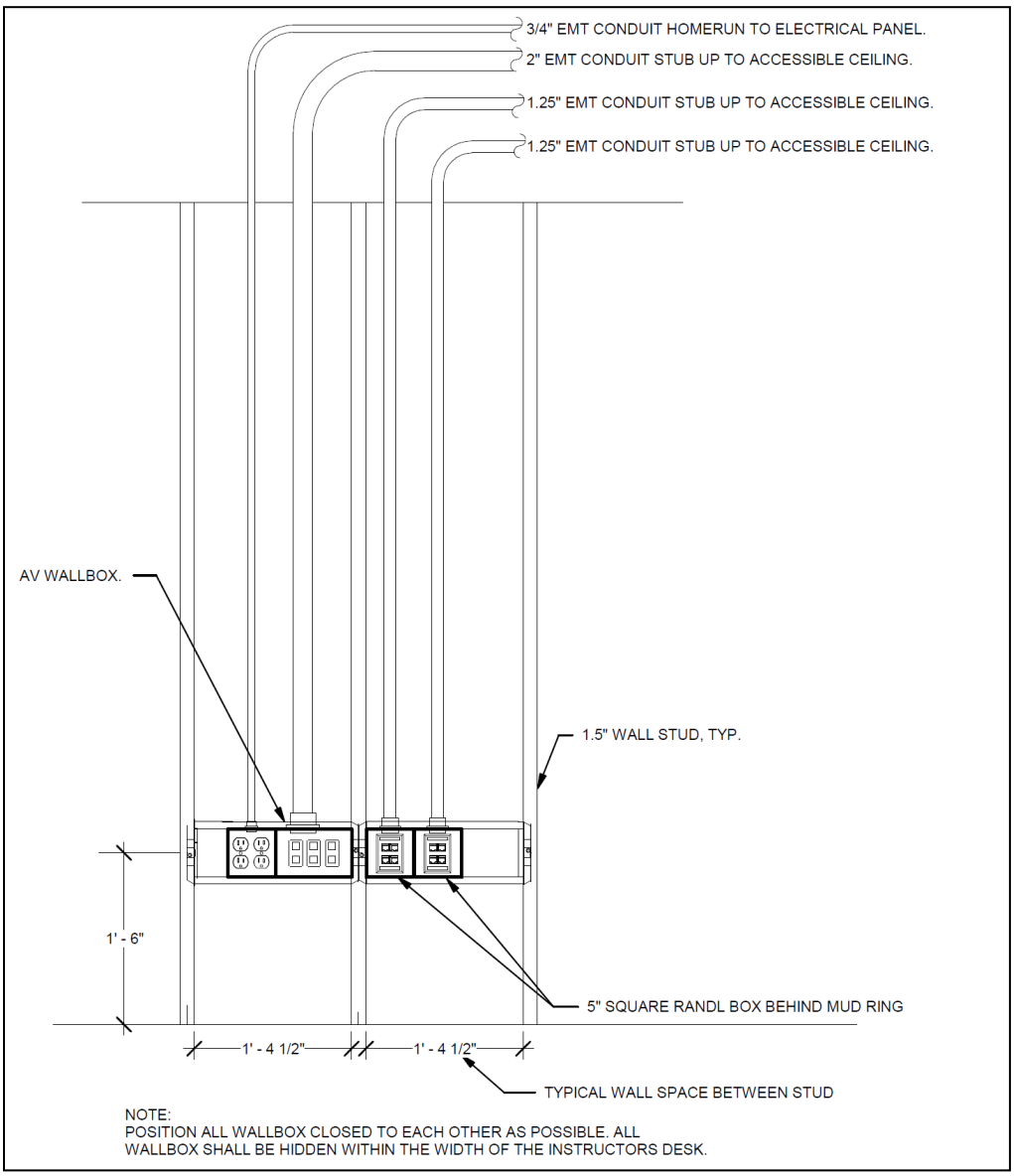
A standard classroom will have the following outlets:

- Instructor's location – One (1) Type C and one (1) Type D, at teacher's desk
- Wall-phone – One (1) Type E, at entrance door.
- Wall connections –Type B, on side or rear walls.
- Laptop cart connectins – Type D, on side or rear walls.
- Projector – One (1) Type B outlet, located at projector, +12" AFC. (not shown)
- Access Point – One (1) Type D outlet, centered in room ceiling, +12" AFC. (not shown)



Note: Classroom telecom outlets will vary with AV standards changes for Hi-Flex configurations and LCD screens.

It is important that the Instructor's station outlets be built as efficiently as possible to conceal cabling to the equipment in the desk.



Refer to AV standards for AV Wallbox details.

11 CLPCCD Product Listing

CLPCCD has standardized on CommScope Systimax infrastructure for Category 6A UTP and fiber. The CLPCCD Board has approved standard products for the telecom infrastructure as shown below. These items are subject to change as products evolve.

Item	Manufacturer	Description
Category 6A UTP	CommScope	2019B Catorgiry 6A.
Category 6A patch panels	CommScope	For new installations 360-IPR-1100A-E-GS6-2U-48 To match existing installations 360-PM-GS6-2U-48
Category 6A jacks	CommScope	MGS-600, white for voice, blue for data
Faceplates	CommScope	M14L - four port (wall outlets) M10LW4SP – one port (wall phones)
Modular Furniture Adapters	CommScope	M14CE-E
Surface Mount Boxes	CommScope	Plenum 2 port
Backboxes	Randl	5” Sq. Telecom #T-55017
Extended Reach connectivity	CommScope	Powered Fiber Cable System: 2-port, 4 strand SMF, 12 Gauge electrical
Single Mode Fiber	CommScope	TeraSPEED Data backbone - 48 strand Data riser – 24 strand FA backbone (Chabot) - 12 strand
Fiber Enclosures	CommScope	MDF/BDF - HD-4U IDF - HD-2U FA – WBE
Fiber Connectors	CommScope	Data – SC, 6 per connector FA – 12 LC auto-shutter

Though not board approved, the following products are preferred by CLPCCD ITS.

Item	Manufacturer	Description
Multimode fiber	Any	FA backbone (LPC) - OM1
Vertical Wire Managers	CPI	Evolution 2g Double-Sided cable manager (12” width)
Floorboxes	Legrand/Wiremold	For Telecom/power- Evolution EFB8 For AV/Telecom/Power - Evolution EFB10
Pokethrus	Legrand/Wiremold	For Telecom/power Evolution 6AT (one telecom outlet) Evolution 8AT (up to three telecom outlets) For AV/Telecom/Power Evolution EFB10

Access Point mounts	Oberon	Varies with model of AP
Fiber Service loop managers	Leviton	ISP - 48900-IFR OSP - 48900-OFR
Cable Tray	Legrand	Cablofil
Vaults	Oldcastle	TCS5494PGE 644-LA

Note that the following items are not included in the telecom infrastructure design for construction projects.

- Horizontal wire managers
- Innerduct
- Power strips
- UPS
- Active network components (switches, access points, DAS equipment)

12 CLPCCD ITS Participation in the Construction Process

It is important that the construction process understands that the early completion of the Telecom (data) system is a critical component for the commissioning of multiple building automation subsystems including, but not limited to, energy management, security, audio-visual, electrical metering, lighting controls, elevator controls, etc. This section describes the telecom infrastructure build out steps, its dependencies on other infrastructure, and the participation of CLPCCD ITS in this process.

CLPCCD Submittals review and RFI responses

CLPCCD ITS participates fully in the review process for Submittals. This includes Division 26xxx, 27xxx and 28xxx submittals and any other section that specifies telecom or AV components or connectivity to the campus data network.

CLPCCD ITS also reviews and responds to RFIs that may in any way change or affect the telecom or AV cabling. This includes outlet deletions/additions/moves, pathway changes and functionality.

CLPCCD ITS comments are provided in written form and will be incorporated into the formal response by the A&E team. As needed, a conference call with the design team may be required so a coordinated response is provided to the contractor. No response shall be returned to the contractor without input from CLPCCD ITS.

CLPCCD Pathway Review

Prior to construction, CLPCCD ITS participates in any discussions that may affect the telecom or AV infrastructure.

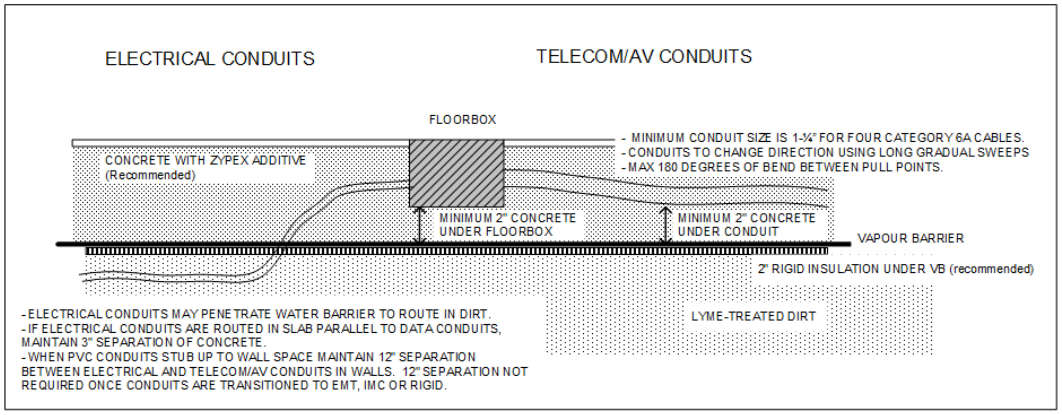
During BIM sessions:
CLPCCD ITS participates to ensure that:

1) Adequate space and access clearance is allocated for telecom cable tray and conduits.
2) Adequate spacing from EMI emitting devices is maintained.
3) Access panels for telecom infrastructure are designed.
4) Conduits do not exceed telecom construction standards, including:
    a. a maximum of 180 degrees of bend, cumulatively between pull points
    b. adequately sized pull boxes are located.
    c. other design rules specified by TIA standards.
5) Any moves/rerouting of cable trays or conduits DO NOT result in cable lengths exceeding the maximum of 295 feet.

As building construction occurs.
Prior to slab pour, CLPCCD ITS comes onsite to inspect the installation of floorboxes for voice/data and AV on the first floor. This includes:

1. Verification that the floorboxes are in the right location, per plan.

2. Verification that the right size conduit is installed.
3. Conduits do not exceed 180 degrees of bend between pull points.
4. Verification that the telecom/AV conduits are correctly spaced from the electrical conduits. (3"of concrete or 12"of well-tamped earth.
5. Verification that the telecom conduits are installed per the CLPCCD design, above the water barrier, and correctly secured such that the conduits are encased adequately in concrete during the pour.



Prior to walls being closed up, CLPCCD ITS and College Technology staff come onsite to review telecom infrastructure pathway for voice/data and AV. The inspection includes:

1. Verification that the backboxes are in the right location/height, per plan.
2. Verification that the right size of conduit is installed.
3. Conduits do not exceed 180 degrees of bend between pull points.
4. Pathway is cleared from obstructions from HVAC, pipes or other ceiling infrastructure that would cause difficulty during cabling.
5. Cable tray is accessible 12" above and 24" to one side.
6. Sleeves/EZ Paths are in line with the cable tray. If offset, the vertical height is verified so that the cable lengths are not exceeded.

Once CLPCCD has verified that the pathway is built per specification and TIA standards, the infrastructure is ready for the Telecom/AV Contractor to begin installing cabling.

TELECOM PRE-CONSTRUCTION MEETING:

A **Pre-construction meeting** with the Telecom Contractor will be scheduled with CLPCCD ITS to review the cabling installation and labeling details. CLPCCD ITS prepares documentation for the contractor that describes the cabling requirements in more detail than what is shown in the drawings. Numbering and labeling schemes are discussed. A tour of an existing IDF to set expectations for quality and workmanship is provided. A tour of the MPOE/MDF, including the review of specific installation instructions for backbone cables, occurs. Typical attendees for

this meeting are the telecom contractor PM and assigned crew lead, the electrical contractor, the GC and CM. Design team may attend if they wish, but are not required.

TELECOM CONTRACTOR WORK

Prior to cabling onsite, the telecom contractor is REQUIRED to take the information from the Telecom Pre-construction meeting and provide a labeling scheme for the telecom outlets. Since the labeling scheme includes the room numbers, the final numbering plan for the building must be provided by the CM/GC. Once the labeling scheme is approved by CLPCCD ITS, the cabling can begin.

1) **Cable rough-in:** typically six-nine months before project completion, depends on building size.

In order for cable pulling to occur, the following items must be in place:

- Backboxes and conduits for outlets are complete and approved by CLPCCD ITS
- Cable tray and sleeves between rooms and tray are installed.
- IDF room is built with sleeves installed for cable routing.
- Building is completely enclosed (roof, windows), so no water intrusion is possible.
- Other trades have completed any conflicting work that would block pathway access.

Cables are roughed in from the outlet location to the IDF room, where they are protected from damage along the entire run. Consideration by other trades, so that they don't damage bundles of suspended telecom cabling is of paramount importance.
During the cable rough-in CLPCCD will periodically come onsite to observe the work and note any issues.

2) **IDF Buildout:** typically three months after cable pulling

This work involves setting up the racks, cable runway and other related room infrastructure. Before racks are placed, the following items must be complete

- Walls are complete with fire-treated plywood, painted with fire stamp showing. NOTE THAT WHEN THE PLYWOOD IS PAINTED, THE CABLES MUST BE PROTECTED SO THAT PAINT DOES NOT GO ONTO ANY PART OF THE CABLE. THIS ALSO APPLIES TO PAINTING ELSEWHERE IN THE BUILDING.
- Floors are cleaned, smoothed and finished. Anti-static flooring and grounding is installed (if designed in the project). If the floor is just sealed concrete, that is completed.
- Lighting and convenience electrical is installed and working. NOTE: OUTLETS TO THE RACK ARE NOT INSTALLED UNTIL RACKS ARE PERMANENTLY BOLTED.
- Door is installed.
- All non-telecom contractor materials are removed from IDF.

Once complete, racks are assembled and staged in the IDF room. This includes all racks and VWM. CLPCCD ITS and College Technology staff come onsite to review, adjust and approve rack placement. Note that CLPCCD ITS may move, rotate or reverse the racks during the

inspection. No infrastructure will be permanently installed in the BDF/IDF until the rack review is performed, and rack locations are approved by CLPCCD ITS.

Once rack placement is approved, the following activities can take place:

- Racks with VWM are bolted and tested to meet seismic requirements.
- Cable runway is installed.
- Power to racks is installed. Note: power outlets are ALWAYS at the rear of the racks and suspended independently above the racks.
- Cable terminations can begin, per the detailed design as discussed in the Telecom Pre-construction meeting.

Installation of the backbone cables can be scheduled at the discretion of the contractor and coordinated with the GC/EC. Access to the Campus MDF/MPOE is coordinated with CLPCCD ITS and College Technology staff. Contractors are only able to access the MDF/MPOE if CLPCCD ITS is available to supervise.

Note that as the telecom installation is completing, CLPCCD ITS will come onsite frequently to inspect progress.

3) Cable Terminations

When cable terminations commence, the IDF room should be used exclusively by the telecom contractor. It is now a "clean" environment for the termination of the copper and fiber cabling. With limited access for work pertinent to the telecom infrastructure, other trades doing HVAC or electrical work may need to access the IDF, but they cannot use the room for storage of their materials. The IDF room door should be closed at the end of each workday, preferably locked. In the rest of the building, jacks and faceplates will be installed. Once labeled and tested, the jacks should be covered (blue painter's tape) to keep dirt out of the jacks. If painting is not complete, faceplate/jacks should be bagged to make sure that no paint gets on the infrastructure. IT IS OF CRITICAL IMPORTANCE THAT THE CABLES DO NOT GET PAINTED. Paint on the cables will cause the sheathing and inner UTP to degrade. It invalidates the 25-year warranty for the site. Any cables painted must be completely removed and reinstalled at the contractor's expense.

4) Network IP address assignment.

Once faceplates are permanently installed and final numbering is completed, CLPCCD ITS will accept requests from contractors for IP address assignments through the RFI process. IP addresses will be assigned and returned. The following systems need IP address assignments: EMS/BMS, electrical metered panels, lighting controls, security panels and cameras, CCTV cameras, AV equipment, elevator control devices, irrigation controllers. No devices will use the campus wireless for connectivity. Only wired connections with static IP addresses will be allowed.

5) Temporary Network connectivity.

To facilitate the commissioning of BMS, security and other data network-connected systems, CLPCCD ITS will configure and install temporary network switches in the BDF/IDF. This usually occurs 3 months before Substantial Completion.

The following items must be completed before the temporary network switches can be placed:

1. All station cabling is installed, terminated, labeled and tested.
2. Backbone copper and fiber cables are installed, terminated, labeled and tested.
3. Copper and Fiber test results are sent to CLPCCD ITS for review and approval.
4. BDF/IDF construction is complete.
5. BDF/IDF racks/VWM/patch panels are cleaned of construction dust.
6. Contractor surplus materials are removed. Floor is cleaned.
7. Rack bolts are provided (one bag of 50 per rack).
8. The lock on the door to the BDF/IDF is changed to a restricted CLPCCD keyset.
9. Power and lighting is provisioned and stable.
10. Grounding is complete.
11. Other contractors no longer need access to the BDF/IDF rooms.

Permanent air conditioning is not required, but it would be helpful. Once the temporary switches are installed, CLPCCD ITS will patch the devices that have been assigned IP addresses to the network. Integration of those systems to the campus controls can then begin.

PUNCHLIST

Though much of the BDF/IDF completion/approval will take place before the temporary network switches are installed, CLPCCD ITS will perform a formal inspection and punchlist as part of the building acceptance process.

13 Fire Alarm Fiber Loop

Each campus has a fiber loop that connects the Fire Alarm Panels for audio notifications through the speaker-strobes. This fiber loop is completely separate from the data fiber with no interconnections. In new construction or building modernizations, if a new FA fiber backbone needs to be installed, the design for the fiber is shown on the telecom backbone drawings. The fiber is installed, terminated, labeled and tested by the telecom contractor. RED labels are installed on the FA fiber at all pull points. The telecom contractor supplies RED fiber patch cords, typically LC-LC. These are given to the FA subcontractor, who installs the patch cords and connects the new FA panel to the campus loop.

The fiber infrastructure differs at each campus, as described below:

Chabot Campus - At Chabot, the fiber backbone uses single mode fiber. Each building is provided with a twelve (12) strand CommScope TeraSPEED OS2 fiber. The fiber is installed in a point-to-point topology to three termination hubs on campus:

- Building 800 -interconnects the INX panels in the following buildings: 200, 300,400, 500, 700, 900, 1100, 1200, 1300.
- Building 1800 - interconnects the INX panels in the following buildings: 1400, 1500, 1600, 1700, 2000, 2400, 3500, 3900.
- Building 2500 – interconnects the INX panels in the following buildings: 1900, 2100, 2200, 2300, 2400, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 4000, Baseball.

The FA fiber loop uses four strands of fiber, patched to create a dual counter-rotating loop. A separate set of single mode fiber backbones interconnect buildings 2500, 1600 and 800 to make one continuous loop across the campus. INX panels have LC connectors.

L**as Positas College** – At LPC, the fiber backbone uses multimode fiber. Each building is provided with a twelve (12) strand OM1 or OM4 fiber. The fiber is installed in a point-to-point topology to multiple hubs on campus:

- Building 3100 (M&O) -interconnects the INX panels in the following buildings: PE Fields 3200, Hort 3300, Vit 3600, PSC/AMT 3500
- Building 2400 (MD) - interconnects the INX panels in the following buildings: PE (2500), 1700, 1600.
- Building 1900A – interconnects the INX panels in the remaining buildings:

The FA fiber loop uses four strands of fiber, patched to create a dual counter-rotating loop. Because the LPC loop uses multimode fiber it is sensitive to lengths between panels. When a new patch is added, the contractor must take care to minimize the fiber lengths between the INX panels. INX panels may have ST connectors.

At each campus, the new fiber backbone is terminated in the buildings on a wall-mount enclosure using LC connectors. Installations older buildings at LPC may use ST connectors, but LC connectors are required for new installations.