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<http://home.cerritos.edu/it/SitePages/Network-Cabling-Standards.htm>

## Network Infrastructure Support Standards For New Construction and Renovations

### Overview

These requirements shall be incorporated into the specifications and architectural drawings of new building construction and renovation projects prior to bid; avoid change-orders later. These details are Telecommunications Industry Association (TIA) recommendations, code requirements, established standards, and experience learned from previous construction projects.

The college is not like a commercial building, where cabling and other infrastructure is replaced whenever a new customer moves in. The support system will remain in place until the building is gutted and renovated or until the building is demolished. The plumbing, HVAC and other 'utilities' for buildings do not change over the life of the building. The network cabling does. These standards are meant to facilitate installation of the network cabling system at time of construction, to allow for growth, and to ease the constant moves, additions, and changes over the lifetime of the building. Having a well-designed cable support infrastructure will reduce the cost of these future upgrades.

## Plan Drawings

### Electrical Drawings

On electrical drawings (low voltage drawings), identify location of the telecommunications Equipment Room (aka: ER; not the Data Room, IT Room, IDF, NER or BDF). Use these [Standard Symbols Legend for electrical](#) to represent data wall, ceiling and floor boxes. Amend the Legend and General Notes as necessary. Include height notation for outlets at other than 18" AFF.

### Technology Drawings

On technology drawings for data, fax and phone (ET, T or TC drawings from I.T. consultant), identify location of the telecommunications Equipment Room(s). Also identify utility rooms, custodian closets, etc. Use these [Standard Symbols Legend for data](#) to represent all wired connections. Amend the Legend and General Notes as necessary. Differentiate between data, A/V, and empty "Conduit Only" symbols. Show room numbers and outlines of all fixed wall and base cabinets, and any fixed furniture where data outlets will be installed. Adhere to AIA CAD Layer Guidelines.

Coordinate data drawings with electrical, A/V and furniture drawings early. Data outlet is required within 6 inches of each primary MIP (AV rack location).

After finalizing all data locations, provide two full-size final drawing sets (no clouds!) with grayed fixed-furniture outlines showing locations and number of **all** data / voice outlets, **regardless of**

placement (in walls, ceiling, raceway, furniture, etc.) or use (podiums, wireless, A/V equipment racks, EMS, security, etc.).

Technology drawing design must be performed and stamped by a BICSI Registered Communications Distribution Designer (RCDD).

Provide electronic CAD drawing set showing all data & voice outlets within the building.

## Network Equipment Rooms

### Room Location

Locate the **Equipment Room (ER)** with direct access to a main corridor and as close as possible to the **center of the building floor** to minimize cable lengths, which cannot exceed 295 ft. or certification testing will **FAIL**, meaning no warranty. It is preferred that the Equipment Room not be located adjacent to the electrical room, due to potential EM interference (EMI). Provide one Equipment Room to service each floor, stacking the rooms one on top of the other. Keep clear of water sources and exposed ducts and conduits. No Equipment Room shall be used as a passageway to another room (reference: TIA-568, 569).

For security, display the room number **only** on room signage.

See front view of a typical network rack layout [here](#).

See top view of a typical Equipment Room layout [here](#).

### Room Size

In order to accommodate a typical four communications rack installation (11ft. wide) in an Equipment Room with 3ft. of clearance on all sides, the room should not be smaller than 7 feet deep x 17 feet wide. Adjust room size for smaller areas with only three racks (8 ½ ft. wide) to no smaller than 7 feet deep x 15 feet wide. Room must be large enough to allow for all network connections at time of construction, plus room for future growth.

Make all walls full height, 10 ft. minimum, and sealed to keep conditioned air in this room.

Do not install a false ceiling (Reference: TIA-569). Avoid any / all plumbing above communications racks.

### Power

Starting at 6 ft. from the rear-left corner of the Equipment Room (as viewed from front of racks), install one dedicated non-switched 120V 20A electrical circuit with NEMA 5-20R duplex receptacles and one dedicated non-switched 120V 30A electrical circuit with NEMA L5-30R receptacles every 5 ft. Install outlets recessed into the back wall. Tie into backup generator power circuits, if available.

Install at least one non-switched 120V (15A or 20A) convenience duplex outlet on other walls.

Install all electrical outlets flush in walls at 18" AFF.

### Backboard

Install ¾" A-C **fire-rated** plywood backboard over the drywall in the Equipment Room to fully cover all walls (front, back, 2 sides) using flat countersunk screws. Start plywood at about 21" above finished floor (to clear power outlets). Plywood shall be painted with white paint (2 coats minimum, or per manufacturer's directions), with one fire rating seal unpainted and visible at the top, or rating

verified by the Inspector Of Record (IOR). Allow sufficient open space on the front wall to attach copy of as-built communications drawing, ANSI E size (Reference: TIA-569).

## **Bonding and Grounding**

Install a Telecommunications Main Grounding Busbar (TMGB) in the Equipment Room, with minimum dimensions of 0.25" (6mm) thick x 4" (100mm) wide x 12" (300mm) long, **tin plated** copper with pre-drilled holes meeting standard bolt-hole size and spacing per BICSI / TIA-607-B ([Harger](#), [Panduit](#), [Erico](#), or equivalent). Place at 8 ½ ft. above finished floor, on left side of rear wall (as viewed from front of racks), behind the first communications rack. Bond to main building ground (Ufer ground, building steel, other) (Reference: TIA-607).

For second or more Equipment Rooms, install a Telecommunications Grounding Busbar (TGB) in each additional Equipment Room with the same requirements as the TMGB, bonded to the TMGB (Reference: TIA-607).

From TMGB or TGB, install ½" conduit to 8" AFF with a 6-AWG (minimum) bare copper wire for bonding of conductive floor.

Include this requirement in the electrical section (or CSI Section 270526) of the building specifications, as the electrical contractor typically provides, installs and connects the TMGB and TGBs.

## **Static Control Floor**

[VPI Conductile](#)® **conductive** static control vinyl floor tile, with 25,000Ω -1,000,000Ω electrical resistance, is required in Equipment Rooms. Install per manufacturer instructions using conductive one-part adhesive. Flooring must be installed prior to installation of equipment racks. Locate copper grounding strip beneath the grounding busbar. Bond grounding strip to the busbar. Floor cleaning shall be per manufacturer's Initial Floor Maintenance instructions.

## **Environmental**

Install a 24/7 wall-mounted non-humidifying split-ductless air conditioner system for the Equipment Room ([Mitsubishi Electric](#) "Mr. Slim"), with wall-mounted wired thermostat and a provision for condensation drain line, preferably below the unit to avoid use of a pump. Place on same wall as the door or on side wall at 8ft +. (Reference: TIA-569).

Place servicing power switch high, next to unit. Change factory default settings for temperature to 74 degrees Fahrenheit, and to auto-restart after power failure. Tie into backup generator power circuits if available.

## **Lighting**

Place two 2-light fixtures 2 ft. from back wall to provide lighting to the rear of the communications rack. Place two or three 2-light fixtures about 7 ft. from back wall to provide lighting to the front of the communications rack.

## **Doors**

Provide a 36" wide, 84" high outward opening solid door. Install Storeroom function door lock, and door closer with 180° hold-open arms.

## **Cable Distribution Infrastructure**

## Inter-building Conduit

Install three underground 2" and one 4" PVC conduits from the designated communications manhole to the ground floor Equipment Room for fiber, analog telephone, coax & future use. Transition to rigid conduit above ground where exposed to the outside. Mandrel test these conduits prior to encasing in slurry and again after ductbanks are buried.

Install three 2" EMT conduits from the ground floor Equipment Room to next upper-floor Equipment Room for fiber cables, copper (if needed) and a spare.

Use only large-radius (3 ft. minimum) elbows, as needed, in all underground communications conduits.

Place a metallic warning tape directly above the conduit bank. Wording shall read "Caution – Buried Fiber Optic Cable Below" or similar.

Preferred conduit entrance location is parallel to the wall at the rear-left corner of Equipment Room as viewed from the front of the equipment rack, so as to locate them behind and to the left of the first communications rack.

Place ¼" polypropylene or nylon pull ropes in each conduit.

Install expandable blank duct plugs with internal rope tie attachment ([Jackmoon](#), or equal) on all unused 2" and 4" conduits in the Equipment Room and in the underground utility vault. Install rubber caps (LSP Products Cap-All or equal) on conduits with installed cables.

## Conduit Body

In no case shall a pull box be installed on 2" – 4" conduits to change direction of OSP fiber, copper or other communications cable. Use only BICSI standards-compliant aluminum body "[Smart LB](#)" products from Madison Electric Products. [BlueKote Universal Conduit Elbow \(LU\)](#) from Thomas & Betts may be substituted with prior approval. These products ensure that installed cables do not exceed minimum bend radius.

## Cable Tray

Install an UL-approved 18" wide, 4" deep wire-type cable tray system ([Snake Tray](#)® Mega Snake, [Cablofil](#)® CF 105, [Cooper](#) FlexTray, [CPI](#) Wire Mesh, or equivalent) on each floor. Place above the ceiling in hallways and corridors **in shortest path toward ER**; more cable tray is preferred over conduit. Place 8" (min.) above the ceiling grid, with 12" (min.) of headroom to allow access. Branches and end runs from the main cable tray may be smaller-width tray. Install more cable tray to minimize conduit lengths. Plan placement of cable tray so as to not run into wall studs or conduit where tray penetrates through walls. Route conduits to the sides of the cable tray at the same elevation as the tray, **not to the floor below** – second-floor conduit to first-floor cable tray is unacceptable. Bond all cable tray sections to electrically grounded structural building steel or to the Main Grounding Busbar (CTI Technical Bulletin 15, CEC Article 392.7).

Install four 4" conduit sleeves to penetrate fire-rated walls, including the walls into the ER. Place conduit sleeves side-by-side and center over the raceway. Fire seal around the sleeve penetrations, and bond the sleeves to the cable tray (reference: TIA-569, CEC Article 645-15).

## Intra-building Conduit

Install one 1" EMT conduit in a continuous length (**no daisy-chaining**) up to 100 ft. in length from the cable tray to each / every wall or ceiling workstation outlet box for up to 4 data cables. Place pull string in all conduits.

Install one 1 ¼" EMT conduit in a continuous length (**no daisy-chaining**) up to 100 ft. in length from the cable tray for that floor to each / every floor box location for up to 8 cables. Increase to MINIMUM 2" EMT for use with a cable trough. Place pull string in all conduits.

Install four 4" conduits above hard-lid ceiling to join cable tray sections. Place conduit side-by-side and center over the raceway. Bond the conduits to the cable tray.

Avoid placing conduit underground if possible. Route conduits in shortest, most direct path to closest cable tray, in walls closest to the center of the building, towards the ER, with no more than 3 90° bends, 270° total (Reference: TIA-569, CEC Articles 344.26, 354.26, 358.26).

Do **not** use flex conduit in any conduit run, except for extending to modular furniture. Use black Anaconda Sealtite® EFST for this purpose.

Keep cable pathway distance from Equipment Room, through cable tray and conduit, to workstation outlet box **under 270 ft.** *Cable path must not exceed this distance.*

Install plastic bushings (Arlington Industries [EMTxxx](#) or equivalent) at open ends of *all* metallic conduits (reference: CEC Article 300-4, 300-16 (B)).

### **Pull Boxes**

If pull boxes are required, provide 8" x 8" minimum size. If located in a wall where box is visible, use decorative cover (face plate). Do not use pull boxes for cable directional change.

### **Underfloor Raceway**

If an underfloor cable raceway system is required, specify a manufacturer (Walker Duct, Trench Duct, other). Do not install a build-on-site under-floor trough. The top cover must be easily removable without damage to the flooring material.

### **Wall Workstation Outlet Box**

Install [Randl Industries T-55017](#) 5-Square x 2 7/8" deep Telecommunications Outlet Box at data workstation outlet locations, up to four outlets per box. On walls, place at 18" above finished floor unless noted otherwise, adjacent to power outlet. In offices, install one on each wall as per [typical office furniture layout](#).

Install one Randl Industries T-55017 Telecommunications Outlet Box, flush in wall, for a wall phone outlet at 52" in the Equipment Room next to door (Maximum ADA allowable height for side reach). Do not place light switch or other devices closer than 8" to either side of this box and nothing 16" below (telephone is 10" wide).

Install one Randl Industries T-55017 Telecommunications Outlet Box, flush in wall, for building security next to security / access control panel location. Alternately, install one 1" EMT conduit from the cable tray to the control panel to allow use of a Surface Mount Box.

Install one Randl Industries T-55017 Telecommunications Outlet Box, flush in wall, for Energy Management System (EMS). Alternately, install one 1" EMT conduit from the cable tray to the EMS cabinet to allow use of a Surface Mount Box.

Install Randl D-51Gxxx 5-Square single-gang extension rings (depth as needed) on each wall-mounted 5-Square Telecommunications Outlet Box. Orient vertically for all wall faceplate outlets; faceplates have downward-angled entry for patch cords.

Install Randl 5BSB-16 (16" stud spacing) 5-Square Support Brackets as needed.

If used, install one 1" EMT conduit from the cable tray to the A/V pull box by the teacher station to allow use of a data Surface Mount Box (SMB).

### **Ceiling Outlet Box**

Install Randl Industries T-55017 Telecommunications Outlet Box [8"-12" above ceiling level](#) for wireless access points (WAP) or security cameras. Install facing downward to allow easy access when reaching up into the ceiling. In classrooms, place above projector locations. [Open or high ceilings](#) require special considerations. Inside buildings, do not place WAP or camera outlets above 10 ft. Place on walls at 10 ft., or call I.T. for further discussion. [Exterior WAPs](#) require the Randl box on the interior wall - the WAP and antenna are discrete, requiring a short connection distance. [Exterior cameras](#) require the Randl box in building interior.

Install Randl D-51G000 5-Square flat extension ring on each ceiling-mounted 5-Square Telecommunications Outlet Box to give the faceplate more area to press against.

### **Surface Raceway**

If raceway outlets are required, use Wiremold® [5400TB-WH](#) white finish two-compartment surface raceway with [5400C-WH](#) covers, [5450-WH](#) device brackets, [CM-EPLA-WH](#) end plates, [5507D-WH](#) duplex faceplates (for electrical duplex), [5507B-WH](#) blank covers, and all additional required fittings. Install one 1 ½" conduit as raceway feed for up to 10 cables within 12 ft. of surface raceway. Data conduits are to feed the top raceway compartment, with power taking the bottom. Starting 3ft. from the end, [place device brackets every 6ft.](#)

### **Data / Power Floor Box**

Install 3 ¼" deep Wiremold® [RFB6](#)-series floor boxes with internal duplex or GFI receptacle brackets for power, and two 2A-size CM Open System internal communications brackets for data.

Install a Wiremold FPCTCBZ bronze finish (for carpet) or FPCTCNK nickel finish (for VCT) flanged cutout cover assembly with matching floor material placed into trim recess, or as selected by the architect.

Install one 1 ¼" conduit to each floor box for up to 8 data cables. Route to closest wall, and then extend to the cable tray on that floor. Use fire-classified version of this box in fire-rated floors.

Not recommended, but if floor-type pedestals are required for combined power and data, provide separate isolated entry paths that allows back-to-back data and electrical (most don't!). Low voltage barriers are required to separate power & low voltage data.

### **A/V / Data / Power Floor Box**

If floor A/V connections are required, use Wiremold® Evolution [EFB8](#)-series floor boxes. Include a Wiremold EFB810-DIV divider.

Install a Wiremold EFB610CTCBZ bronze finish (for carpet) or EFB610CTCNK nickel finish (for VCT) cover assembly with matching floor material placed into trim recess, or as selected by the architect.

Install one 1 ¼" conduit to each floor box for data cables. Route to closest wall, and then extend to the cable tray on that floor. Install one 1 ¼" conduit for A/V cables. See A/V drawings for A/V conduit routing. Use fire-classified version of this box in fire-rated floors.

Install one Pass & Seymour [1597NLTTRWCCD4](#) (15A) or [2097NLTTRW](#) (20A) GFCI duplex receptacle with LED nightlight in Evolution EFB8 floor boxes for A/V connections. Other power duplex outlets may be NEMA 5-15R or 5-20R.

## Workstation Power

*It is recommend that one electrical duplex (NEMA 5-15) be installed for every wall & floor data outlet (for computer & monitor) to avoid use of power strips. Place on same wall stud adjacent to workstation outlet box for wall locations. Data outlet faceplates used are white in color. Coordinate electrical outlets accordingly.*

## Communications Cabling

### Cabling System Overview

Determine if CMR (riser) cable is acceptable or if CMP (plenum) cable will be required. Relay this information to College IT department.

Data network Category cable is blue, voice cable (for analog elevator and translation phones) is gray, and video network cable (to projectors) is yellow. Specify that other low-voltage Category X communication cables (EMS, security, fire alarm, lighting, etc.) be other colors for easy identification.

The College IT department has developed specifications for communications (CSI Division 27, Sections 270500, 270528, 270543, 271100, 271323, and 271500) that are revised and tailored to each building project. These shall be utilized as part of the bid documents.

This and other network installation documents and reference drawings are available at:

<http://home.cerritos.edu/it/SitePages/Network-Cabling-Standards.htm>

Allow for approximately 25 ft. of cable in the wiring closet. Subtract this from the maximum allowable cable length (295 ft. - 25 ft. = **270 ft.**) when measuring on the drawings.