SAN MATEO COUNTY
COMMUNITY COLLEGE DISTRICT

Telecommunications Infrastructure Design Standards

Information Technology Services
3401 CSM Drive
San Mateo CA 94402

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Issuance Log

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1.0 INTRODUCTION

1.1 Purpose

This purpose of this document is to describe minimum requirements and establish design guidelines for telecommunications / datacom infrastructure that will support information systems and other data-based systems. This document describes requirements and criteria to guide the Design Team (datacom, electrical, mechanical, and other disciplines) and the Contractor to provide the minimum infrastructure and support for information systems.

This document is not intended to be used as project specifications. Rather, each project shall have produced technical specifications. Also refer to the Information Technology Service's (ITS) MasterFormat specification templates.

1.2 Scope

The scope of this document includes the following:

- Architectural, Structural, Electrical, Mechanical, Plumbing, and Security requirements for Telecommunications Rooms build-out/fit-up
- Outside Plant Underground Pathways
- Telecommunications Rooms build-out/fit-up, including equipment and termination apparatus racking and cable support
- Building Pathways
- Backbone Cabling
- Horizontal Cabling
- Wireless LAN Deployment
- Instructional Technologies

1.3 Application

Information technologies are a critical element in the design of virtually all new and renovation building projects. Whether voice, data, video, security, fire alarm systems, audio/visual systems, or other technology, it is important that a team of experienced professionals are involved in the design of these complex systems.

The requirements and criteria herein apply to the District Office and each campus within the District – Cañada College, College of San Mateo, and Skyline College.

A Structured Cabling Plant is a key concept in enabling Information Technology for each of the three College communities in the District. To maximize network functionality, minimize labor and material costs, and improve maintenance of information technologies infrastructure, ITS has developed standards and practices that projects shall comply to. These standards are managed and administered by the District's ITS Department.

1.4 Arrangement of Information

This document is arranged by design discipline. Best practice has the Designer reading the entire document and related documents; however, the Designer may study the specific sections related to their discipline, and review the other sections.

1.5 Systems Supported

The telecommunications infrastructure shall support data network communications from the equipment in the Telecommunications Room (e.g., switch) to the work area equipment (e.g., desktop computer) and between equipment in Telecommunications Rooms (e.g., core switch in MDF to access switch in TDs).

The data network will support, at a minimum, IP-based host-client applications and voice-over-IP (VoIP) applications.

The telecommunications infrastructure shall support telephone communications from the equipment in the Telecommunications Room to the work area and between Telecommunications Rooms. Examples of these applications include analog non-VoIP voice services to devices such as campus phones and elevator control panels (elevator car emergency phone).

The telecommunications infrastructure shall support additional building systems such as security systems, building control systems, fire alarm, . . etc.

1.6 Procedures

A. ITS Contacts

Use the following URL for ITS contact information:

http://www.smccd.net/accounts/itwirespecs/contact/

B. Project Design

Projects designed and led by an architect/engineer, whether a capital project, shall have the telecommunications infrastructure designed by a Telecom Designer (part of the Design Team or associated consultant) approved by ITS.

http://www.smccd.net/accounts/itwirespecs/contact/

This infrastructure shall include all pathways, cabling, terminations, testing and telecom room construction related to the telecommunications systems. The Designer shall provide services in accordance with these standards, and as directed by ITS.

The Design Team shall verify that all applicable portions of these standards are incorporated into the project's design, drawings, specifications and final construction. Requests for variances from these standards shall be submitted in writing to the Project Manager.

C. Project Installation

The Contractor shall be a Certified Panduit Installer fully capable of providing an extended system warranty, and shall be experienced in this structured cabling system.

This infrastructure shall include all pathways, cabling, terminations, testing and telecom room construction related to the telecommunications and AV systems. The Designer shall provide services in accordance with these standards, and as directed by ITS.

The Design Team shall verify that all applicable portions of these standards are incorporated into the project's design, drawings, specifications and final construction. Requests for variances from these standards shall be submitted in writing to the Project Manager.

D. Scheduling

Designers and Contractors shall develop construction schedules that allow adequate time for ITS to inspect the installation and perform equipment provisioning, as stated following, prior to the Owner's occupancy of each part of a project. ITS will provide estimates to the Contractor of the amount of time and target dates that will be needed to complete both the Contractor's infrastructure and ITS' work within the overall project construction schedule. Contractors shall be required to cooperate with ITS personnel and allow them equal access to the jobsite to complete their work, concurrent with other work underway by the Contractor.

E. Demolition Of Existing Cabling

If existing cabling must be demolished, coordinate with ITS the extent of the demolition work. ITS may chose to have some equipment recovered (such as jacks, faceplates, racks, or other components). The demolition plans must be produced with this information expressly stating the components to be recovered and turned over to ITS.

1.7 Owner-Provided Equipment

ITS will furnish and install the networking equipment, telephone handsets, and AV equipment. ITS shall perform the final patching between the networking equipment and horizontal field and the final cross-connect wiring between the backbone field and horizontal field.

2.0 ARCHITECTURAL

2.1 Telecommunication Rooms – New Construction

Refer to section 8.2 for descriptions of the different types and functions of the Telecommunications Rooms. "Telecommunications Room" covers service entrance room, main distribution room, and intermediate distribution room.

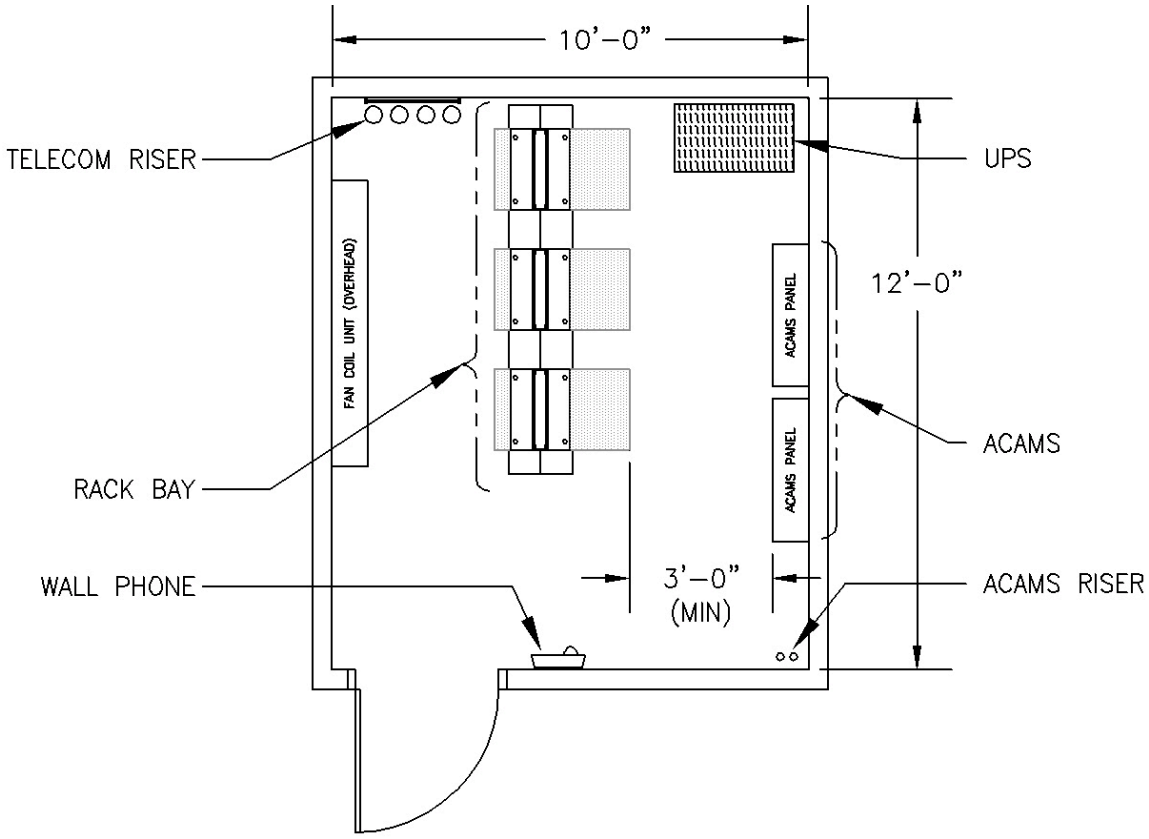
A. Size / Critical Dimensions

Use the following dimensions as guidelines for the minimum size of a Telecommunications Room. The actual dimensions will vary depending upon attaining the minimum critical dimensions and accommodating building elements.

These are the minimum critical dimensions for equipment and clearances for rooms to house floor-standing equipment racks:

1. Width: 10'-0"
2. Depth: 7'-0" for the first rack and UPS, 30" for each additional rack (recommend three racks for typical floor plate of approximately 50,000 square-feet) See diagram below for example.
3. Height: 9'-6" from finished floor to the lowest clearance (such as fireproofing on steel beam).

If area is encroached by building elements such as columns, critical dimensions must still be adhered to and the room dimensions appropriately adjusted.



Telecom Room Plan Example

B. Location and Adjacencies

Telecommunications Rooms should be centrally located on the floor plate.

Telecommunications Rooms should be located such that there are no areas of telecom service beyond a circle area with a diameter of approximately 165 feet centered in the Telecommunications Room. In other words, every telecom outlet should fall within that 165' radius circle.

In multi-storey Buildings, Telecommunications Rooms should be vertically adjacent / stacked floor-to-floor. This will improve long-term management and will result in lower construction costs for backbone pathways and backbone cabling.

C. Construction

Walls should be typical metal-stud framed walls. However, wall construction will depend on Building design.

Walls are not required to be fire rated.

Walls shall be full height – to the structure above.

D. Door

Swing: The door should swing outward to maximize the usable area within the room, though egress codes may dictate an inward swing (for example, if the Telecommunications Room were to be located on a main egress corridor). If the door swings into the room, the door shall swing into the clearance space.

Size: The door shall be 36" wide by 84" tall, minimum.

E. Finishes

1. Floors

Floors shall be either sealed concrete or the same resilient floor product that is being installed in the contiguous public floor areas.

2. Walls

Concrete and/or CMU walls shall be sealed prior to receiving plywood backboard.

Walls shall receive one layer ¾-inch plywood as backboard. The plywood shall be fire treated, in accordance with ASTM E 84.

The plywood shall be installed starting at 6-inches above the floor up to 8'-6", minimum.

The fasteners shall be designed per instance, and will depend on the substrate (wall type) and project requirements. The suggested installation shall be five equally-spaced fasteners installed vertically on both sides and in the middle of each plywood sheet. For framed walls, install the fasteners into the studs and/or preinstalled backing plate.

The plywood shall be painted a bright color (such as white, to improve lighting/illumination) with two coats of a semi-gloss paint. Mask fire rating stamp prior to painting.

3. Ceilings

The ceilings shall be left open. That is, no ceiling is required.

F. Accessibility / ADA Compliance

Though building codes may vary as well as the enforcement of those codes, Telecommunications Rooms contain equipment non-compliant to ADA accessibility requirements. For example, the equipment racks will contain equipment at about 90" that needs to be accessed.

That said, this document loosely recommends that no ADA accessibility design aspects be applied to Telecommunications Rooms unless required by code.

2.2 Telecommunication Rooms – Renovation

For the most part, renovation projects shall come as close to new construction requirements as possible. While acknowledging that Telecommunications Rooms often get "shoe-horned" into a space on the floor plan (usually a space that can't be used for anything else), the lack of plentiful space for Telecommunications Rooms does not lessen the clearance requirements or make the equipment smaller.

A. Sizes

The size of the room may or may not be confined by existing conditions. If the size is not confined by existing walls, then refer to "Telecommunication Rooms – New Construction" \ "Sizes" previously. The same sizing guidelines apply to renovation as well.

B. Critical Dimensions

Refer to "Telecommunication Rooms – New Construction" previously. The same critical dimensions apply to renovation as well.

C. Location and Adjacencies

Where possible, Telecommunications Rooms should be centrally located on the floor plate and should be vertically adjacent / stacked.

D. Construction

Where new walls are constructed, walls should be typical metal-stud framed walls.

Walls shall be full height – to the structure above.

E. Door

Refer to "Telecommunication Rooms – New Construction" previously. The same door requirements apply to renovation as well.

F. Finishes

Refer to "Telecommunication Rooms – New Construction" previously. The same finishes requirements apply to renovation as well.

3.0 STRUCTURAL

3.1 New Construction

A. Floor Loading, at Telecommunications Rooms

Floor loading at Telecommunications Rooms shall be 50 pounds per square-foot, minimum.

B. Seismic Bracing of Equipment Racks, in Telecommunications Rooms

Equipment racks, possibly both floor-mounted and wall-mounted, will be installed into Telecommunications Rooms.

For design-bid-build projects, the Design Team's Structural Engineer shall be responsible to confirm the seismic bracing design (including structural calculations and details as required by the Project), and shall provide recommendations as necessary.

For design-build projects, the Construction Team's Structural Engineer shall be responsible to design the seismic bracing for the equipment racks.

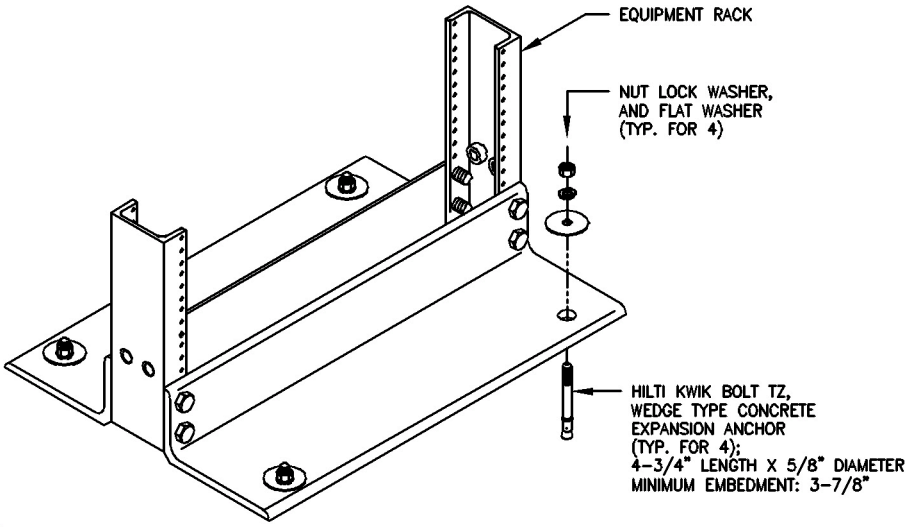
3.2 Renovation Construction

A. Floor Loading, at Telecommunications Rooms

The floor load capacity will be dependent upon existing conditions. The floor loading should be 50 pounds per square-foot, minimum. If the Structural Engineer has determined the floor system has a capacity lower than this requirement, then the Structural Engineer must notify ITS (either directly or through the Design Team lead).

B. Floor Anchoring for Equipment Racks

Floor-standing equipment racks and cabinets shall be anchored to the structural floor via devices pre-approved by DSA. Examples of such devices include Hilti Kwik-Bolt 3.



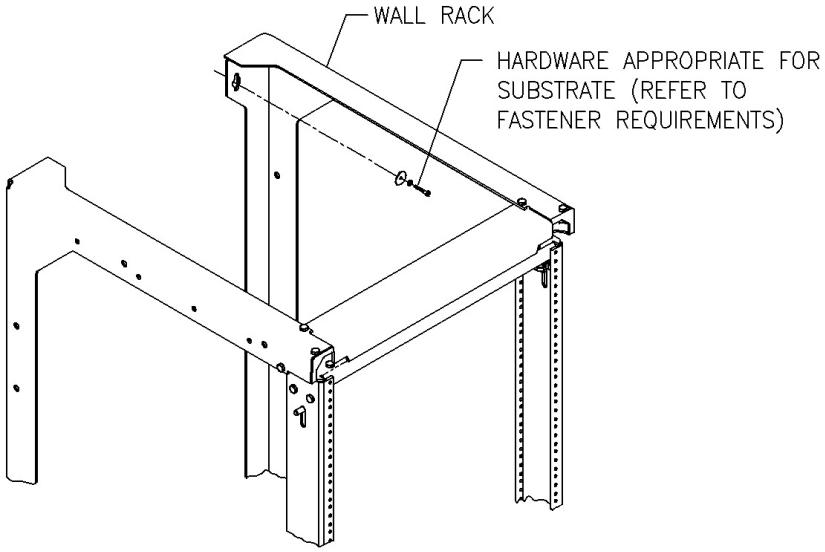
Rack Base Anchor Example

The structural engineer shall determine the applicability of the anchoring device set in the floor system, including minimum embedment depth.

C. Wall Anchoring for Equipment Racks and Cabinets

Wall-mounted equipment racks and cabinets shall be anchored to the wall via fasteners pre-approved by DSA. Examples of such fasteners include woods screws into plywood backboard and expansion anchors into concrete wall.

The structural engineer shall determine the applicability of the fasteners depending upon the mounting substrate, including minimum embedment depth.



Wall Rack Mount Example

D. Fasteners

The following chart is a guide to the fasteners generally approved for mounting backboards, equipment , . . etc.

Wall Type	**Fastener Required**
Concrete Wall	TAPCON, 3/16" x 1¼" with 1" min embedment
CMU Wall	TAPCON, 3/16" x 1¼" with 1" min embedment
Metal Stud Framed Wall, 1 Layer Gypsum	Into metal stud: no. 8 x 2" self-tapping metal screw for metal studs
	Into gypsum wallboard: Toggler toggle bolt BA (3/16" x 24)
Wood Stud Framed Wall, 1 layer Drywall	Into wood stud: no. 8 x 2" wood screw
	Into gypsum wallboard: Toggler toggle bolt BA (3/16" x 24)
Plaster Wall	Toggler toggle bolt BA (3/16" x 24)
Plywood Backboard	no. 8 x 2" wood screw

Approved Fasteners Chart

4.0 PLUMBING

4.1 Piping Coordination through Telecommunications Rooms

Piping and plumbing unrelated to telecom (other than what is required to support the room such as chilled water supply/return) shall not be routed through Telecommunications Rooms and/or on the floor above and directly over Telecommunications Rooms.

If any piping must be routed through a Telecommunications Room, the design must be carefully coordinated with the Design Team lead, the Telecom Engineer, and ITS. This will involve alternate designs to the room and containment design for the piping. The Plumbing Engineer shall obtain acceptance in writing by ITS and District to route piping through a Telecommunications Room.

5.0 MECHANICAL

5.1 Telecommunication Rooms

A. General

In general, each Telecommunications Room will require environmental control. Given that electronic equipment, which rejects heat, will be deployed within these rooms, control implies cooling.

The design for environmental control per instance will depend on the rooms' heat load and the building's infrastructure. There may be instances where the load is low enough to allow simple ventilation to cool the room while most instances will require a dedicated system.

Each room's cooling design must be accepted in writing by ITS and District.

B. Preferred Cooling Solutions:

If the building has a chilled water loop, the preferred solution is a fan coil unit connected to the chilled water loop.

If the building does not have a chilled water loop, the preferred solution is a dedicated split system.

If the rooms' heat load is low enough (under 1,500–2,000 BTU/hour) and the building does not have a chilled water loop and the Building has general air conditioning, the room could be cooled via ventilation (air changes). Though a dedicated cooling system is preferred, project budgets must be considered.

C. Environmental Control Requirements

Mechanical equipment within Telecommunications Rooms shall be controlled and monitored by SMCCCD's Building Management System. Refer to Section 25 55 00 Building Management System design standard.

The temperature in Telecommunications Rooms shall be controlled between 65 and 85 degrees Fahrenheit.

D. Loads

The load will be determined per instance.

The recommended load, in lieu of no specific criteria, is 40 watts per square foot. The Mechanical Engineer can assume 12,000 BTU/hour per room or applying a 1-ton unit.

The temperature in Telecommunications Rooms shall be maintained between 65 and 85 degrees Fahrenheit, and shall cause a system alarm on the BMS when it goes outside of those parameters.

E. Air Changes

Telecommunications Rooms require one air change per hour, minimum.

F. Spatial Coordination

The Telecommunications Rooms' equipment layout will be based on a standardized design approach. The mechanical design and mechanical equipment layout shall follow the telecom/datacom equipment layout. In general, locate the cooling unit in front of the rack bay.

The Mechanical Engineer shall be responsible for coordination of the final locations of mechanical systems and equipment with the Telecom Engineer and ITS, as well as through the Design Team.

G. Installation

The cooling unit (for example, fan coil unit) shall be installed either hung from the structure above or high on the wall. Coordinate the location of the condensate pump to avoid conflict with telecommunications/datacom equipment.

The location of the cooling unit shall be coordinated with the equipment plan as not to have wet components above the equipment racks or other equipment that could be damaged by leaks. The piping to the cooling units shall be routed as not to pass over the rack bay and the equipment clearance of the rack bay. Piping connections shall not be installed over where equipment may be installed.

Ducting unrelated to the Telecommunications Room shall not be routed through Telecommunications Rooms.

6.0 ELECTRICAL

6.1 Grounding for Telecommunications/Datacom

A. Telecommunications Grounding Backbone

A grounding backbone is required for each building with a ground terminal presented in each Telecommunications Room.

The Telecommunications Grounding Backbone shall be designed in compliance with ANSI-J-STD-607-A.

1. Bonding Conductor for Telecommunications (BCT)

   A BCT is required from the TMGB to the main building ground reference. The conductor shall be insulated, green. Size the conductor as 1,000 circular-mils per foot up to 3/0 AWG.

2. Telecommunications Main Grounding Busbar (TMGB)

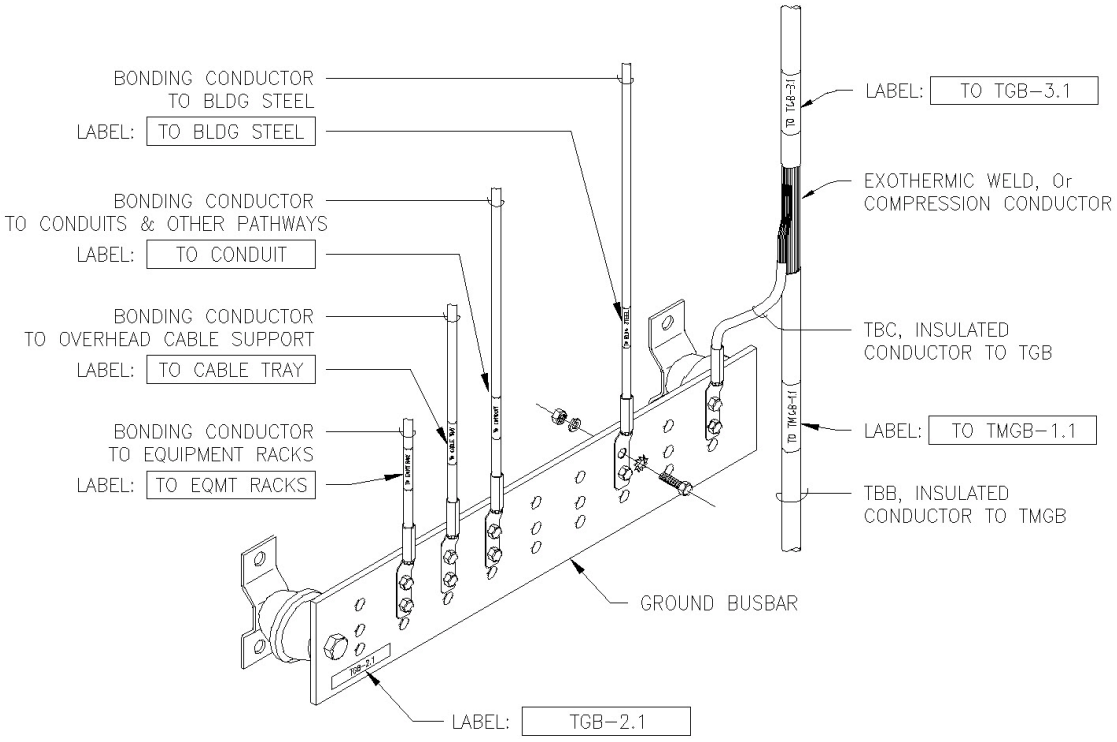
   A TMGB is required in the Service Entrance and Termination Room / MDF. Refer to ANSI-J-STD-607-A for busbar size and requirements. The Electrical Designer shall coordinate the busbar location with ITS (location will depend on equipment layout).

3. Telecommunications Bonding Backbone (TBB) Conductor

   A TBB is required from the TMGB to each TGB. The conductor shall be insulated, green. Size the conductor as 1,000 circular-mils per foot up to 3/0 AWG.

4. Telecommunications Grounding Busbar (TGB)

   A TGB is required in the Equipment Room / MDF or IDF, and in each per-floor Telecommunications Room / IDF. Refer to ANSI-J-STD-607-A for busbar size and requirements. The Electrical Designer shall coordinate the busbar location with ITS (location will depend on equipment layout).



Grounding Busbar Example

B. Telecommunications Bonding to Grounding Backbone

Metallic components, such as pathways (conduit), overhead cable support, rack bays, etc., within a Telecommunications Room shall be bonded to the respective TGB.

6.2 Electrical Service in Telecommunication Rooms

A. Convenience Outlets

Convenience outlets shall be 120V. Convenience outlets shall be circuited from a normal power panel.

On walls adjacent to the rack bay (where the rack bay butts up against the wall), provide one quadplex outlet approximately 12 inches in front of the rack bay and one quadplex outlet approximately 30 inches behind the rack bay.

On the other walls, provide two quadplex outlets per wall up to 15 feet. On walls longer than 15 feet, provide two duplex outlets.

B. Rack Bay Service

The rack bay will receive power from a UPS system and power strips (*see next item*).

C. UPS Service

A dedicated electrical outlet shall be provided for the UPS system. The service shall consist of one 120V 20A circuit to an L5-30R receptacle and one 120V 30A circuit to an L5-30R receptacle located behind the rack bay in close proximity to the intended location of the UPS system. Both branch circuits' wiring shall be 10 AWG. The Telecom Designer and Electrical Designer shall coordinate the electrical service with the equipment layout. Confirm design draft with ITS prior to finalizing.

The UPS system with the power strips for rack service will be provided by ITS.

D. Security System (ACAMS) Service

Coordinate the service requirements with the Security Designer, as the security/ACAMS system will require a dedicated 120V 20A circuit with special termination requirements.

E. Lighting

Lighting shall be overhead both in front of and behind the rack bay. Lighting should be dual-lamp fluorescent type, lens not required.

Luminance shall be 50 foot-candles measured horizontally at 3 feet above finished floor, minimum.

6.3 Pathways Coordination

Pathways can be shown on either electrical or telecom drawings. If shown on electrical drawings (for example, surface raceway), the Electrical Engineer and Telecom Engineer shall carefully coordinate the pathway requirements to avoid missed and/or duplicated requirements, and to ensure component compatibility.

Also refer to the sections "OSP Underground Pathways" and "Building Pathways" following. These sections give requirements relative to the electrical pathways (joint trench, conduit types, etc).

7.0 SECURITY

Refer to SMCCCD "Physical Access Controls Design Standard" for additional information.

7.1 Access Control for Telecommunication Rooms

Telecommunications Rooms require access control. Access control shall be electronic / a card reader. Only if a card reader is not possible, access control shall be mechanical / dedicated key-type for ITS rooms.

The design will depend on construction type (new or renovation) and the room locations within the building (shared with another function such as in a mechanical room).

7.2 Security Equipment, within Telecommunication Rooms

The Telecom Designer and the Security Designer shall coordinate the equipment layout / wall elevation within the Telecommunications Room with ITS and the Electrical Engineer.

Refer to article 2.1 for a room layout example indicating security equipment coordination within Telecom Room.

8.0 TELECOMMUNICATIONS / DATACOM

8.1 Outside Plant Underground Pathways

A. Conduit Types

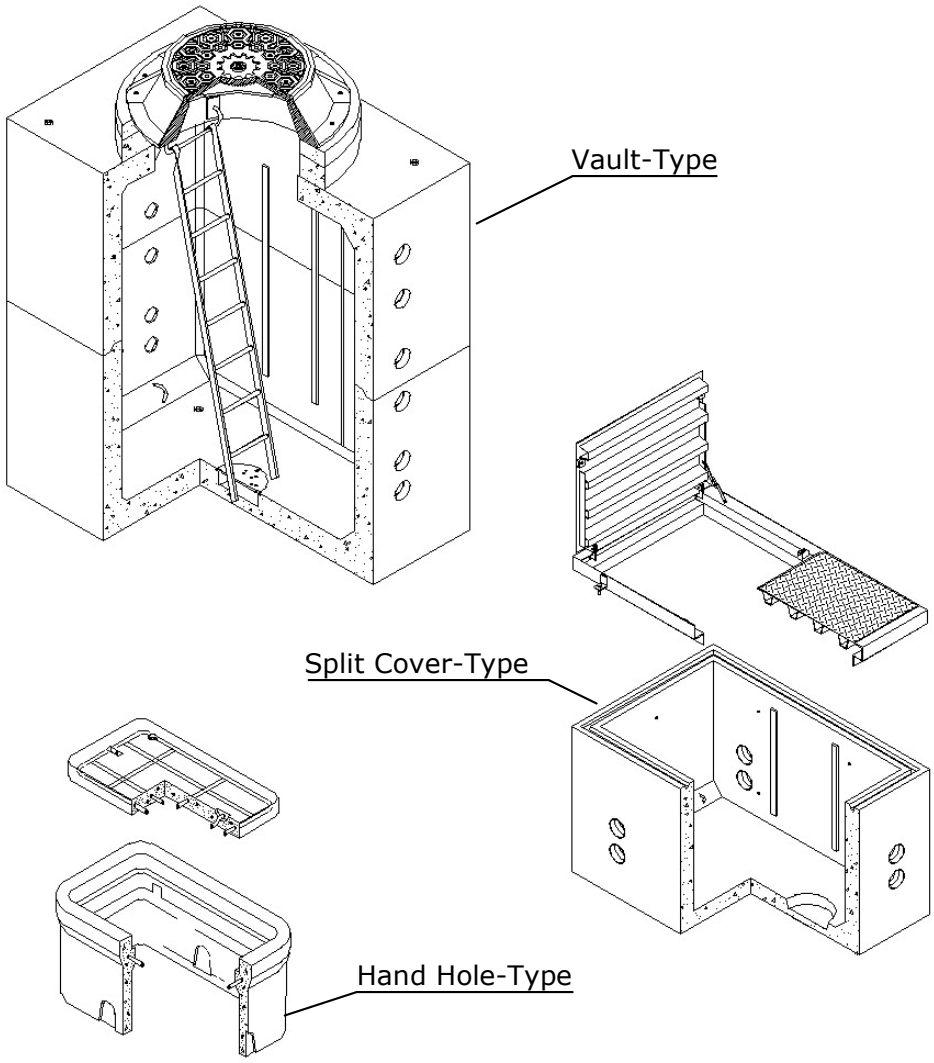
The following conduit types will be accepted for the different circumstances:

Circumstance	Acceptable Conduit Types
Straight Sections, no vehicular traffic	• Non-Metallic Schedule 40 PVC, concrete encasement not required • Non-Metallic Schedule 80 PVC, concrete encasement not required • Galvanized Rigid Steel / GRS
Straight Sections, under vehicular traffic	• Non-Metallic Schedule 40 PVC, with concrete encasement • Non-Metallic Schedule 80 PVC, with concrete encasement • Galvanized Rigid Steel / GRS
Sweeping Bends	• Non-Metallic Schedule 40 PVC, with concrete encasement • Non-Metallic Schedule 80 PVC, concrete encasement suggested • Galvanized Rigid Steel / GRS
Factory Bends/Elbows	• Non-Metallic Schedule 40 PVC, with concrete encasement • Non-Metallic Schedule 80 PVC, with concrete encasement • Galvanized Rigid Steel / GRS, with concrete encasement
Building Entrance	• Galvanized Rigid Steel / GRS, with concrete encasement

B. Maintenance Hole Types

The maintenance holes shall have the following features:

1. Vault-type maintenance holes/pull boxes:
   a) Minimum size (interior clearances) shall be 48-inches wide by 84-inches deep by 60-inches long
   b) Equipped with pipe connection to a storm drain that is gravity drained and has a back-flow valve
   c) Equipped with a sump, corrosion-resistance pulling irons, corrosion-resistance cable racks, and grounding.
2. Split cover-type maintenance holes/pull boxes:
   a) Minimum size shall be 36-inches wide by 48-inches deep by 60-inches long.
   b) Equipped with pipe connection to a storm drain that is gravity drained and has a back-flow valve
   c) Equipped with a sump, corrosion-resistance pulling irons, corrosion-resistance cable racks, and grounding.
3. Hand hole-type pull boxes:
   a) Minimum size should be 17-inches wide by 12-inches deep by 30-inches long, installed with a 12-inch deep (minimum) gravel base for drainage.



Maintenance Holes Examples

C. Pathway Service Per Building

Each building shall receive two 4-inch trade size conduits, minimum, from the campus' telecommunications underground pathways infrastructure.

Within 15 feet of the point where the conduit enters the building, the conduit type shall be GRS. Non-metallic / PVC conduit will not be accepted.

D. Installation

The minimum burial depth for conduits shall be 36 inches.

Duct banks shall not contain more than two 90-degree bends between pull points, and should exceed 300 feet between pull points.

At buildings, install the conduit sloping toward away from the building with no less than 0.125 inches per linear foot of slope

Between maintenance holes, install the conduit sloping towards maintenance holes with no less than 0.125 inches per linear foot of slope.

Datacom conduits shall be separated from other underground structures as follows:

Structure	**Separation**
Power, concrete-encased	3 inches
Power, buried	12 inches
Power, on poles	Separate poles if possible; if not possible, 90 degrees, minimum

Conduits shall be bonded to the grounding backbone within the telecommunications rooms.

E. Subduct (and Innerduct)

At least one of the service conduits shall contain fabric subduct (Maxcell).

Alternatively, four 1-inch trade size innerducts. Each innerduct shall be uniquely colored.

8.2 Telecommunication Rooms

A. Telecom Room Types

The following descriptions summarize the typical telecom room types ITS utilizes, along with the room's associated functions.

1. Service Entrance and Termination Room (MDF)

   This is the main telecommunications building service entrance. It is the area where the demarcation between the interbuilding and intrabuilding cabling systems is effected. This securable room is to be dedicated to this purpose with no other building services sharing the space wherever possible.

2. Equipment Room (MDF/IDF)

   This space provides for the demarcation between inter-building and intra-building telecommunications service. This area contains the electronic equipment that transitions between the core campus data, voice and video backbones and the building backbone. This securable room is to be dedicated to this purpose with no other building services sharing the space wherever possible. This space may be co-located with the Service Entrance and Termination Room, provided the room is sized for both functions.

3. Telecommunications Room (IDF), Per-Floor

   This room provides for demarcation between the per-floor horizontal customer service cabling and the building data and voice backbone cabling. Additionally this room contains the electronic equipment that transitions between the data and voice building backbone and the end user telecommunications equipment. This securable room is to be dedicated to this purpose with no other building services sharing the space wherever possible. This space may be co-located with the Service Entrance and Termination Room and/or Equipment Room provided the room is sized for both functions.

8.3 Building Pathways

A. Backbone Pathways

The backbone pathways, namely the conduits from the MDF to each IDF, will be designed per Project. As a default, each Telecommunications Room / IDF shall receive two 4-inch trade size conduits, minimum, from the MDF. Truncate conduits 2" into the rooms.

Conduits shall not contain more than two 90-degree bends between pull points, and should not exceed 300 feet between pull points. Pullboxes shall be readily accessible (for example, in a corridor versus a classroom). Pull boxes shall be straight through and shall not be used for turns. Bends for conduits 3-inch and larger shall be factory fittings.

The backbone pathways may also be shared with the Horizontal Primary Pathway – for example, cable basket throughout the building.

At no time may backbone cables lay directly on suspended ceilings and/or be clipped to suspended ceiling support wires.

B. Horizontal Pathways

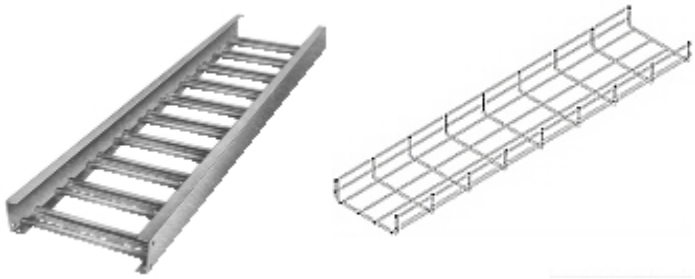
The horizontal pathways shall be defined as those pathway components that support horizontal cabling. These pathways are generally limited to a single floor from a Telecommunications Room or riser system.

Conduits shall not contain more than two 90-degree bends between pull points. Pullboxes shall be readily accessible (for example, in a corridor versus a classroom). Pull boxes shall be straight through and shall not be used for turns. Conduits shall have continuous pull strings end-to-end.

Primary pathways should be located in easily-accessible non-user spaces, such as over corridor ceilings. This will minimize disruption to user spaces during future cable adds/changes.

At no time may horizontal cables lay directly on suspended ceilings and/or be clipped to suspended ceiling support wires.

1. Primary Pathways: The primary horizontal pathways shall be defined as those directly from a Telecommunications Room serving a section (a wing or side) of the building or an entire floor. The primary pathway components can be cable basket or cable tray.

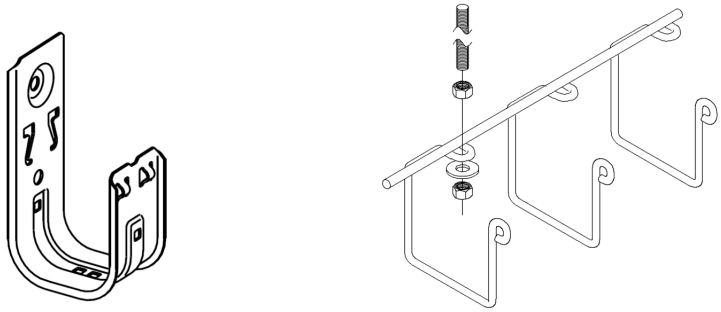


Cable Tray Cable Basket

Images of Typical Primary Pathways

Note: "Secondary pathways" may be used as primary pathways when the total cable counts are low enough to allow a lower capacity system. Lower cable counts are approximately 50-100 cables, maximum, throughout an IDF's service area.

2. Secondary Pathways: The secondary horizontal pathways shall be defined as those from the primary pathways serving an area of a section or to specific devices. The secondary pathway components can be cable hangers or, as an alternative, "Snake Tray".



Cable Hanger "SnakeTray Series 201"

Images of Typical Secondary Pathways

C. Device Pathways

The device pathways shall be defined as the pathway supporting a single compliment of cabling to a single device within a User Space.

For all installation configurations requiring a conduit stub, the conduit shall be 1-inch trade size, minimum. Stubs shall be continued to the first accessible location.

For all installation configurations requiring a device box, the box shall be 4-11/16" square or 4" square, and shall be deep (2-1/8" min).

The following descriptions shall be used to plan the configuration of telecom devices throughout the Building. These descriptions are for planning purposes and the exact configuration shall be finalized per instance.

1. Framed Wall, for both New Construction and Renovation:

   The device pathway at framed walls shall be conduit stub from an accessible space (such as acoustical tile ceiling) to a device box within the wall interstitial.

   The device box should be installed at +18 inches for typical outlets or as coordinated by the Architect.

2. Concrete Wall, for New Construction:

   The device pathway at concrete walls should be buried (cast within the forms) into the wall.

3. Concrete Wall, for Renovation:

   The device pathway at concrete walls shall be either conduit surface-mounted to a device box surface-mounted, or surface raceway to a device box surface-mounted.

4. CMU Wall, for both New Construction and Renovation:

   The device pathway at CMU walls shall be either conduit surface-mounted to a device box surface-mounted, or shall be surface raceway to a device box surface-mounted.

5. Floor Devices, for both New Construction and Renovation:

   The device pathway for in-floor type instances shall be buried (cast within the forms) into the floor.

   For poke-thru type instances, no special device pathway is required as the cables will be routed within standard building pathways on the floor below to the poke-thru device.

6. In-Ceiling Devices, for both New Construction and Renovation:

   The device pathway for in-ceiling devices shall be a device box installed either on the structure above or onto a channel at an accessible height above an accessible ceiling.

   The cables will be routed within standard building pathways to the device box.

7. Pathways within Classroom for AV

   Refer to Instructional Technologies section for requirements on pathways.

8.4 Backbone Fiber Optic Cabling

A. Cabling Deployment

New buildings shall receive new interbuilding backbone fiber optic cabling and new interbuilding backbone twisted pair cabling from the campus main communications room.

1. New Buildings

New buildings shall receive new campus backbone fiber optic cabling and new campus backbone twisted pair cabling from the campus' main communications room.

2. Renovated Buildings

If the building to be renovated does not have singlemode fiber service from the MPOE, the building shall receive new campus backbone fiber optic cabling from the campus' main communications room.

If the building to be renovated does not have twisted pair service from the MPOE, the building shall receive new campus backbone twisted pair cabling from the campus' main communications room.

B. Outdoor Backbone Fiber Optic Cable Type

Backbone fiber optic cables installed outdoors shall be loose buffered.

For installation within innerduct, backbone fiber optic cables shall have a sheath consisting of a polyethylene jacket over the inner cable components (buffer(s), strength element, and other components). The cable shall be dielectric.

For installation without innerduct, backbone fiber optic cables shall have a sheath consisting of a polyethylene outer jacket, an armor (corrugated metallic tape), and should have an inner jacket, all over the inner cable components (buffer(s), strength element, and other components).

ITS prefers dielectric cable and innerduct over no innerduct and armored cable, where possible. A dielectric cable is easier to work with, is electrically non-conductive (won't conduct transient voltages), and including an innerduct allows easier cable demolition and replacement (if necessary).

The Designer shall confirm with ITS prior to finalizing the design.

C. Indoor Backbone Fiber Optic Cable Types

Backbone fiber optic cables installed indoors shall meet the rating required by the authority having jurisdiction.

Backbone fiber optic cables installed indoors shall be tight buffered.

Backbone fiber optic cables installed indoors should have a sheath consisting of an integral strength element with a thermoplastic outer jacket over the inner cable components (buffered fibers, strength element, and other components).

D. Fiber Types

New multimode fiber not joined with existing multimode fiber shall be 50/125μm laser-grade, with a minimum bandwidth of 500/1000 MHz-km at 850/1300 nm.

New multimode fiber joined (connector or splice) with existing multimode fiber shall match the physical and optical properties of the existing fiber grade.

New singlemode fibers shall be 8.3/125μm, with a maximum dispersion of 3.5 ps/nm•km at 1285-1330 nm, and a cutoff wavelength of 1260 nm.

E. Cable Capacity / Conductor Count

1. Campus Backbone Fiber Optic Cabling

Campus backbone fiber optic cabling links shall contain 24 singlemode strands. Confirm the strand counts with ITS.

2. Intrabuilding Backbone Fiber Optic Cabling

Intrabuilding backbone fiber optic cabling links shall contain 12 multimode strands. Confirm the strand counts with ITS.

F. Splicing

Where fiber splicing is explicitly stated in writing, the splicing shall be fusion. No mechanical splicing will be accepted.

G. Termination

1. Connectors

Multimode fibers shall be terminated via multimode SC connectors. SC connectors shall be 568SC type, and shall meet all requirements of TIA/EIA-568-B.3, section 5.0 including references. The connector housing and the boot shall be aqua in color.

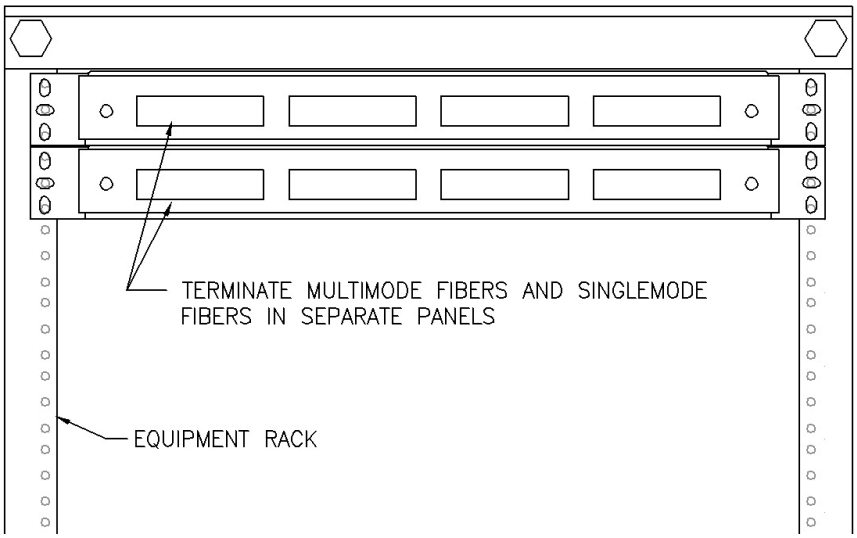
Singlemode fibers shall be terminated via singlemode SC connectors. SC connectors shall be 568SC type, and shall meet all requirements of TIA/EIA-568-B.3, section 5.0 including references. The connector housing and the boot shall be blue in color.

If existing multimode 62.5/125μm fiber is to be reterminated (for example, after a relocation), these fibers shall be terminated via multimode ST connectors.

2. Patch Panel

The patch panels shall be rack-mount type and shall be installed into an equipment rack, preferably in the top RMU. Coordinate the final location with ITS.

Provide one patch panel for multimode termination and one patch panel for singlemode termination – as applicable.



Fiber Optic Cabling Termination Layout Example

3. Adapters

   Adapters within the patch panels shall meet all requirements of TIA/EIA-568-B.3, section 5.0 including references.

   Multimode 50/125 adapter housing shall be aqua in color and shall be duplex.

   Singlemode adapter housing shall be blue in color and shall be simplex.

H. Backbone Fiber Optic Cabling Testing

   Each fiber strand requires testing. The testing shall be bi-directional characterization testing (via OTDR) and passive link insertion loss test (via light source and power meter).

   Prior to 'production' field testing, the Designer, with the Installer and a local representative of the equipment manufacturer, shall observe the testing methods. The purpose for this is to approve the methods prior to completing testing activities only to have a flawed method yielding non-reliable test results.

8.5 Backbone Twisted Pair Cabling

A. OSP Backbone Twisted Pair Cable Type

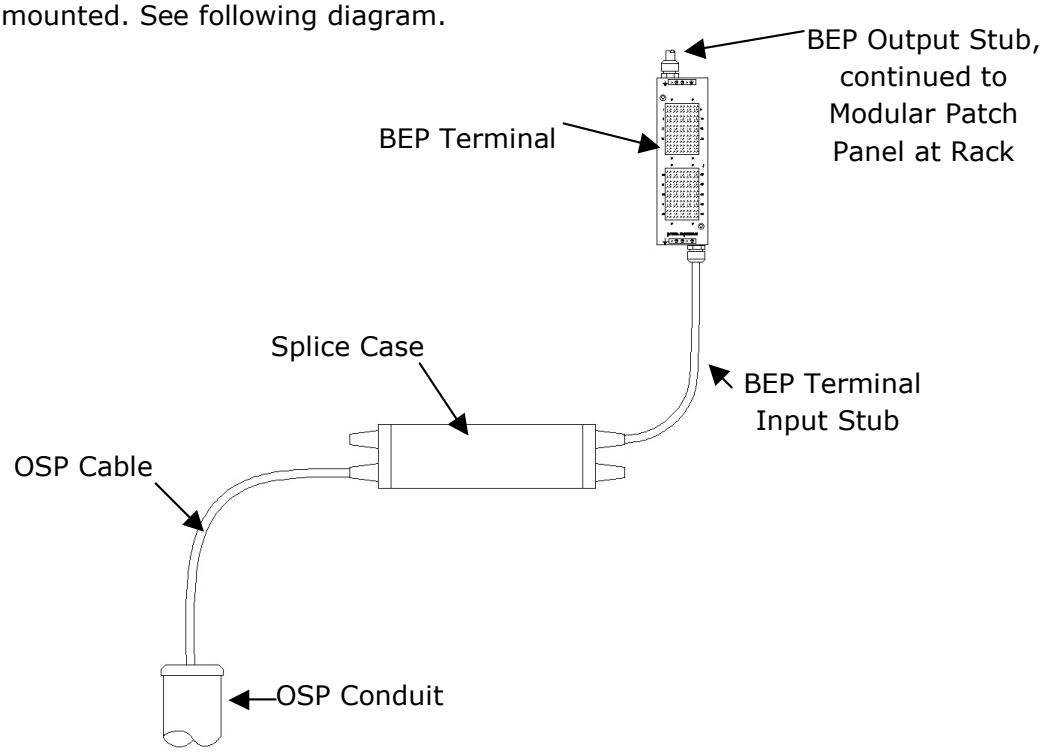
   Backbone twisted pair cables installed outdoors shall be gel-filled and should be ANMW type, with an ASP sheath.

B. OSP Backbone Twisted Pair Cable Capacity / Conductor Count

   OSP backbone twisted pair cabling links should contain either 50 pairs or 100 pairs. Confirm conductor count with ITS per Project

C. OSP Backbone Twisted Pair Cabling Entrance Termination

Backbone twisted pair cabling links entering from underground from the Campus shall be spliced to building entrance protection terminals, wall-mounted. See following diagram.



Backbone OSP Twisted Pair Cable Termination Example

D. Indoor Backbone Twisted Pair Cable Types

Backbone twisted pair cables installed indoors shall meet the rating required by the authority having jurisdiction.

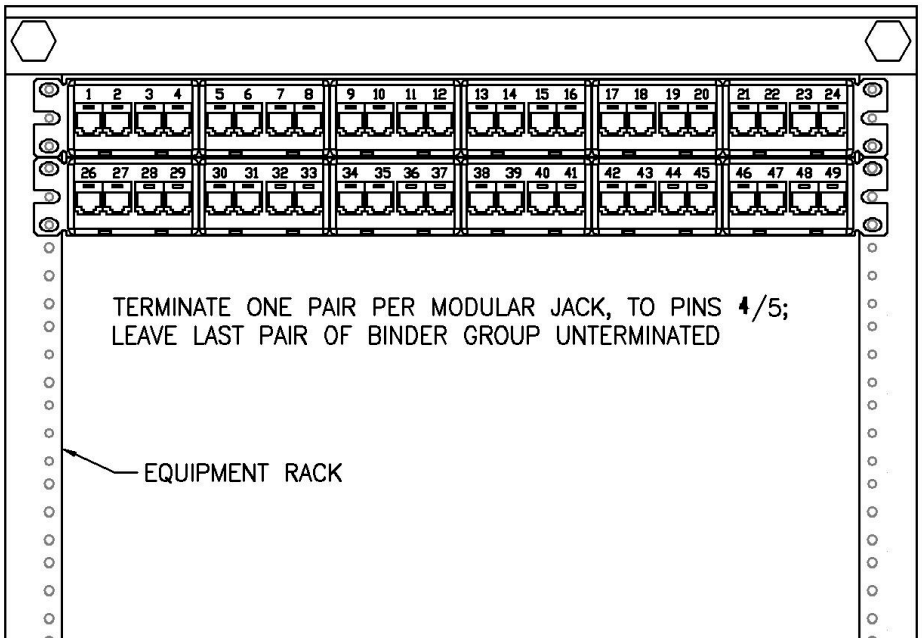
Backbone twisted pair cables installed indoors should ARMM type.

E. Indoor Backbone Twisted Pair Cable Capacity / Conductor Count

Indoor backbone twisted pair cabling links should contain either 25 pairs or 50 pairs to each IDF. Confirm conductor count with ITS per Project

F. Backbone Twisted Pair Cabling Termination

Backbone twisted pair cabling links, including output stubs from BEP terminals (see prior paragraph), shall be terminated to modular patch panels on an equipment rack. Refer to Horizontal Cabling for modular patch panel specifications. The following diagram depicts the intent for the backbone twisted pair cable termination.



Backbone Twisted Pair Cable Rack-Mount Termination Example

G. Backbone Twisted Pair Cabling Testing

Backbone twisted pair cabling links shall have 100% of the pairs tested for wire map and one pair from each 25-pair binder group tested for length.

8.6 Horizontal Cabling

A. Horizontal Cable Type

Horizontal cables shall meet the rating required by the authority having jurisdiction. Assume that all cables shall be CMP (plenum) rated.

Horizontal cables shall be unshielded twisted pair type, with four twisted pairs, and should have a CMP rated sheath.

B. Link Performance

Link performance shall be Category 6.

C. Telecommunications Room Termination

In the Telecommunications Rooms, cables shall be terminated via modular jacks in a rack-mounted modular patch panel. Also refer to "Modular Jacks" following.

Modular patch panels shall be discrete port type (snap-in modular connectors). Coordinate layout of patch panels in rack through ITS.

D. Workstation Termination

At the workstations, cables shall be terminated via modular jacks – refer to "Modular Jacks" following.

Also refer to "Building Pathways" \ "Device Pathways" for additional outlet configuration information.

E. Modular Jacks

Modular jacks shall be 8-position 8-conductor type connectors, compliant with T568B wiring.

F. Service, Per Work Area

A "link" shall consist of a single cable, termination in the datacom room and termination at the work area. Termination in the datacom room shall consist of one port on a patch panel. Termination at the work area shall consist of one modular jack (one per cable) into a faceplate within appropriate device pathways.

- A "standard device" shall consist of three links, minimum, to a single device.
- A "classroom device" shall consist of two links, minimum, to a single device.
- A "wallphone device" shall consist of one link to a single device. The faceplate shall be an "860" type with 2 mounting studs

The maximum quantity of links per device shall be four. If the service requirement at any instance is greater than four, then specify multiple devices to meet this requirement.

1. Fixed Office: Fixed offices shall receive at least two standard devices, generally on opposing walls. If the fixed office is large enough and intended to support multiple workstations, add one standard device per additional workstation.
2. Open Office: Generally, open offices shall receive one standard device per workstation.
3. Conference Rooms: Conference rooms shall receive at least two standard devices, generally on opposing walls. If the conference rooms have video projection or are intended to support multiple workstations, add one class room device in the ceiling to support the projector and one standard device per workstation.
4. Classroom: Generally, classrooms shall receive three classroom devices – one at the front of the room, one at the back of the room, and one in the ceiling (for projector). Classrooms shall also receive one wallphone device, located adjacent to the door.

5. Computer Lab: Computer labs shall receive one link per computer station and printer (assume one printer per six computers).
6. WLAN Access Point: Access points shall receive two links. The deployment shall be determined per project as the coverage area is building-specific (*refer to Wireless LAN Service article following*). Also, the installation shall vary per instance (wall mount, ceiling mount, . . etc.).
7. Telecom Room (TD): Telecom Rooms shall receive one wallphone device, located adjacent to the door.
8. Elevator: Elevators shall receive one link to the elevator control panel.
9. Copy Machine: Copy machines shall receive two links, wall-mounted behind the equipment.
10. Yamas UNC: Yamas UNCs (building management system control panel) shall receive two links, located within 5 feet of the panel.
11. ACAMS Panel: ACAMS (access control and monitoring system) control panels shall receive two links, located within the panel.

8.7 Administration / Labeling

A. General

Labels, tags, and straps shall be high quality that will endure over the life of the cable plant. Hand written labels are not acceptable.

Cable labels shall be self-laminating. Cable labels shall be provided at both ends of the cable and installed on the cable jacket within ten inches of the termination ends

B. Identifier Assignment

Apply the following criteria to assign identifiers to the components of the telecommunications infrastructure.

1. Telecom Rooms

   Assign identifiers to each telecom room using sequential letters prefixed with "TD" – for example, "TDA", "TDB", TDC", . .

   Formally, the telecom room identifier shall be prefixed with the building number – for example: "B05-TDB".

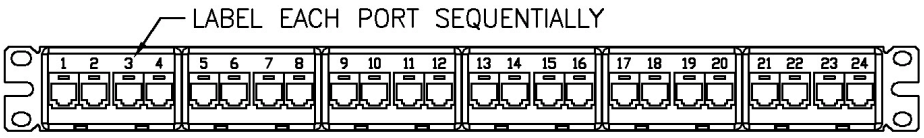
2. Cables

   Assign identifiers to each cable from a given telecom room using numbers starting with "1".

   Formally, the cable identifier shall be prefixed with the telecom room number – for example: "TDA-22".

C. Patch Panel Labeling

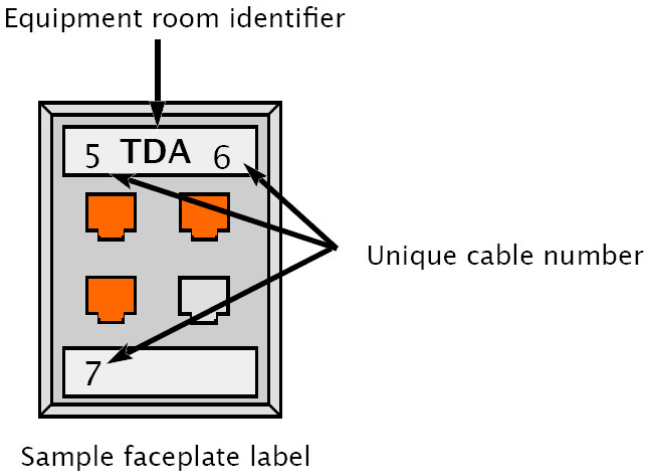
Each used port of a modular patch panel shall be labeled with the cable number. Example:



Modular Patch Panel Labeling Example

D. Outlet Labeling

Each faceplate shall be labeled with the serving telecom room number. Each used port of a faceplate shall be labeled with the cable number. Example:



Outlet Labeling Example

9.0 WIRELESS LAN SERVICE

9.1 General Information

ITS has established Cisco Aironet model 1200 access points as the exclusive standard for wireless networks throughout the District.

Representatives from ITS and the Facilities have conducted "walk-throughs" for all of the existing buildings at the three Colleges and have identified the correct placement and number of wireless access points required to provide complete wireless network coverage for each building. These marked-up floor plans can be obtained from ITS. Refer to these plans when laying out the access point locations in existing buildings and as guidelines for installation of wireless networks in new buildings.

All plans of access point locations **MUST** be approved by ITS before the plans are issued for bid.

9.2 Access Points

A. Enclosures

The use of ceiling-mount enclosures should be the first choice whenever the building has suspended (dropped) ceilings. Wall-mount enclosures should only be used as a second choice only when there is an open ceiling design or when the ceiling is too high to be reached safely (for example, Gymnasiums, Theater Stage, etc.).

B. Placement Guidelines

All plans for placement of wireless access point enclosures **MUST** be approved by ITS before the plans are submitted for bid.

Access points should be installed on each floor of the building.

Generally, maximum access point spacing should be 50' – 70'.

In areas that are less than 3500 square feet, a single access point may be required. When possible, the access point should be placed at the center point of the area.

In areas that are open and not subdivided:

1. Where the longest wall is < 125', locate an access point at the center point of each of the shortest walls.
2. Where the longest wall is > 125 and there is a suspended ceiling, locate an access point at the center point of each of the shortest walls, and at the center of the area.
3. Where the longest wall is > 125' and there is **not** a suspended ceiling, locate an access point at the mid-point of each of wall.

In standard rectangular buildings or areas with a center hallway and where the hallway walls are mainly sheet rock and not poured concrete:

4. Access points should be placed down the center of the hall
5. The first access point at each end of the hall should be placed no more then 25' from the end (roughly the length of a normal classroom).
6. Access points should be then evenly placed between these two access points with no more then 50' (or the length of two normal size classrooms). It is recommended that more access points be installed when coverage may be questionable. However, it is expected that ITS will be involved in the discussion of locations and quantities of access points for each building construction project whether it is a new building or the remodeling of an existing building.

In standard rectangular building with center hallway where the hallway walls are mainly poured concrete:

7. Access points should be placed inside the classrooms.

8. An access point should be installed at approximately 1/3 of the length of the building from each end of the building, and on both sides of the hall.
9. If 1/3 of the total length is > 70' then three access points should be installed, evenly spaced on each side of the hall
10. Whenever possible the access point should be placed at the center point between the hallway and the exterior classroom walls.

In a building or area that is more square in shape, where the interior is mainly subdivided by sheet rock walls:

11. An access point should be installed approximately 25' inside the building from each of the 4 corners formed by the exterior walls.
12. If the area is >22,000' sq then an additional access point should be installed at the center point of that area as well.

In a building or areas that is more square in shape, where the halls are <75' long, an access point should be installed at the center point of each hall.

13. If there is an internal work or preparation area in between the rooms an additional access point should be installed at the center point of this area.

In a building or area that is more square in shape, where the halls are >75' long, access points should be installed on the inside corners of any two parallel hallways and also at the center point of the two opposite parallel halls.

9.3 Installation Coordination

A. Cabling Service

Telecom Contractor shall provide two cables from the serving IDF/MDF to the access point enclosure location, including testing. In the IDF/MDF, the cables shall be terminated in the patch panel on the rack used for the VoIP voice/data network switches with Power-over-Ethernet ports. At the enclosure, the cables shall be terminated in an outlet installed above suspended ceilings located within 5 feet of the enclosure.

The Telecom Contractor shall install one modular patch cord from the outlet into the enclosure (for final connection by ITS).

B. Enclosure Installation

ITS shall furnish the enclosure (either ceiling and/or wall mount) to the project site.

The Telecom Contractor shall install the enclosures, per the manufacturer's instructions as shown on the approved plans.

C. Access Point / Antenna Installation

ITS shall provide (supply, configure and install) the access point into the enclosure and make the final connection (plug the cord into the access point).

10.0 INSTRUCTIONAL TECHNOLOGIES

The District is committed to providing a consistent, high quality teaching and learning environment for its students and faculty. The use of technology to support instruction is integral to achieving this goal. Whether it be audio/visual systems, communication technologies, or network technologies it is important that a team of experienced instructional professionals are involved in the design and specification of the instructional classrooms and laboratories.

The technology used to support instruction is to be determined based on the unique instructional needs and utilization of each room or laboratory. **No** facility should be designed or specified **without consultation** with the **instructional faculty** that will use the technology and the **ITS staff** that are responsible for the support of the technology.

The goals for establishing Instructional Technology Standards and Guidelines are to:

- Serve as a planning and design reference for architects, engineers, and furniture coordinators.
- Assist with budget planning and cost estimation.
- Facilitate service and maintenance by having consistent technology throughout the District.

The specific requirements for each instructional facility will depend on the unique instructional use of that facility. Therefore, these standards are guidelines and are subject to change based on the introduction of new technologies or to meet unique instructional needs.

10.1 General Guidelines for Instructional Technology

New instructional technology installations must reflect current technology at the time of opening and be designed to be easily upgraded as technology and pedagogy change over time.

Equipment specified by make and model shall not be substituted without written approval of ITS.

New or remodeled classrooms should be a Smart Classroom.

Where appropriate, new or remodeled instructional laboratories should be should be a Smart Classroom.

Instructional facilities shall have wireless access so that students and faculty may connect to the Internet.

10.2 Smart Classrooms Infrastructure

A. Construction Standards

The minimum standard for all new or modernized classrooms is to include a projector mount, projector power, projector data connection, teaching position data connection, teaching position power, pathway for cables from the projector to the teaching position, a projection screen, a mounted controller for the projector, speakers, and controlled room lighting.

1. Ceiling Mount for Projector Pole

   Mount shall be centered relative to projection screen 15'+/-6" distance from front of screen.

   For flat ceilings, use Chief CMA-110 8" x 8" - 1 ½" NPT fitting

   For angled ceilings, use Chief CMA-395 Angled Ceiling Adapter 4 1/4" H x 3" W x 7 1/2" L

   Locate projector mount centered with the projection screen 15' +/-6" from front of screen.

2. Projector Pole

   Chief Extension Column. Column length is to be determined by screen mounting height. The threaded bottom end of the pole is to be at the same height as the top of the screen housing.

3. Projector Mount

   Chief RPMA 6000 key lock

4. Power for Projector

   Each projector requires one duplex 120VAC 20A circuit, located 12" +/- 6" behind projector.

5. Data for Projector

   Each projector requires one 2-port telecom outlet, located 12" +/- 6" behind projector.

B. Teaching Position Infrastructure

The teaching position will be the location where the instructor will base their laptop during instruction. The teaching position will also be the location for the permanent DVD/VCR player and ITS equipment to support the Smart Classroom technology.

The teaching position is typically located in the front of the room, on the side of the room away from the door. The teaching position should be at least 5 ft from the side of the projection screen when the screen is pulled down.

The teaching position infrastructure shall include the following:

1. Power for Teaching Position

   Each Teaching Position requires one duplex 120VAC 20A circuit, located no more that 3' away from teaching position and 18" above finished floor.

2. Data for Teaching Position

   Each Teaching Position requires one 2-port telecom outlet, located no more that 3' away from teaching position and 18" above finished floor. A standard device box is to be installed. Installation is to be no more that 3' away from teaching position and 48" above finished floor.

3. Pathways for Teaching Position

   Each Teaching Position requires one pathway for video and audio signal and one pathway for projection control.

   The video and audio signal pathway shall consist of one 2" conduit within the wall from a 4" x 4" box routed up and turning above the ceiling. Alternatively, the pathway may be a surface-mounted raceway – this requires written approval from ITS. The device box shall be installed 18" above finished floor no more than 3' away from teaching position, and shall come equipped with a coverplate with a 1" diameter opening.

   The video control pathway shall consist of one ½" conduit within the wall from a 4-square device box routed to within 12" of the projector. The device box shall be installed 48" above finished floor no more than 3' away from teaching position.

   Typically, cable hangers will support the cables above ceilings.

C. Projections Screens

   Ceiling conditions or light fixtures may require a modification to optimize the projection. Contact ITS for a variance.

   1. Rooms with maximum seating capacity up to 60

      The projection screen shall be Da-Lite Model C, Matte White, Video format screen, 69" x 92", with Da-Lite Model No. 6 installation brackets.

      Screen shall be installed between 10 and 11 feet.

      The screen location shall be determined based on instructional needs.

   2. Rooms with seating capacity from 60 to 100

      The projection screen shall be Da-Lite Model C, Matte White, Video format screen, 87" x 116", with Da-Lite Model No. 6 installation brackets.

      Screen shall be installed between 11 and 13 feet.

      The screen location shall be determined based on instructional needs.

   3. Rooms with seating capacity greater than 100

      Rooms with seating capacity greater than 100 will be considered on an individual basis

D. Lighting Controls

   Ceiling lighting that occurs between the projector and screen shall be switched on/off independent of other ceiling lights. The switch shall be of a different color that other switches for easy identification.

E. Speakers

Smart Classrooms without suspended ceilings require wall-mount speakers. The speakers shall be JBL Control 1. Typical room installation will include 2 speakers, though speaker quantities and locations shall be determined according to room purpose, room size, and seating orientation. The speakers shall be installed at the same height as the screen equally spaced on either side 18" +/- 6 inches.

For any room type, consult ITS for speaker layout.

1. Smart Classrooms with Suspended Ceilings

   Rooms with suspended ceilings require ceiling-mount speakers. Typical room installation will include 4 speakers, though speaker quantities and locations shall be determined according to room purpose, room size, and seating orientation.

   The speakers shall be JBL Control 26T.

2. Smart Classrooms without Suspended Ceilings

   Rooms without suspended ceilings require wall-mount speakers. Typical room installation will include 2 speakers, though speaker quantities and locations shall be determined according to room purpose, room size, and seating orientation. The speakers shall be installed at the same height as the screen equally spaced on either side 18" +/- 6 inches.

   The speakers shall be JBL Control 1.

3. Wiring

   Speakers require #14 stranded wire from the teaching position with a 10-foot tail coiled at the teaching position. The color scheme is to be red (+) white (-).

10.3 Smart Classrooms Equipment

The equipped classroom includes the minimum standards plus projector, projector mount, sound system, and cabling.

A. Projector and Projector Mount

The Project shall fund the projector and its mount, SMCCCD ITS shall furnish the projector and mount, and the Contractor shall install the projector and mount.

1. Rooms with maximum seating of 75: Epson 6100P projector and Chief RPMA 6000 key lock projector mount.
2. Rooms with seating capacity greater than 75 will be considered by ITS on an individual basis.

B. Sound System / Audio Amplifier

The sound system shall consist of an audio amplifier and an appropriate quantity of loudspeakers. Due to the number of variables that can effect sound in a classroom, contact ITS for appropriate sound solution.

The Project shall fund the audio amplifier and loudspeakers, SMCCCD ITS shall furnish the projector, and the Contractor shall install the projector.

C. Cabling Bundle

The cabling bundle is from teaching position to projector and loudspeakers. The cabling bundle shall consist of the following:

1. One VGA cable
2. In rooms that use document cameras, a second VGA cable
3. Three stereo mini phone cable
4. Combination stereo audio and composite video RCA cable
5. Twisted pair of AWG #16 stranded wire

The Project shall fund the cabling, SMCCCD ITS shall furnish the cabling, and the Contractor shall install the projector.

APPENDIX A: APPROVED PRODUCTS LIST

<insert products list – page 1 – here>

<insert products list – page 2 – here>

<insert products list – page 3 – here>