

# **IST Telecommunications Standards**

## **12/2/14**

In order to ensure compliance with these standards, telecommunications designs and plans shall be reviewed for approval by IST Telecom prior to the start of any project. While every effort has been made in the crafting of the IST Telecom standards, it is acknowledged that all field conditions may not be addressed and that questions regarding intent and implementation will arise. Contractors shall review all applicable IST Telecommunications Standards prior to the start of any project. Any questions regarding the accurate implementation of any standard herein shall be delivered, in writing, for final interpretation by IST Telecom. Guidance as a result of interpretation shall be implemented as indicated.

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## SECTION 0 – MINIMUM COORDINATION REQUIREMENTS

### Section 0 - Minimum Coordination Requirements

#### SCOPE

The purpose of this section is to identify critical coordination required between project designers, contractors, UC Berkeley Real Estate Division, Owner's Representative, and Information Services and Technology's Telecommunications unit (IST-Telecom) in order to meet the Telecommunications needs in support of the UCB campus and other entities under the service umbrella of IST-Telecom. The items identified in this section do not denote the entire requirements, but rather minimum basic coordination needed between the parties and IST-Telecom.

All coordination for a project shall originate through the designated UCB Owner's Representative and/or UC Berkeley Real Estate Division in order that all parties are aware of the IST-Telecom standards and in order to produce a Telecommunications installation meeting IST-Telecom standards. All coordination shall exist in writing, preferably electronic format using industry standard compatible documentation software available to all parties.

All parties are required to read and understand the standards and pose questions to any part of the standards that may not be understood in order to obtain clarification directly from IST-Telecom for Telecommunications related issues supported by IST-Telecom. **IST-Telecom is to be consulted prior to starting any work related to IST-Telecom supported Infrastructure and/or Services.**

#### 1 DESIGNER

A designer is considered to be any professional contributing to the formulation of contract documents used for the purpose of defining a project's contractual documents used for bidding a project and giving direction to an installation. The designers shall accomplish the following coordination:

- A. Coordinate the telecommunication room (TR) requirements between the designing engineer and the architect for the purpose of sizing and locating a TR based on UCB IST-Telecom standards as early in the project as possible.
- B. Seek approval from IST-Telecom for all TR size and locations at the time they are defined, and at any time the room size, shape, location, or parameters change.
- C. Emergency Phone(s)
  1. Coordinate emergency phones with IST-Telecom and the University Campus Police Department (UCPD) as early in the project design phase as possible.
  2. Confer with UCPD and IST-Telecom in the event there is a change in style or type of emergency phone, type or method of communications, etc.
  3. Coordinate such items as location and quantity of emergency phones, termination method, signage, pathway requirements, and cable requirements.
  4. If emergency power is available, connect emergency phone blue strobe.
- D. Confer with IST-Telecom at the beginning of project design to determine if any standards have changed since the publication of the published standards. This includes acceptable products as well as installation practices.
- E. Coordinate User Space furniture as early as possible, but prior to pathway design coordination, as it can greatly affect the infrastructure pathways and design coordination between Telecommunications device/outlet locations and associated electrical power.
- F. All room numbers must be assigned by Campus Space Management and approved by the Campus Fire Marshal. Ensure that approved room numbers are used prior to completion of design documents as this affects all cable and equipment identification in an adverse manner when changed after approved labeling has taken place.

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- G. For existing building upgrades, review intended Telecommunications design with IST-Telecom at midpoint of Design Development and again at midpoint Construction Documents phases to ensure the intended design continues to meet IST-Telecom needs.
- H. Schedule and include regular field visits, agreed on at the onset of the project, for installation review during construction relative to Telecommunications. All scheduled visits relating to Telecommunications shall include IST-Telecom personnel.
- I. IST-Telecom shall receive a copy of design documents at all phases, but at a minimum 50% and 100% Design Development, as well as 50%, 90%, and 100% Construction Documents , and at any time significant changes affecting Telecommunications are made so that IST-Telecom has the opportunity to review and approve.
- J. The Architect and Owner’s Representative shall coordinate intended changes to design with the Telecommunications engineer for the project changes during construction. The Architect, Owner’s Representative, and Telecommunications design engineer(s) shall discuss the change with IST-Telecom if it affects the ability to meet IST-Telecom standards.
- K. The designer shall plan for and prepare final labelling floor plans when cabling is completed for a project (refer to [SK204](#) for style). The designer shall plan for and create the initial spreadsheet for cable labelling according to UCB IST-Telecom standards for the type of cabling designed for the project.

### 2 CONTRACTORS

- A. Contractor and subcontractor(s) shall read and understand all UCB IST-Telecom standards prior to bidding a project and shall pose any questions, in writing, for Telecommunications issues that may need clarification for a complete understanding.
- B. Request For Information (RFI)
  - 1. The Contractor and subcontractor(s) shall provide an RFI for any change to the installation according to contract drawings and specifications for Telecommunications related issues and seek approval from IST-Telecom in writing prior to making a change if the change affects the pathway infrastructure or structured cabling system’s accessibility once the project is complete.
- C. Labeling Samples
  - 1. As part of coordination, the Contractor (to include subcontractor(s)) shall provide sample mockups of all labeling, affixed to segments of the actual product where possible, to UCB IST-Telecom for approval prior to the actual labeling of the Structured Cabling System (SCS) and its related equipment and pathways (refer to [Section 9](#) for additional information). The mockups shall be issued to the Owner’s Representative, who will inform IST-Telecom of their existence and provide them to IST-Telecom for review and written approval.
- D. Cable Identification Schedule
  - 1. The cable schedule shall be created by the design engineer or IST-Telecom only, using the IST-Telecom provided, preformatted, electronic Excel spreadsheet.
- E. Emergency Phone(s)
  - 1. Coordinate the completion of emergency phone installations cabling and physical phone placement with IST-Telecom in order that they can schedule termination and testing of the phones.
- F. Schedule completion of TRs with Owner’s Representative, Telecommunications design engineer, and IST-Telecom in preparation of “Room Ready” status.

## SECTION 1 – CODES AND STANDARDS

### Section 1 - Codes and Standards

#### SCOPE

This section lists the codes and industry established standards applicable to the telecommunications infrastructure and structured cabling systems for commercial buildings. Not all codes and standards apply to every project. Project type, systems, and products deployed determine applicable codes and standards.

#### APPLICABLE CODES AND STANDARDS

This section breaks-out the content based on the various subsystems of the telecommunications infrastructure.

##### 1 GENERAL

These codes and standards apply to the telecommunications system as a whole.

- A. California Code of Regulations (CCR):
  1. Title 8, "Industrial Relations", Chapter 3.22, "California Occupational Safety and Health Regulations (CAL/OSHA)"
  2. Title 24, "California Building Standards Code"
    - a. Part 1, "California Building Standards Administrative Code"
    - b. Part 2, "California Building Code" (CBC)
    - c. Part 3, "California Electrical Code" (CEC)
    - d. Part 11, "California Green Building Standards Code" (CALGreen)"
- B. National Fire Protection Association (NFPA):
  1. NFPA 70, "National Electrical Code" (NEC)
  2. NFPA 75, "Protection of Information Technology Equipment"
- C. United States Department of Labor (DOL) Occupational Safety and Health Administration (OSHA) Regulations (Standards - 29 CFR):
  1. Part 1910, "Occupational Safety and Health Standards"
  2. Part 1926, "Safety and Health Regulations for Construction"
- D. International Code Council:
  1. International Building Code (2009)
  2. International Fire Code (2009)
  3. ICC Performance Code (2009)
- E. Telecommunications Industry Association (TIA) 568 Series:
  1. ANSI/TIA-568-C.0, "Generic Telecommunications Cabling for Customer Premises"
  2. ANSI/TIA-568-C.1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements"
  3. ANSI/TIA-568-C.2, "Balanced Twisted Pair Telecommunications Cabling and Components"
  4. ANSI/TIA-568-C.3, "Optical Fiber Cabling Components"
- F. ANSI/TIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces"
- G. ANSI/TIA/EIA-598-B, "Optical Fiber Cable Color Coding"
- H. ANSI/TIA-606-B, "Administration Standard for Telecommunications Infrastructure"
- I. ANSI-TIA-607-B, "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
- J. ANSI/TIA-758-A, "Customer-Owned Outside Plant Telecommunications Infrastructure Standard", including the following addenda"

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- K. ANSI/TIA-1005, “Telecommunications Infrastructure Standard for Industrial Premises”
  - L. EIA testing standards
  - M. Building Industry Consulting Services International (BICSI):
    1. Telecommunications Distribution Methods Manual (TDMM)
    2. Customer-Owned Outside Plant Design Manual
    3. Wireless Design Reference Manual (WDRM)
    4. Network Design Reference Manual (NDRM)
    5. Information Transport Systems Installation Manual (ITSIM)
- 2 TELECOMMUNICATION ROOMS
- A. NFPA National Fire Protection Association (NFPA) 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
  - B. ASTM E 84-05 Standard Test Method for Surface Burning Characteristics of Building Materials
  - C. American Wood-Preservers' Association (AWPA) Standard C27 Plywood - Fire Retardant Treatment by Pressure Processes
- 3 OUTSIDE PLANT (OSP) PATHWAYS
- A. American Association of State Highway and Transportation Officials (AASHTO):
  - B. Federal Specifications (FS):
    1. FS RR-F-621E: Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.
    2. FS SS-S-210A: Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints.
    3. FS W-C-1094A: Conduit and Conduit Fittings Plastic, Rigid.
  - C. American National Standards Institute, Inc. (ANSI):
    1. ANSI C80.1: Rigid Steel Conduit, Zinc-Coated.
    2. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
  - D. American Standards for Testing and Measurement (ASTM):
    1. ASTM C478: Specification for Precast Reinforced Concrete Manholes Sections
    2. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
    3. ASTM C858: Standard Practice for Underground Precast Concrete Utility Structures
    4. ASTM C923: Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
    5. ASTM C990: Standard Specifications for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
  - E. Underwriters Laboratories, Inc. (UL) - UL 651: Schedule 40 and 80 Rigid PVC Conduit.
  - F. Concrete Reinforcing Steel Institute (CRSI)
  - G. National Electrical Manufacturer Association (NEMA):
    1. NEMA TC 2: Electrical Plastic Tubing and Conduit.
    2. NEMA TC 3: PVC Fittings for use with Rigid PVC Conduit.
    3. NEMA TC6: PVC Plastic Utilities Duct (EB and BD Type)
  - H. A 2005 National Electric Code, Annex B B. NEMA TCB2
  - I. American Concrete Institute (ACI):
    1. ACI 304: Guide for Measuring, Mixing, Transporting, and Placing Concrete
    2. ACI 318: Building Code Requirements for Reinforced Concrete.
- 4 INSIDE PLANT (ISP) PATHWAYS
- A. ASTM International:
    1. ASTM A 123, “Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel”

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2. ASTM A 510, "Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel"
  3. ASTM A 580, "Standard Specification for Stainless Steel Wire"
  4. ASTM A525, "General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process"
  5. ASTM A 580, "Standard Specification for Stainless Steel Wire"
  6. ASTM A591, "Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets"
  7. ASTM A 641, "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
  8. ASTM A 653, "Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process"
  9. ASTM B 633, "Specification for Electrodeposited Coatings of Zinc on Iron and Steel"
  10. ASTM D 769, "Standard Specification for Black Oxide Coatings"
  11. ASTM D3451, "Standard Guide for Testing Coating Powders and Powder Coatings"
- B. National Electrical Manufacturer Association (NEMA):
1. NEMA VE 1, "Metal Cable Tray Systems"
  2. NEMA VE 2, "Cable Tray Installation Guidelines"
- C. National Fire Protection Association (NFPA):
1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"
  2. Underwriters Laboratories (UL)
  3. UL 467, "Grounding and Bonding Equipment"
5. OUTSIDE PLANT (OSP) BACKBONE CABLING
- A. Fiber Optic Cabling
1. National Fire Protection Agency - NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces", 2007
  2. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
    - a. UL 1569, "Metal-Clad Cables"
    - b. UL 1651, "Optical Fiber Cable"
    - c. UL 1666, "Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts"
  3. Insulated Cable Engineers Association (ICEA):
    - a. ANSI/ICEA S-87-640-1999, "Fiber Optic Outside Plant Communications Cable"
    - b. ANSI/ICEA S-104-696-2001, "Indoor-Outdoor Optical Cable"
  4. Telcordia - GR-20-CORE, Issue 3, "Generic Requirements for Optical Fiber and Optical Fiber Cable"
- B. Copper Cabling
1. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
    - a. UL 497, "Protectors for Paired-Conductor Communication Circuits"
    - b. UL 497A, "Secondary Protectors for Communications Circuits"
    - c. UL 497B, "Protectors for Data Communications and Fire-Alarm Circuits"
    - d. UL 497C, "Protectors for Coaxial Communications Circuits"
    - e. UL 1863, "Communications-Circuit Accessories"
  2. Insulated Cable Engineers Association (ICEA):
    - a. ANSI/ICEA S-84-608-2007, "Telecommunications Cable Filled, Polyolefin Insulated, Copper Conductor Technical Requirements"
    - b. ANSI/ICEA S-85-625-2011, "Telecommunications Cable Aircore, Polyolefin Insulated, Copper Conductor Technical Requirements"
    - c. ANSI/ICEA S-107-704-2012, "Broadband Buried Service Wire, Filled, Polyolefin Insulated, Copper Conductor Technical Requirements"
  3. Telcordia - GR-421-CORE Issue 2, "Generic Requirements for Metallic Telecommunications Cables"

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### 6 INSIDE PLANT (ISP) BACKBONE CABLING

#### A. Fiber Optic Cabling

1. National Fire Protection Agency (NFPA):
  - a. NFPA 255, “Standard Method of Test of Surface Burning Characteristics of Building Materials”, 2006
  - b. NFPA 259, “Standard Test Method for Potential Heat of Building Materials”, 2003
  - c. NFPA 262, “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces”, 2007
2. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
  - a. UL 1569, “Metal-Clad Cables”
  - b. UL 1651, “Optical Fiber Cable”
  - c. UL 1666, “Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts”
3. Insulated Cable Engineers Association (ICEA):
  - a. ANSI/ICEA S-83-596-1994, “Fiber Optic Premises Distribution Cable”
  - b. ANSI/ICEA S-87-640-1999, “Fiber Optic Outside Plant Communications Cable”
  - c. ANSI/ICEA S-104-696-2001, “Indoor-Outdoor Optical Cable”
4. Telcordia:
  - a. GR-20-CORE, Issue 3, “Generic Requirements for Optical Fiber and Optical Fiber Cable”
  - b. GR-409-CORE, Issue 2, “Generic Requirements for Indoor Fiber Optic Cable”

#### B. Copper Cabling

1. National Fire Protection Agency (NFPA):
  - a. NFPA 255, “Standard Method of Test of Surface Burning Characteristics of Building Materials”, 2006
  - b. NFPA 259, “Standard Test Method for Potential Heat of Building Materials”, 2003
  - c. NFPA 262, “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces”, 2007
2. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
  - a. UL 444, “Communications Cables”
  - b. UL 497, “Protectors for Paired-Conductor Communication Circuits”
  - c. UL 497A, “Secondary Protectors for Communications Circuits”
  - d. UL 497B, “Protectors for Data Communications and Fire-Alarm Circuits”
  - e. UL 497C, “Protectors for Coaxial Communications Circuits”
  - f. UL 1581, “Reference Standard for Electrical Wires, Cables, and Flexible Cords”
  - g. UL 1666, “Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts”
  - h. UL 1863, “Communications-Circuit Accessories”
3. Insulated Cable Engineers Association (ICEA):
  - a. ANSI/ICEA S-90-661-2008, “Category 3, 5, and 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems”
  - b. ICEA S-102-700-2004, “ICEA Standard For Category 6 Individually Unshielded Twisted Pair Indoor Cables (With Or Without An Overall Shield) For Use In Communications Wiring Systems Technical Requirements”
4. Telcordia - GR-111, “Generic Requirements for Thermoplastic Insulated Riser Cable”

### 7 HORIZONTAL CABLING

#### A. National Fire Protection Agency (NFPA)



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- B. NFPA 262, “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces”, 2007
- C. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
  - 1. UL 444, “Communications Cables”
  - 2. UL 497, “Protectors for Paired-Conductor Communication Circuits”
  - 3. UL 1581, “Reference Standard for Electrical Wires, Cables, and Flexible Cords”
  - 4. UL 1666, “Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts”
  - 5. UL 1863, “Communications-Circuit Accessories”
- D. Insulated Cable Engineers Association (ICEA):
  - 1. ANSI/ICEA S-90-661-2008, “Category 3, 5, and 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems”
  - 2. ICEA S-102-700-2004, “ICEA Standard For Category 6 Individually Unshielded Twisted Pair Indoor Cables (With Or Without An Overall Shield) For Use In Communications Wiring Systems Technical Requirements”
- E. Telcordia - GR-111, “Generic Requirements for Thermoplastic Insulated Riser Cable”

### 8 TESTING

- A. Fiber Optic Cabling
  - 1. TIA/EIA-526-14A (OFSTP-14), “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”
  - 2. TIA/EIA-526-7 (OFSTP-7), “Measurement of Optical Power Loss of Installed Single mode Fiber Cable Plant”
  - 3. EIA/TIA-455-77 (FOTP-77), “Procedures To Qualify A Higher-Order Mode Filter For Measurements On Single mode Fibers”
  - 4. EIA/TIA-455-78A (FOTP-78), “Spectral-Attenuation Cutback Measurement for Single mode Optical Fibers”
  - 5. EIA-455-95 (FOTP-95), “Absolute Optical Power Test for Optical Fibers and Cables”
  - 6. EIA-455-171 (FOTP-171), “Attenuation By Substitution Measurement – For Short-Length Multimode Graded-Index And Single-Mode Optical Fiber Cable Assemblies”
  - 7. American National Standards Institute (ANSI) Z136.2, “American National Standard for the safe use of optical fiber communication systems utilizing laser diode and LED sources”
  - 8. BICSI Telecommunication Distribution Methods Manual (TDMM)
- B. Copper Cabling
  - 1. ANSI/TIA-1152, “Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling”

### 9 GROUNDING AND BONDING

- A. NFPA 70, “National Electrical Code”, particularly the following Articles:
  - 1. Article 250: Grounding
  - 2. Article 770: Optical Fiber Cables and Raceways
  - 3. Article 800: Communications Systems
  - 4. Article 810: Radio and Television Equipment
  - 5. Article 820: Community Antenna Television and Radio Distribution Systems
- B. Underwriters Laboratories, Inc. (UL) UL 467: Grounding and Bonding Equipment
- C. Electronic Industries Association/Telecommunication Industry Association - ANSI-TIA-607-B, “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
- D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

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1. IEEE 467, “IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems”
2. IEEE P1100, “IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems”

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### Section 2 - Telecommunications Rooms

#### SCOPE

This section describes the requirements for the telecommunications rooms (TR) within a building. Typically, buildings at University of California Berkeley (UCB) require up to three types of telecom rooms, one Building Distribution Facility (BDF), and possibly one or more Intermediate Distribution Facilities (IDF), or Riser Closets (RC). At minimum, each building will have a BDF room, provided it can serve the entire building.

- 1 BDF
  - A. The BDF room acts as the backbone distribution point for the Building. The BDF receives data connectivity services from the Campus and distributes them to each IDF room in a star topology within the building. The BDF receives voice services from either the Campus, or a service provider such as AT&T. Typically the BDF acts as the Entrance Facility for the building. The BDF may also serve telecommunication outlets within a distance of 295 feet (tested length) of the room (refer to [SK-500](#) sketch for room layout parameters).
  - B. The BDF room will exclusively house the building's core network equipment installed by IST-Telecom in support of the building. .
  - C. With proper coordination and approval from IST-Telecom, the BDF room may house head-end equipment for the building's security systems, such as access control and video surveillance.
- 2 IDF
  - A. The IDF rooms serve the telecommunications outlets within its serving area. The IDF rooms receive their backbone connectivity from the building's BDF room in a star topology.
  - B. The IDF rooms exclusively house the network equipment, installed by IST-Telecom, for the area they serve. (refer to [SK-500](#) sketch).
  - C. With proper coordination and approval from IST-Telecom, the IDF room may house head-end equipment for the building's security systems, such as access control and video surveillance.
- 3 RC
  - A. The RCs provide a path for backbone and horizontal cabling (when a TR serves more than one floor). For the most part, RCs transition horizontal cabling from the user space of one floor to the BDF or IDF on the floor below or above. This configuration provides a means to realize measurable savings by eliminating the need to build-out unnecessary rooms and procure additional LAN switch equipment, besides the long term cost of cooling and power.

#### DESIGN PARAMETERS

This paragraph describes the requirements for TR placement, shape, and sizing.

- 1 LOCATION
  - A. The Telecommunications design engineer shall work with the architect to identify the proper location for the TR(s). Once defined, the design team shall obtain approval from IST-Telecom for the selected location of each TR following the defined location, or when a TR is relocated in the design documents.
  - B. Locate the TR within 90 meters (295 feet, tested length) of the most-distant telecommunications outlet it serves. This distance includes all cable slack in the routing, rise and fall as the cable routes from the outlet to accessible space and to its termination location within the TR, plus required cable slack at the outlet for possible moves or cable re-termination (4 feet).

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- C. It is preferable to have TRs centrally located on a floor where possible and to have a TR serve multiple floors of a building to minimize equipment cost over the life of the building. Additionally, having a TR serve multiple floors minimizes construction costs, cooling costs, primary equipment costs, and equipment power consumption costs.
- D. TRs are dedicated to Telecommunications use only. Do not share the TR space with other department's equipment, personnel, storage, janitorial staff or equipment, outside support groups or equipment, or other materials not directly supporting Telecommunications.
- E. Avoid common walls with rooms containing electromagnetic interference (EMI) such as, but not limited to, elevators, pump motors, generators, other motors and transformers, X-ray equipment, radio transmitters, induction heating devices, sources of mechanical vibration, power lines, and other potential sources of EMI. Where rooms must be placed near EMI generating equipment, maintain a minimum distance of 4 feet from such equipment. **Under no circumstances shall a transformer be located within a TR.**
- F. Provide direct access to TRs from hallways and not through classrooms, offices, mechanical and electrical rooms, or other user or facility spaces. Do not locate other work, storage, equipment, mechanical, or electrical spaces that require passage through the TR for access.
- G. In multistory buildings, vertically align the TRs to facilitate riser system between the TRs. If a rated shaft cannot be achieved, then install STI EZ-Path™ firestop devices with 2 hour temperature rating as the riser system. Unless verified by UCB Fire Marshal, assume all riser penetrations require firestopping. STI EZ-Path™ devices are the preferred method unless otherwise noted in the contract documents (refer to [SK400](#) and [SK401](#) for example).
- H. Do not share TR allocated spaces with other functions such as, but not limited to, electrical spaces, boiler rooms, washrooms, janitorial closets, and storage rooms. IST-Telecom may share TRs with the building's security systems and CCTV when properly coordinated through the project's design process.
- I. Do not locate the rooms where it may be subject to water or steam infiltration, humidity from nearby water or steam, heat, or any other corrosive atmospheric or environmental conditions, either adjacent or below.
- J. Do not locate a TR below water level unless preventive measures against water infiltration are employed. The rooms shall be free of water or drain pipes not directly required in support of the equipment within the room. Provide a drain within the TR if risks of water ingress exist.
- K. Do not locate a TR such that a column is within the TR or penetrating within the wall's perimeter.

### 2 SIZING

- A. Provide one minimum sized TR of 10 feet x 11 feet 8 inches for each user space area up to 10,000 square feet (typical 3 racks). Size and placement requires evaluation for horizontal cabling area served, amount and type of estimated rack-mounted equipment, allowances for wall mounted equipment (such as 110 termination fields, building entry protection blocks, electrical and security panels, etc.), and working clearance in front and rear of the floor and wall mounted equipment of 36 inches (refer to [SK-500](#) sketch).

For user space service area between 10,001 to 18,000 square feet, size the room to include two additional equipment racks, effectively extending the room to 10 feet by 13 feet 6 inches (typical 4 racks).

For user space service area beyond 18,000 square feet, size the room to include one additional equipment rack, effectively extending the room to 10 feet by 16 feet 8 inches (typical 5 racks).

The dimensions noted above denote inside room clearance requirements.

- B. A TR must be rectangular with no building columns within the perimeter of the room. The door should be on one of the 10 foot walls starting at 12 inches off the corner of the wall.

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- C. As a general guideline, for user space service area between 10,000 to 18,000 square feet, size the room to include one additional equipment rack; effectively extending the room to 10 feet by 13 feet 6 inches.
  - D. As a general guideline, for user service areas beyond 18,000 square feet, extend the length to accommodate two additional equipment racks; effectively extending the room size to 10 feet by 16 feet 8 inches.
  - E. The dimensions noted above denote inside room clearance requirements.
- 3 OTHER PARAMETERS
- A. TRs may not have windows.
  - B. As needed, insulate each TR for noise suppression due to equipment noise within the TR.
  - C. Do not locate plumbing or mechanicals within, or passing through, a TR unless they specifically service the space. Do not route plumbing, ducts, roof drains, waste lines, fire riser mains, etc through TRs. Only plumbing lines supporting the cooling units within the room are allowed to enter the room.
  - D. Do not locate electrical service panels within a TR that serve areas or equipment outside the TR.

### ROOM CONFIGURATION & SUPPORT SERVICES

This paragraph describes the specific BDF and IDF room requirements by discipline.

- 1 ARCHITECTURAL
- A. Floor  
Sealed concrete is the preferred flooring. Anti-static tiles are not required.
  - B. Ceiling. Open to structure above. If insulation is required for energy efficiency, install insulation sandwiched between the deck above and a gypsum hard cap ceiling directly beneath the insulation.
  - C. Walls
    - 1. Install full height walls to the structure above and seal all gaps. Paint walls with a low-gloss white (or other light color, as approved by IST-Telecom) paint and install plywood as follows:
    - 2. Mount ¾ inch fire retardant knot free, AC grade plywood sheets with stamp on A side, from 6 inches above finished floor to a minimum of 8 feet 6 inches above finished floor. Install an additional 2 feet of plywood starting at 8 feet 6 inches if cable management equipment is braced by the wall above 8 feet 6 inch wall line.
    - 3. Mount plywood to the wall such that it is capable of supporting 50-pounds per linear foot of wall space. Install plywood as follows;
      - a. Plumb, level, true, and straight with no distortions. Shim as required using concealed shims.
      - b. Trim the plywood around electrical and telecommunications outlets.
      - c. Install plywood with the A side out, with fire rated stamp on A side. Mask the fire rated stamp before painting.
    - 4. Paint plywood backboards with two coats of low-gloss white paint, or to match existing wall color.
    - 5. Counter sink plywood mounting fasteners so they are flush with wood surface.
  - D. Door  
At minimum, install a 3 foot solid door without a window. Door shall swing outward from the TR.
  - E. Signage  
Install a sign outside each telecom space identifying its UCB assigned room number.

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### 2 RISER CONDUITS

Locate riser conduits at the corners of the TR when possible, typically behind the entry door. Consider door location before placing riser conduits/EZ-Paths near a door corner of the TR. Consider structural beams when locating riser conduits/EZ-Path.

### 3 ELECTRICAL

#### A. Equipment Service

Locate two 20A 120v power circuits terminated in an L5-20R (See Product List for Power Distribution Unit (PDU) details) above each equipment rack. Mount the circuit boxes to side of overhead level-1 cable runway; face circuits toward rear circulation aisle. Wire the power circuits with 30A rated wire for future upgrade of the receptacle and breaker without the need to rewire the circuits. Ensure that the electrical circuit boxes do not impede free operation of the vertical wire manager doors.



B. If a PBX UPS is required, IST will specify a 5-20R or a 5-30R at bottom of vertical wire manager.

C. If security is housed in the TR, install a 20A double-gang receptacle at the wall area servicing the security equipment.

D. Electrical distribution panels serving a TR shall be located in the TR.

#### E. Convenience Outlets

Place convenience outlets every 6 feet along the walls, with a minimum of one per wall. Locate these outlets at 12 inches above finished floor so as not to impact wall mounted equipment.

F. IST-Telecom may specify the installation of Starline Track Bus System™ for larger TRs, or those that are expected to have changing power requirements.

G. If a generator is available, confer with IST-Telecom to determine if any equipment power receptacle requires emergency backup power.

### 4 LIGHTING

A. Provide 50 foot-candles of illumination on the vertical surfaces of the wall and rack mounted equipment.

B. Install shine down type fixtures with cage over bulbs. Align fixtures with circulation aisles and locate above and to the side of overhead cable management (refer to [SK503](#)). Maintain a minimum 12 inch clearance from the top of the upper most cable tray.

C. Install one fixture within room with a battery-operated ballast (or connection to the building's emergency generator, if available), locate emergency fixture closest to the door.

### 5 GROUNDING & BONDING

A. [Refer to Section 10](#) – Grounding and Bonding for additional information.

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### 6 MECHANICAL/HVAC

- A. Install split system (e.g. Mitsubishi Mr. Slim), based on an output of 6,500 BTUs per equipment rack. Cooling system shall operate 24/7 365 days per year, be controlled from within the TR, and maintain a temperature between 64 °F to 75 °F.
- B. The humidity range should be 30% to 55% relative humidity. Maintain positive air pressure within the room with one air change minimum per hour.
- C. If not installing a split system for cooling, hang all mechanical equipment from the ceiling. Do not wall mount equipment unless located a minimum distance of 12 inches above the overhead cable runway. Mount equipment as high as possible so as not to interfere with horizontal sleeves and cable management within the room. Place equipment so that it may be easily accessed for service after full room build-out is complete.
- D. Cooling unit shall receive its power from the room's electrical panel.
- E. Provide an independent thermostat control located within the room, and configure it as its own dedicated zone. Do not share this zone with other building user or facilities rooms.
- F. Do not place HVAC unit or piping directly above active equipment, whether wall or rack mounted.

### 7 SECURITY

- A. Provide secure door hardware for each TR, allowing the doors to be locked and keyed separately from non-TR doors. Do not use electronic mortise locks.
- B. IST-Telecom's preference, listed in order, for TR access control is:
  - 1. Card access managed by University of California Police Department (UCPD)
  - 2. Cyber Key™
  - 3. T-Key

### 8 FIRE PROTECTION

- A. Provide high temperature sprinkler heads. Locate sprinkler heads at least 24 inches above the top of the overhead cable management and provide cages to protect heads from accidental activation.
- B. Provide smoke detection as required by code. Note: Campus Fire Marshal shall determine applicable code.

## TELECOMMUNICATION ROOM REQUIREMENTS

This paragraph describes the specific component requirements for telecommunication within TRs. RCs are described at the end as its own paragraph.

### 1 EQUIPMENT RACK-BAY

Typical size and configuration of equipment rack bay is 7 feet high 19 inch wide open 2-channel equipment racks and double-sided deep vertical cable managers with doors. Quantity of racks and size of cable managers is dependent on cable and patch cords counts. Unless otherwise coordinated with IST-Telecom, the minimum size room noted above will house one rack-bay configured as follows:

- A. Three equipment racks
- B. Two 10 inch wide vertical cable managers installed between the racks
- C. Two 6 inch wide vertical cable managers installed at ends of rack-bay

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### 2 OVERHEAD CABLE MANAGEMENT

The TRs require three overhead cable management systems to support the various types of cabling, backbone, horizontal, and patch cords. The three levels of cable management breakdown as follows:

- A. Level 3 – Upper Level
  - 1. Locate this level of cable support at minimum 8 feet 6 inches above finished floor. Use this level for the routing and support of horizontal station cabling, backbone copper and fiber cables.
  - 2. Install at minimum 18 inch wide cable runway supported from deck above. Install 7 inch retaining post every 36 inches on center and at corners with end cap protectors.
- B. Level 2 – Middle Level
  - 1. Locate this level of cable support at minimum 7 feet 6 inches above finished floor. Use this level for the routing of fiber patch cords only. Typically, this level is reserved for IST-Telecom use only.
  - 2. Install a 4 inch by 4 inch yellow fiber trough. Route the section above each rack-bay with a downspout into the vertical cable managers between the racks. Align the downspout with the rear of the vertical management section (refer to [SK502](#)).
- C. Level 1 – Lower Level
  - 1. Locate this level of cable support at minimum 7 feet above finished floor. Use this level for the routing of copper patch cords between equipment racks, and between equipment racks and wall fields. Typically, this level is reserved for IST-Telecom use only (refer to [SK501](#)).
  - 2. Install at minimum 18 inch wide cable runway supported by the equipment rack-bays and braced to the wall at each end. Route the runway centered above each rack-bay within the TR, and along the wall containing horizontal and copper backbone terminations. Offset the section along the wall above the terminations field 6 inches from the wall. Do not use triangular support brackets for this level of runway, instead use a cantilever type bracket to maximize wall space available for systems and cable terminations. Install 7 inch retaining post every 36 inches on center and at corners with end cap protectors.



### 3 WALL MOUNTED 110 FIELD

If the TRs require horizontal and/or backbone copper voice terminations, install according to the following guidelines:

- A. Style 110 Termination
  - 1. For installations where backbone terminations are required, provide 5-pair copper termination style 110 blocks.



## SECTION 2 – TELECOMMUNICATIONS ROOMS

2. For installations where horizontal copper terminations are required, install 4-pair field termination style 110 blocks.
- B. 900-pair 110 Tower and Cable Manager
  1. For installations where more than 600 total pair terminations (to include 10% spare per 100 pairs), backbone and/or horizontal terminations are required, install 900-pair 110 style tower units with adjacent vertical 900-pair cable manager in quantities to meet actual termination copper pairs plus 20% spare for each type of termination (refer to [SK507](#) for pre-2014 and [SK507A](#) for 2014 projects and later).
  2. Mount the 900-pair towers starting at 18 inches above the finished floor, aligned horizontally and spaced together with approximately one quarter inch between 110 style block tower and adjacent vertical managers.
- C. 300-pair 110 Tower and Cable Manager
  1. For existing installations where more than 200 total pair terminations (to include 10% spare per 100 pairs), backbone and/or horizontal terminations, install 300-pair 110 style tower units with adjacent cable manager of the same style in quantities to meet actual termination pairs plus 20% spare for each type of termination.
- D. 100-pair 110 and Cable Manager
  1. For existing installations where less than 300 total pair terminations (to include 10% spare per 100 pairs), backbone or horizontal terminations, install 100-pair 110 style units with feet and associated style adjacent cable manager in quantities to meet actual termination pairs plus 10% spare.

### RISER CLOSET REQUIREMENTS

This paragraph describes the specific component requirements for telecom Riser Closets. Riser closets are small in size (minimum 6 feet by 6 feet) and will not hold any electronic equipment or cable terminations. These closets provide a transition and pull-point for cables between floors.

1. ARCHITECTURAL
  - A. Floor  
Sealed concrete.
  - B. Ceiling  
Open to structure above. If insulation is required for energy efficiency, install insulation sandwiched between the deck above and a gypsum hard cap ceiling directly beneath the insulation.
  - C. Walls
    1. Provide full height walls to the structure above, and seal. Paint walls with a low-gloss white paint (or other light color, as approved by IST-Telecom) and install plywood as follows:
      - a. Mount  $\frac{3}{4}$  inch fire retardant knot free, AC grade plywood sheets, with fire rated stamp on A side, from 6 inches above finished floor to the underside of the deck above. Install plywood with the A size out. Mask the fire rated stamp before painting. Typically, plywood is only required on the back wall of a riser closet. Install plywood on riser closet side walls where required to support cable management apparatus.
      - b. Mount plywood to the wall such that it is capable of supporting 50-pounds per linear foot of wall space. Install plywood plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Trim the plywood around electrical and telecommunications outlets. Install plywood with the A size out.
      - c. Paint plywood backboards with two coats of low-gloss fire retardant white paint, or to match existing wall color.
      - d. Countersink plywood mounting fasteners so they are flush with wood surface.

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### D. Door

At minimum, provide a 3 foot solid door without windows. Swing the door outward from the closet.

### E. Signage

Install a sign outside each TR space identifying its UCB assigned room number.

## 2 ELECTRICAL

Install one 15 amp convenience outlet on one of the short walls such that the vertical cable management within the rooms does not block access to it.

## 3 LIGHTING

Locate one fixture on the same wall as the door(s) to provide 50 foot-candles of illumination. Provide a cage over the fixture/bulb.

## 4 GROUNDING & BONDING

Bond the vertical, and horizontal if present, cable management components to the bus bar in the nearest TR (TR may be on the floor above or below). Refer to Section 10 for additional information).

## 5 MECHANICAL

No cooling required.

## 6 SECURITY

Provide door hardware for room allowing the doors to be securely locked and keyed separately from doors of non-telecommunication spaces. Do not use electronic mortise locks. IST-Telecom's preference for Riser Closet access control is a T-Key.

## SECTION 2 – TELECOMMUNICATIONS ROOMS

### SKETCHES

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements within telecom rooms.

- [SK500](#) – Telecom Room Floor Plan, Three Equipment Racks
- [SK501](#) – Telecom Room Overhead Plan, Level-1 Cable Management
- [SK502](#) – Telecom Room Overhead Plan, Level-2 Cable Management
- [SK503](#) – Telecom Room Overhead Plan, Level-3 Cable Management
- [SK504](#) – Telecom Room Elevation Rack-Bay
- [SK505](#) – Equipment Rack and Overhead Cable Management Section View
- [SK505A](#) – Equipment Rack Anchoring
- [SK505B](#) – Equipment Rack Gusset Kit
- [SK506](#) – PDU Mounting within Vertical Cable Manager
- [SK507](#) – Wall Elevation (pre 2014)
- [SK507A](#) – Wall Elevation 2014
- [SK508](#) – 110 Wall Field (pre 2014)
- [SK508A](#) – 110 Wall Field 2014
- [SK509](#) – Cable Runway to Wall Bracing
- [SK510](#) – Cable Runway to Rack-bay Bracing
- [SK511](#) – Cable Runway with Retaining Posts
- [SK800](#) – TR Grounding Bus Bar and Labeling
- [SK801](#) – Conduit Bonding
- [SK802](#) – Riser Conduit Bonding
- [SK804](#) – Cable Runway Bonding
- [SK805](#) – 110 Wall Field Bonding
- [SK806](#) – Rack-Bay Bonding
- [SK807](#) – Rack-Bay Bonding (no bus bar)

## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

### Section 3 - Outside Plant (OSP) Pathways

#### SCOPE

The Outside Plant (OSP) pathways connect the building to the campus underground communications pathway infrastructure, and facilitate the placement of the backbone cabling. University of California Berkeley (UCB) has developed an extensive underground conduit system for communications referred to as Inter-building Communications Conduit System (ICCS).

The typical ICCS duct bank consist of fifteen 4 inch conduits in a 3x5 pattern and encased in steel reinforced concrete between vaults spaced no more than 300 feet apart and with no more than four 45 degree bends. Ninety degree bends are not used, as they increase the friction when pulling cabling through the duct bank sections and subjects fiber optic cable to excessive micro-bends, especially in an “S” configuration. For this reason, only multiple 45 degree bends are allowed, with no more than a maximum 180 degrees total radius bends between vaults/pull boxes.

Typically, each building requires a minimum of two 4 inch conduits to support the various telecommunications cables. Some buildings, based on function and/or other requirements, may require redundant entry facilities. These facilities stub into the Building Distribution Facility (BDF), or Entrance Facility (EF), depending on the project.

Larger buildings requiring more conduit feeds in or out may require up to twelve 4 inch conduits. Confer with IST-Telecom at the beginning of a project to determine the total quantity of conduits required. Consider the ability to place vaults/pull boxes and their location on the premises. Coordinate vaults and pull boxes placements with the Civil Engineer for the project, if available.

#### DESIGN PARAMETERS

- 1 DUCT BANKS
  - A. Install Schedule 40 (with concrete encasement) or Schedule 80 (without concrete encasement) PVC type conduit (refer to [SK703](#) for connection to vault).



## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

In cases where the ICCS conduit bank runs parallel to a 4KV or higher voltage distribution system for more than ten (10) feet, any ICCS conduit with less than a four (4) foot separation from the high voltage conduit system must be Electrical Metallic Tubing (EMT), and grounded in at least one of the attached Communications Vaults (CV).

- B. Install galvanized rigid steel (GSR) from 5 feet outside building line and into the EF or BDF, whichever is applicable for the Project. Install (2) 45 degree, or (1) 72 inch bend at the point the conduit turns up into the building's telecommunication room (TR), stopping between 3 and 4 inches above the finished floor of the TR.
- C. Install fiberglass conduits when communication duct bank crosses or parallels steam pipes with less than 3 feet of separation. Fiberglass conduits should be used 5 feet either side of the crossing, and/or 5 feet beyond the end of the paralleling with steam.
- D. Install Link-Seal® assembly when duct bank is going through building or vault walls. If pre-manufactured Term-A-Duct™ are used in vaults, Link-Seal® assembly is not required.
- E. Provide a pull-point after every four 45-degree bends or 250 feet of conduit run containing one or more bends.
- F. Provide a pull-point at any straight run of conduit 300 feet in length.
- G. Install 3 inch wide, metal impregnated, warning tape above telecommunication conduit(s) the length of the trench. Telecommunication and electrical conduits may share the same trench where both travel the same route, but with a minimum of 12 inch separation of packed earth, or 3 inch separation within a concrete encased duct bank.
- H. For concrete encased duct bank(s), install #4 rebar around the duct bank every 24 inches on center and along each corner and along center line of each side at the perimeter of the encasement, leaving no caps. Overlap ends of rebar a minimum of 2 inches at all ends and wrap with wire to secure in place. All intersections of perpendicular rebar and overlaps must be affixed to each other with wire to prevent movement when concrete is poured. The concrete shall have a 28 day strength of 4,000 psi and a slump of no more than three (3) inches when placed.
- I. Conduits shall enter and exit a vault/pull box from opposite ends of the short sides of the vault/pull box, entering in two banks of conduits toward the outer edges of the vault/pull box sides and no closer than 12 inches to the edge of the long walls of the vault/pull box (refer to [SK700](#)).
- J. Conduits shall make a minimum 8 foot radius sweep, using factory bends only, when changing direction where possible to minimize the friction when pulling cable. Conduits shall not sweep in opposite directions within a distance of twenty feet of each other and no more than a 90 degree bend.
- K. If a duct bank is not encased in concrete, install a minimum 3 inch concrete on the inside bend to prevent burn-through when pulling cable.
- L. Provide a minimum 24 inches of ground cover over the duct bank. Install a metal impregnated detectable marker tape at 18 inches above the duct bank along the centerline of the duct bank through its entire length.
- M. Install 4 inch conduits in duct banks spaced 3 inches apart to all sides using support separators designed for the purpose of maintaining consistent spacing between conduits along the entire pathway (refer to SK).
- N. Seal all joints prior to pouring any slurry or concrete encasement to prevent moisture from penetrating over the life of the duct bank.
- O. Install pull ropes in each conduit. Pull rope between pull points must be unidirectional, such as DuPont™ Kevlar® Pulling Tape with up to 1,250 lbs. of tensile strength. Install additional 10 feet of pull rope slack at each pull point, coiling the slack within the end of the conduit, just behind the duct plug.

## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

As a guideline, the following capacities should be provided:

<u>Total Building Area</u>	<u>Number of 4 in. Conduits</u>
Less than 50,000 ASF	2
50,000 - 100,000 ASF	4
100,000 - 300,000 ASF	8
300,000 - 500,000 ASF	9
500,000 - 700,000 ASF	10
More than 700,000 ASF	12

### 2 INNERDUCTS

- A. Innerducts are primarily used for routing fiber optic cabling within a 4 inch conduit in order to maximize the use of the conduit. Typically, a 4 inch conduit will have four 1 inch innerducts of different colors, and at minimum one of the conduits must be fully populated with innerducts. IST-Telecom standard colors are Blue, Black, White, and Orange (refer to [SK702](#)).

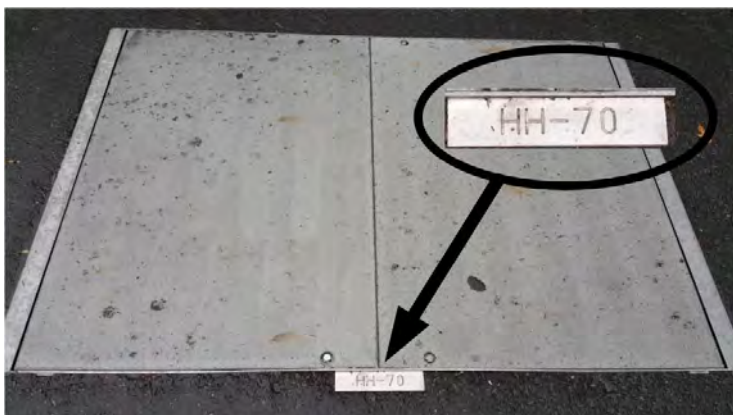
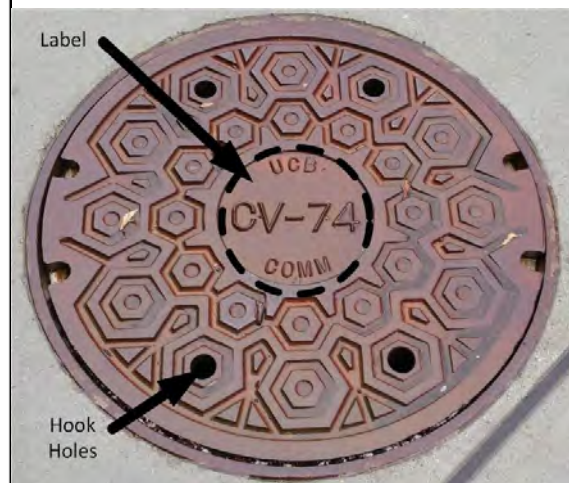
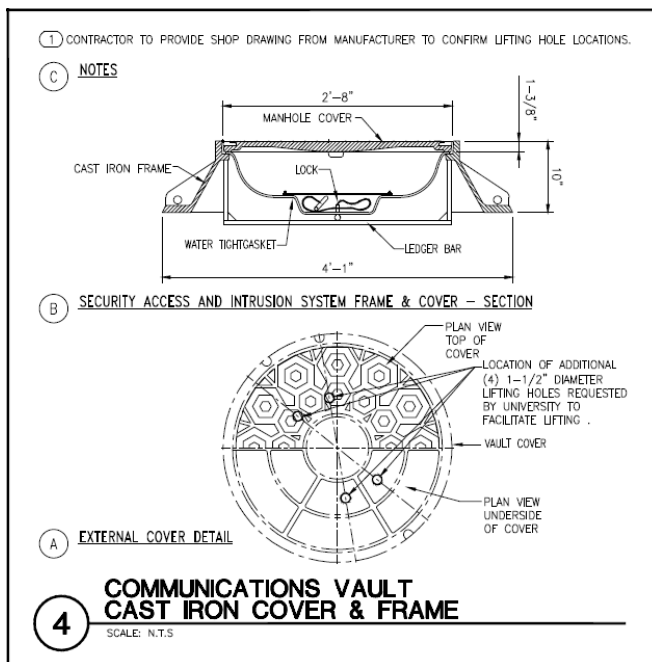


- B. Innerduct(s) must be continuous and ribbed inside with smooth outside with low friction surface internally, containing no welds or joints. Material shall be extruded high-density polyethylene (HDPE) resin in accordance to the requirements of ASTM D3350 Type III.
- C. Each innerduct shall contain a pre-installed mule tape with footage marker and pull tension rating of 1,250 pounds tensile strength.
- D. Within a 4 inch conduit, install four different colored innerducts, consisting of white, orange, blue, and black, oriented the same within the conduit pathway throughout the entire route between origin and destination.
- E. Spare innerduct(s) may be used within an existing campus duct bank segment if available. If the last innerduct in a 4 inch conduit is utilized, the project needs to place four new 1 inch innerducts in an adjacent empty conduit for future cabling so there is always spare innerducts through the campus duct bank system.
- F. In cases where a project may have existing cabling in a conduit, but innerduct was not installed and used, fabric type innerduct (such as MaxCell™ fabric multi-cell pathway) may be used in lieu of hard innerduct to provide sub-ducting for additional cabling with a minimum of three cells, each with a different color identifier and pull string.

## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

### 3 VAULTS

- A. Install vaults 6 feet by 8 feet in plan view, and 7 feet deep minimum, with a pre-manufactured base. Anything smaller is referred to in this documentation as a pull box (refer to [SK700](#) as example). Install a Jensen precast vault #K612AT7 with a wall thickness of 6 inches and 6 inch by 36 inch intercept knockout.
- B. The shorter sides are typically used for main conduit bank penetrations for the normal flow of cable routing. The longer sides are used for feeder conduit branching off the main bank.
- C. Locate conduits branching off on the longer side near the edges of the vault wall for proper cable management and to keep cabling out of the central area of the vault. Cables routing through the long wall must exit the vault/pull box at the opposite end of the vault than where it enters.
- D. Locate conduits branching off on the long side walls at the farthest point from the direction of the cable run from a Zone Distribution Facility (ZDF) to the target building.
- E. Access to vaults consist of a minimum 36 inch circular lid, identified as communications by UCB IST-Telecom's labeling standards. Any vault/pull box within a potential traffic area must contain a traffic rated lid. Install LockDown Security Device™.



## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

- F. Do not locate vaults beneath roadways, especially public roadways.
- G. Where vaults must be located at a higher elevation than the penetration point of a building, the vaults must contain a sump hole with pump that drains directly to the areas nearest storm drainage system. The vault must also have power to operate the vault's pump. The pump must be protected by a cast iron grate.

In the event a drain cannot be tied directly to the storm drain system, install second drainage conduit routed downstream to a vault containing a pump to minimize the build-up of water within the vault.

For vaults not in use, whose base is located below the water table, install a drain cap to prevent groundwater infiltration.

- H. Install P-3200 series channel precast in the sidewalls of the vault along the long sides (entire length of the vault wall up to 18 inches from edges) in three rows two feet apart, centered vertically on the wall for the purpose of racking cables and cable slack. Install minimum 18 inch standoffs rack units.
- I. Install 120V power to each vault requiring a pump. Confer with IST-Telecom for vaults requiring power for miscellaneous use such as lighting. In this case, install GFI receptacles with weather covers affixed to the underside of the vault ceiling. Install a hook for the hanging of a portable light.
- J. Install a removable rung ladder from the center access of the vault to the floor, resting the weight of the ladder and occupants at the floor. Top of ladder must affix to an anchoring system while in use, but removable to allow for cable pulling within the vault.
- K. Install pull-eyes at the floor and at the wall for the purpose of pulling cable. Pull-eye must be pre-cast into the vaults floor and both end walls.
- L. Install white for interior, black for exterior, epoxy based paint for water proofing of vault/pull box surfaces. IST-Telecom does not allow Latex based paint.
- M. Penetrations into a sidewall must be flush with the interior wall. Any new penetration must be cleanly bored and sealed at the exterior with epoxy filler or Room Temperature Vulcanizing (RTV) along with Link-Seal® Assembly.

### INSTALLATION PARAMETERS

The following installation parameters are general and do not cover unique project requirements, as these situations must be discussed and reviewed with IST-Telecom personnel prior to design work for the issues.

#### 1 CABLE ROUTING

- A. Install "J" style rack supports for support of service loops of cabling, affixed to the vertical racking member using the proper mounting bolts and washers designed for the function and properly sized.
- B. All fiber optic cabling must route through innerducts between vaults, with 30 feet of fiber optic cable slack in each vault/pull box, supported at the sidewall such that service loop remains in place until manually removed or repositioned. Wrap the slack on opposite sides of the loop using VELCRO® style wrap, encircling the cable at least twice.
- C. All copper cable routing within a single conduit is dependent on cable size. Install multi-cell fabric innerduct, such as MaxCell™, for copper backbone cable in 100 pairs or less to allow for maximum use of a duct bank conduit.
- D. All cables shall route through the short end, from a Zone Distribution Facility (ZDF), and exit the opposite end against the same side wall when possible. Cable should immediately travel to the sidewall racking system at the level it enters the vault/pull box, providing additional rack supports for their support as required. Multiple cables may rest on the same rack support arm side-by-side only and not resting closer than 2 inches from the end of the racking arm.



## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

- E. Affix the cable to the sidewall racking system using VELCRO® style material for easy removal. Plastic ties may be used provided they do not deform the cable sheath.

### 2 PREPARATION

- A. Survey the entire cable pathway to make sure all components are in place and have been inspected and approved prior to scheduling any cable installation. Survey receiving telecommunications rooms to ensure termination equipment exists and meets termination requirements according to IST-Telecom standards. Install additional equipment as required to support all new cable terminations.
- B. Schedule and notify IST-Telecom and design team at least 5 business days in advance of when cabling will commence between locations. Coordinate and schedule termination of cables with IST-Telecom prior to installing cable, making sure telecommunications rooms have been inspected and accepted by IST-Telecom and are “Room Ready”.
- C. Room Ready means: the room’s equipment has been placed, inspected, and approved, and there is finished power and lighting available within the room, and there are no obstructions that can interfere with the proper pulling and termination of the cabling.

### 3 CABLE PULLING

- A. Do not exceed the pulling tension suggested by the manufacturer for the specific cable installed. In general machine pulling is not allowed on campus, However, if allowed, due to special circumstances, the installer must use a tension break-away tool so as not to exceed the recommended maximum pulling tension published by the manufacturer.
- B. When pulling cable, the cable shall not rest on a fixed object so as not to cause damage to the cable and/or sheathing. When pulling cable, do not exceed bend radius and pulling tension identified in the manufacturer’s published guidelines. Maintain a minimum bend radius of 20 times the cable diameter when pulling cable and 10 times the cable diameter after installation.

### 4 CABLE ROUTING THROUGH EXISTING VAULT AND DUCT BANKS

- A. When routing cabling through existing OSP conduit pathways, survey the existing route to ensure available conduits exist for pulling of new cabling through the entire route. Follow all OSHA safety guidelines for entering a vault or pull box. If a vault within the routing does not contain available empty conduit pathway, to include one spare, contact IST-Telecom immediately to determine how to route the new cabling.
- B. Always contact IST-Telecom in advance of planning a new cable route for OSP to ensure any available empty conduits are not already planned for utilization for a different project. Reserve any new pathways with IST-Telecom to ensure they remain available for the project.
- C. When determining cable routing, select the first empty conduit starting from the lowest right available conduit. If an empty conduit exists, ensure there is at least one other empty conduit for future cable pulling.
- D. When routing fiber optic backbone cabling, determine if there is an available empty innerduct before utilizing an empty conduit. If there is an empty innerduct, but it is the last available innerduct, then install four new innerducts for future fiber optic cabling in that segment of duct bank. Before using the last spare conduit, confer with IST-Telecom to alert them of the issue and to determine action to be taken before proceeding with infrastructure cabling design for the project. Fiber and copper cabling shall not be placed in the same conduit.

### 5 LABELING

- A. All OSP pathway related components must be labeled per IST-Telecom standards. Conduits are labelled at both entry and exit points, and vault/pull boxes are labelled on the covers. IST-Telecom will

## SECTION 3 – OUTSIDE PLANT (OSP) PATHWAYS

provide unique identification numbers for new installations and labelling scheme at beginning of each specific project.

### SKETCHES:

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements for Outside Plant pathways.

[SK700](#) – Vault Detail

[SK701](#) – Vault Grounding

[SK702](#) – Quad Duct Plug

[SK703](#) – Vault Stub-out For Future Pickup

[SK704](#) – Vault Lid Lockdown Security Plate

## SECTION 4 – INSIDE PLANT (ISP) PATHWAYS

### Section 4 - Inside Plant (ISP) Pathways

#### SCOPE

This section describes the requirements for cable pathways within the building. These pathways breakdown into two subsystems, backbone (also described as risers) and user space (also described as horizontal). The riser pathways carry the backbone cables routing between telecom rooms (TR). The user space pathways carry the horizontal cabling from the serving TR to the communications outlets.

The horizontal pathways in the user space may carry the backbone cables in addition to the horizontal cabling. In these instances, the horizontal pathway sizes must account for the extra backbone cabling.

#### DESIGN PARAMETERS

1. BACKBONE PATHWAYS (RISER)
  - A. The inside plant backbone pathways connect the Building Distribution Facility (BDF) to each of the Intermediate Distribution Facility (IDF) rooms in a star topology, and facilitate the placement of the backbone cabling.
  - B. With TRs stacked, install EZ-PATH® SERIES 33 fire rated systems from the BDF room and through each of the IDF rooms within the stack. Quantity to be determined based on planned and future growth (refer to [SK400](#) and [SK401](#)).
  - C. Install additional 4 inch EZ-Path® devices as required to accommodate other low voltage cabling such as audiovisual, security, coaxial, and horizontal cabling transferring between floors. Maintain one empty spare riser EZ-Path® when calculating riser cable volume.
  - D. For cables routing more than 3 feet vertically up a wall, install cable management affixed to the wall and support cabling to the cable management vertically every 18 inches using VELCRO® style wraps. Use of nylon wire ties is prohibited, as they tend to deform cable jacket and can have a negative effect on the cable performance.
2. USER SPACE PATHWAYS (HORIZONTAL)
  - A. The user space pathways, intended for primary pathway support of horizontal cables, generally originate outside the TR and route through the user space. These pathways may also support other Telecommunications low voltage systems cables. However, designers and contractors must obtain prior written approval from IST-Telecom before placing non-telecommunications cables within the horizontal pathways (refer to [SK101](#) and [SK102](#)). Alarm cables are expressly prohibited.
  - B. Typically, user space pathways are composed of cable basket tray and conduit and further breakdown into the following components:
    1. Primary Horizontal Pathways
      - a. Install cable basket tray to within 30 feet of any outlet where possible. Route the basket tray through the main building corridors above the accessible ceiling no higher than 12 inches above the suspended ceiling, leaving 24 inches of side access every 20 feet unobstructed. Install vertical support from the structure above at ends and every 4 feet on center throughout the cable basket tray routing.
      - b. Transition the pathway to large capacity conduits when routing over hard lid and other non-accessible ceiling types, always matching conduit capacity to tray capacity.
      - c. If total number of cables, including projected future growth, is 40 or less, the use of alternate cable hangers may be considered, subject to IST-Telecom approval.

## SECTION 4 – INSIDE PLANT (ISP) PATHWAYS

- 3 SECONDARY PATHWAYS
  - A. Secondary pathways are defined as a cable pathway support system between the primary pathway and the outlet. At minimum, install cable hangers above accessible ceiling.
  - B. Use only Cat5e rated cable hangers with cable retaining devices. Do not allow cabling to rest on non-telecommunication objects. Install a cable hanger on each side of a non-telecommunication object to keep cabling supported only by cable hangers. Route cables under other objects when possible, but maintain a minimum height of 6 inches above the finished ceiling grid and maximum 24 inches.
  - C. Space cable hangers no further than 5 feet on center along the entire hanger path. Last cable hanger must be within 18 inches of the conduit pathway routing to the outlet and shall contain the slack cable loop.
  - D. Cable Hangers shall not contain greater than 40 cables. Take into consideration current and future anticipated growth.
- 4 OUTLET ROUGH-IN (EXISTING INFRASTRUCTURE FOR BUILDINGS USING LEGACY PANDUIT SOLUTION – TYPICALLY PRIOR TO JANUARY 2014)
  - A. For Cat5e cabling, install one 1 inch conduit from the accessible ceiling space, or the primary pathway, to outlet back box.
  - B. Install one square 4-11/16 inch by 2-1/8 inch deep double-gang box with single gang ring for the outlet back box.
- 5 OUTLET ROUGH-IN (NEW BUILDING OR TR USING NEW SIEMON SOLUTION AS OF JANUARY 2014)
  - A. Install one 1-1/4 inch conduit from the accessible ceiling space, or the primary pathway, to outlet back box (for maximum of 4 cables).
  - B. Install one 5 inch square by 2-7/8 inch deep double-gang box with single gang ring for the outlet back box.

### INSTALLATION PARAMETERS

- 1 CABLE TRAY/BASKET TRAY
  - A. Install a cable tray, or basket tray, system consisting of straight sections, field or pre-manufactured bends based on type of tray, splice connectors, support components, and other accessories all by the same manufacturer. Install in accordance with manufacturer's instructions and recognized industry practices, and ensure that the installed system complies with requirements of the NEC and applicable portions of NFPA 70B, NEMA VE-2 "Cable Tray Installation Guidelines" and NECA's "Standards of Installation" pertaining to general electrical installation practices.
  - B. For basket tray, use cutting tool recommended by the manufacturer to ensure there are no sharp edges of any kind in, or around, the tray.
  - C. Install supports at intervals up to 5 feet on center, at turns and end points. Use dual support hangers, trapeze hangers, or wall brackets. Supports should consist of threaded rod with appropriate hardware (nuts, washers, lock-washer, etc.), construction channel, and attachment brackets.
  - D. Install cable trays, or basket tray, parallel or at right angles to the centerlines of columns and beams.
  - E. Install supports using a structurally-approved anchoring system approved by a state licensed structural engineer.
  - F. Do not support cable tray, or basket tray, from ductwork, piping, or other equipment hangers.
  - G. Remove all sharp edges from cable tray or basket tray to prevent damage to cable sheath and injury to personnel maintaining cables and pathways.

## SECTION 4 – INSIDE PLANT (ISP) PATHWAYS

- H. Seismically brace the cable tray, or basket tray, following construction regulations relative to the project's seismic zone. Provide and install for seismic joints were applicable, supporting a minimum 3 feet of cable slack at the seismic joint.
  - I. Installation Clearances:
    - 1. Provide for top access clearance of 12 inches minimum for structures running parallel to the cable/basket tray. Structures running perpendicular, and less than 6 feet in width may cross above or below the cable/basket tray at no less than 6 inches.
    - 2. Provide side access clearance of 24 inches minimum for structures running parallel to the cable/basket tray.
    - 3. Provide a minimum of 6 inches clearance from fluorescent light fixtures, or other EMI sources.
    - 4. Provide a minimum of 4 feet of clearance from any motor or transformer.
    - 5. For structures running parallel to the cable tray provide a minimum of 12 inches of clearance from any flue, hot water, steam line, or other heat producing source, 3 inches minimum for structures crossing perpendicular to the cable tray. For areas not having an air exchange equal to one hour provide a minimum clearance distance of 24 inches.
  - J. Pathway shall not be installed in areas where ambient temperature is above 85 degree Fahrenheit.
  - K. Provide a minimum 12 inch bend radius on all changes in cable direction. For field manufactured bends, such as those for basket tray, install radius shields at each bend/corner of "T" type intersections and cross intersections
  - L. Install blind end caps where cable/basket tray does not terminate at a wall.
  - M. Bonding and Grounding:
    - 1. Refer to [Section 10](#) for additional information on Bonding and Grounding.
  - N. Install manufactured cable drop-outs at locations where cables transition between two different heights of cable tray, or other pathway types, in excess of 6 inches.
2. PRIMARY PATHWAY CONDUITS
- A. Run conduit in groups/banks in the most direct route possible, but parallel to building lines, and at elevations that avoid unnecessary offsets. Do not route conduit through areas in which flammable material may be stored, or near heat sources such as boilers, incinerators, hot water lines, or steam lines.
  - B. Install new conduit free from dents or deformations.
  - C. No bends greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes (contains no continuous section longer than 100 feet). . IST-Telecom does not allow the use of condulets (hard 90's) within pathways.
  - D. Ream conduit ends to eliminate sharp edges, burrs, etc. Install bushings on conduit ends that provide rounded surfaces so as not to deform cable jackets in any manner.
  - E. Bond one end of the primary pathway conduit run to the nearest electrical panel's grounding system, or grounded cable/basket tray within the user space. Multiple conduit banks may be bonded at one end in series to either an electrical panel's grounding system or grounded cable/basket tray.

## SECTION 4 – INSIDE PLANT (ISP) PATHWAYS



### 3 CABLE HANGERS (RATED FOR CAT5E OR ABOVE)

- A. Install a cable hanger system, consisting of hangers, drop wires, straps, threaded rod, and other required accessories, from primary pathways to outlet rough-in. Install in accordance with manufacturer's instructions and with recognized industry practices, to ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Install dedicated supports at a maximum of 5 foot intervals. At minimum, supports consist of #12 drop wire, or one-quarter inch threaded rod, depending on the cable hanger's or strap's requirement. Support wire, or rod using components appropriate for the purpose.
- C. Do not share support (wire/rod) with other trades. Do not support the hanger on ceiling grid support wires.
- D. Do not support the hanger from ductwork, piping, or other equipment hangers.
- E. Install hangers in a manner such that other building infrastructure does not block access to the cable(s).
- F. Install cable hangers a minimum of 6 inches above finished ceiling, and no more than 24 inches above accessible ceilings.
- G. Install a cable hanger within 18 inches of any conduit pathway transition, such as into an outlet conduit stub.
- H. Installation Clearances:
  1. Cables shall not rest upon any other structure not intended for the direct support of the cable(s).
  2. Provide minimum clearance of 6 inches from any EMI sources.
  3. Provide minimum clearance of 4 feet from any motor or transformer.
  4. Provide minimum clearance of 12 inches from flue, hot water, steam line or other heat producing source.
- I. Close cable hanger loop, retainer, or latch after cable installation or removal.

### 4 OUTLET ROUGH-IN

- A. No bends greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes (contains no continuous section longer than 100 feet). IST-Telecom does not allow the use of condulets (hard 90's) within pathways. The use of 45 degree bends are preferred where practical. Do not install bends in opposite directions within 36 inches of each other.
- B. Ream conduit ends to eliminate sharp edges, burrs, etc. For conduits less than 2 inches, install Arlington EMT style plastic bushings on conduit ends. For conduits 2 inches or greater, install Bejed Cable Spillway™.

## SECTION 4 – INSIDE PLANT (ISP) PATHWAYS



5. OUTLET ROUGH-IN (EXISTING BUILDINGS USING LEGACY PANDUIT SOLUTION – TYPICALLY PRIOR TO JANUARY 2014).
- A. Install boxes plumb, square, and matched in height to corresponding electrical outlet. Adjust locations and heights as required to suit coordination requirements. Outlets must be within 16 inches of corresponding electrical outlet.
  - B. Do not daisy-chain outlet boxes.
  - C. Install boxes flush with walls, ceilings, and floors.
  - D. Do not remove fabricated knock-outs without using the opening for a conduit connector. Do not create any additional opening to the back box.
  - E. Framed Walls, both Fire Rated and Non-Rated
    - 1. Do not install outlet boxes back-to-back (outlet boxes facing opposite sides of a wall). At framed walls not fire rated, install boxes with at least 6 inches of separation. At fire rated framed walls, install boxes a minimum of 24 inches apart, or on the opposite side of a framing stud separation, or as dictated by code.
    - 2. For fire rated walls, install fire rated putty pads on outside of outlet box
  - F. Ceilings
    - 1. Install boxes, supports (such as T-bar support bracket), and ring such that the finished condition is flush with ceiling finishes or as required by condition. At non-accessible ceilings, continue the outlet conduit to an accessible location nearest the outlet.

### SKETCHES

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements telecommunications pathways.

[SK100](#) – Basket Style Cable Tray Trapeze Support and Clearances

[SK600](#) – Horizontal Cable Routing Through Full-height Partitions

[SK601](#) – Horizontal Cable Routing Through Low Profile Partitions

## SECTION 5 – OUTSIDE PLANT (OSP) BACKBONE CABLING

### Section 5 - Outside Plant (OSP) Backbone Cabling

#### SCOPE

The Outside Plant (OSP) backbone cabling connects buildings to at least one of the campus Zone Distribution Facilities (ZDF) for voice and data services.

For campus distribution, the cabling will route within the OSP duct bank pathways as identified in OSP Pathways [Section 3](#). The backbone cabling will support voice, data, and other low voltage communications and is comprised of multi-strand fiber optic and multi-pair copper cabling. The cost for extending backbone cabling into new buildings is borne by the project.

#### DESIGN PARAMETERS

Verify with IST-Telecom that the quantity of OSP copper pairs, fiber strands, and cable types meets the project's backbone needs..

- 1 COPPER SPLICE ENCLOSURES AND ACCESSORIES
  - A. Install building entrance type splice enclosures. Install indoor splice enclosures suitable for installation within a telecommunications room (TR) or Entrance Facility (EF) for the splicing of OSP and Inside Plant (ISP) cabling. Either butt-splice or through-splice configurations are acceptable, with either solid sleeve or slip sleeve. Install a re-entry type of splice case for future maintenance or modifications.
  - B. The splice case end caps must allow for multiple 100 pair copper cables exiting the enclosure for 100 pair tie cables between the splice case and the Building Entrance Protector (BEP). Locate the enclosure within a maximum of 50 feet from the point the OSP cable exits the entrance conduit, but always as close to the entrance conduit as possible.
  - C. Install BEPs in 100 pair units, unless otherwise requested, and wall mounted near the entrance conduits. The quantity of BEPs is based on the size of the incoming service cable pairs. Size the enclosure for the size of the incoming service cable and splice bundles housed within the enclosure (refer to [SK507](#) for placement).
  - D. Encapsulant – For splice cases within OSP vaults or pull boxes, install encapsulant suited for keeping out moisture or other contaminants, but allows for re-entry for maintenance.
  - E. Install 25 pair splice modules for copper voice terminations within an enclosure in quantities according to the incoming OSP copper multi-pair cable(s).
  - F. For the BEP, install a 26 AWG gauge 100-pair tie cable as a fusible link between the BEP and incoming copper multi-pair cable.
  - G. Cable transition (OSP to ISP) in TR shall accept mixed solid wire gauges (26-19 AWG). Modules shall accept mixed insulation types (PIC, PVC, or pulp/paper insulated conductors) up to maximum insulation outside diameters of 0.70 inches.
- 2 BUILDING ENTRANCE PROTECTORS (BEP)
  - A. All buildings connected to the University campus must have lightning protection at the entrance where the multi-pair copper enters the building.
  - B. Install the quantity of BEPs based on the total quantity of pairs coming into the building. Wall mount the BEP adjacent to the voice backbone 110 style termination field, as close as practical, but no farther than 25 feet from the farthest 110-backfield termination block.
  - C. For the protector modules within the BEP, install gas discharge tube protector module.



## SECTION 5 – OUTSIDE PLANT (OSP) BACKBONE CABLING

### 3 MULTI-PAIR COPPER TIE CABLE

Install a 100 pair copper multi-pair copper cable between a BEP and the voice backfield for each 100 pair of incoming backbone multi-pair copper. The tie cable should be comprised of copper conductors two gauge thinner wire than the wire used for cross connects and the incoming OSP copper wire, allowing for a failure in the actual BEP such that the wire melts the same as a fuse wire before the cross connect wire. Example: if the OSP wire is AWG #24, then the tie cable wire should be AWG #26 gauge.

### 4 COPPER BACKFIELD TERMINATION EQUIPMENT

- A. Install 5-pair field terminated 110 blocks for the termination of the backbone tie cable(s) between the BEP and the 110 style backfield. Refer to [Section 2 Telecommunication Rooms](#) and sketch Series 500 for additional information and sketches for general room layout of a Building Distribution Facility, (BDF), Intermediate Distribution Facility (IDF), or Entrance Facility (EF).
- B. Confer with IST-Telecom for the placement of the copper backbone field within the room's 110 style termination blocks, leaving a minimum of 10% additional spare capacity for future growth for each 100-pair.

### 5 FIBER OPTIC BACKBONE CABLE

- A. Confer with IST-Telecom for the quantity and types of fiber optic strands required for the specific Project. Install a minimum 24 strand single mode fiber optic cable containing water blocking barrier and suitable for an OSP environment within an in-ground duct bank and vault/pull box.
- B. Review fiber optic cabling type and size with IST-Telecom based on building functional communications requirements.
  1. Fiber parameters:
    - a. Corning Cable Systems, SMF 8.3/125,
    - b. Non-buffer, except at breakout kit
    - c. Mode field diameter equal to 8.8  $\mu\text{m}$ ,  $\pm 0.5 \mu\text{m}$
    - d. Cladding diameter equal to 125 $\mu\text{m}$ ,  $\pm 1.0 \mu\text{m}$
    - e. Core/Cladding concentricity equal to  $\leq 0.8 \mu\text{m}$
    - f. Minimum tensile strength equal to 100,000 psi
    - g. Fiber strength – 110 kpsi minimum
    - h. Color code – EIA/TIA 568, color coding for fiber optic cables.
    - i. Cable jacket marking must be legible and shall contain the following information:
      - 1) Manufacture's name,
      - 2) Manufacturer's part number,
      - 3) Manufacturer's date,
    - j. Fiber count and type (for example, 12F SM for 12 strands of single mode),
    - k. Sequential foot markings
    - l. Minimum performance specifications as follows:
      - 1) Maximum attenuation: 0.4 dB/Km @ 1310 nm  
0.3 dB/Km @ 1550 nm
  - C. If requested, provide a mock up sample consisting of a 100 foot section of 2-strand single mode fiber optic cable terminated in the connectors specified. Perform both the attenuation and OTDR testing ([Section 8 Testing](#)) specified and provide a sample loss budget and sample test printouts for review prior to any termination and testing of fiber optic cabling at the site.
  - D. Have fiber optic cabling delivered to the job site on reels, wrapped to protect the cabling from outside contaminants and damage. The reels must contain the manufactures OTDR traces and power meter attenuation data upon delivery and unpacking witnessed by the Owner's Representative. Test one

## SECTION 5 – OUTSIDE PLANT (OSP) BACKBONE CABLING

fiber strand from each buffer tube at the time of delivery to ensure the fiber cabling has not sustained damage during shipment or in the manufacturing process.

- E. Install, breakout, fusion splice, or direct terminate and test fiber optic cabling. First contact IST-Telecom for the type of termination preferred for the Project.
  - F. Single mode Installations: Install rack-mounted fiber optic termination panel fully loaded with SC single mode couplers. Install a rack-mounted splice shelf for fusion splicing of the single mode strands with pigtails.
- 6 COPPER BACKBONE CABLE
- A. Install a minimum of one twisted multi-pair copper OSP cable, ARMM type, containing a minimum of 100 pairs. Terminate the cable on wall-mounted 110 block Building Entrance Protector (BEP) inside the EF, or BDF room, whichever is applicable for the project. Review cable type and pair count with IST-Telecom.
  - B. Install gel-filled multi-pair cable with sub-sets of 25-pair, color codes to industry standards and sized for the project. Cable(s) must be designed for OSP conditions in an underground duct bank environment.

### INSTALLATION PARAMETERS

#### 1 FIBER OPTIC CABLE TERMINATION AND INSTALLATION

- A. Place all optical fiber OSP cabling within innerduct.
- B. For loose tube fiber optic cables:
  - 1. After dressing the cable to its final destination, remove sheath to a point that allows the strands to be placed in break out kits and terminate in a neat and uniform fashion. Terminate fiber optic cable in compliance with the manufacturer's published instructions.
  - 2. Clamp cable sheaths to the outside of fiber termination shelf using an outside plant cable clamp. Install a cable clamp from the same manufacturer as the fiber optic cable, designed by the manufacturer for the specific purpose.
  - 3. Install the cable and clamp according to the manufacturer's published guidelines.

#### 2 SERVICE LOOPS

Route fiber optic cabling along perimeter walls and install 30 foot service loop in each vault/pull box along the OSP pathways between origin and destination. Place fiber cable loops on sidewall racking system using "J" style rack members attached to strut channel.

#### 3 MUTLI-PAIR COPPER BACKBONE

- A. Route cable between origin and destination, providing splice enclosures as needed, every 900 to 1,000 feet, depending on the length of the run between termination points.
- B. For backbone runs of 100-pair copper cable, route cable within multi-cell fabric pathways within duct bank conduits to maximize the use of each conduit.

#### 4 CABLE INSTALLATION

- A. Use a break-away tool when pulling backbone cables, ensuring not to exceed manufacturers pulling tension requirements or recommendations.
- B. Replace any cable with a damaged sheath.

## SECTION 5 – OUTSIDE PLANT (OSP) BACKBONE CABLING

### LABELING

- 1 INSTALLATION
  - A. Install OSP applicable cable identification tags on cable sheaths at vaults, pull boxes, service loops, conduits, and fiber termination panels.
  - B. Install machine-generated fiber identification tags on the buffered fibers on the back side of the termination panels.
  - C. Install machine-generated two sided fiber identification cards on the front panel of the termination panels.
  - D. Install stainless steel engraved cable identification tags on cable sheaths at vaults, pull boxes, service loops, Conduits, and fiber termination panels.



- E. Refer to [Section 9](#) for additional information on labeling standards.

### TESTING

- 1 GENERAL
  - A. With a power meter and light source test for attenuation to create a loss budget variance schedule of single mode fiber OSP cable strands..
  - B. With an Optical Time Domain Reflectometer (OTDR) create traces of single mode fiber optic OSP cable strands.
  - C. Refer to [Section 8C](#) for detailed information on testing and submission of test results.

## SECTION 6 – INSIDE PLANT (ISP) BACKBONE CABLING

### Section 6 - Inside Plant (ISP) Backbone Cabling

#### SCOPE

The Inside Plant (ISP) backbone cabling connects the Building Distribution Facility (BDF) to each Intermediate Distribution Facility (IDF) or telecommunication room (TR) in a star topology. The cables route within the backbone pathways as described in Section 4. The backbone cabling will support voice, data, and other low voltage communications cabling. The ISP cables comprised of multi-strand fiber optic and multi-pair copper cables.

The ISP backbone cabling, for the purpose of design and installation, refers to both horizontally and vertically routed cable installations within a building. ISP cable does not travel through any underground pathways where environmental conditions can impact the cable.

#### DESIGN PARAMETERS

- 1 FIBER OPTIC BACKBONE CABLE
  - A. Verify with IST-Telecom the quantity of single mode strands needed between the building's BDF and each IDF room. Install one single mode fiber optic cable to each IDF.
  - B. All fiber optic cabling must be delivered to the job site on reels, wrapped to protect the cabling from outside contaminants and damage during shipping. The reels must contain the manufactures Optical Time Domain Reflectometer (OTDR) traces and power meter attenuation data upon delivery and unpacking witnessed by the Owner's Representative. One fiber strand from each buffer tube must be tested at the time of delivery to ensure the fiber cabling has not sustained damage during shipment or in the manufacturing process.
  - C. Install fiber optic plenum rated armored cables, building distribution type (for example, Material Identification Code (MIC/DX) type), containing a minimum of 24 strands of single mode, terminated using SC style connectors into a rack-mounted fiber patch panel at each end.
  - D. Fiber optic patch panels shall be an enclosed housing for protecting, storing and organizing the termination of fiber cable(s) and fiber strands. Install means to strain relieve and support the specified cables. Install facilities to store fiber slack, fiber splices, and patch cord management.
  - E. Install passive physical equipment and apparatus used in terminating, interconnection, and cross-connecting fiber optic cabling in fiber optic patch panels. Equipment shall possess a minimum fire resistant rating of UL94V-1, and shall conform to existing Occupational Safety & Health Administration (OSHA) health and safety laws.
  - F. Install rack-mounted fiber optic patch panels.
  - G. Install cable(s) suitable for indoor installation, between floors in vertical riser system and communications pathways through overhead ceiling space, such as cable tray or conduit.
  - H. The fiber optic cable shall meet flame rating of NEC (Article 770) rated as OFCP and UL listed as such.
  - I. Terminate the single mode cabling on panels with pre-manufactured pig-tails, fusion spliced
- 2 CABLE CHARACTERISTICS:
  - A. Ensure transmission performance that is not significantly affected by environmental fluctuations, installation, or aging.
  - B. Materials shall not contain hydrogen in quantities that will increase light attenuation.
  - C. Each fiber shall be completely covered with a "primary coating" (acrylate material). Coating diameter = 250  $\mu\text{m}$ ,  $\pm 5 \mu\text{m}$ .

## SECTION 6 – INSIDE PLANT (ISP) BACKBONE CABLING

- D. Each coated fiber shall be fully covered with a material extruded over and directly onto the coating – referred to as the tight buffer. Tight buffer diameter = 900  $\mu\text{m}$ ,  $\pm 5 \mu\text{m}$ . Material = Poly Vinyl Chloride (PVC), or Equal flame retardant thermoplastic.
- E. Buffered strands shall be individually color-coded to meet the requirements of ANSI/TIA/EIA-598-A-1995. (Also, ref. ANSI/ICEA S-83-596-1994, and EIA-230)
- F. The cable shall have an internal strength element such as aramid yarn (e.g., Kevlar).
- G. The fiber optic cable shall have a seamless inner jacket (material = PVC, or Equal) applied to and completely covering the internal components (fiber strands, strength element, other).
- H. For armored fiber optic cable, the cable shall have an interlocking metallic or plastic armor applied spirally and longitudinally to and completely covering the cable.
- I. The cable shall have a seamless plenum rated outer jacket (material = PVC, or Equal) applied to and completely covering the armor. The cable shall have a minimum tensile strength of 150-lb rated load.

### 3 COPPER BACKBONE CABLE

- A. Copper backbone cabling shall consist of a minimum 25 pair Category 3 unshielded twisted pairs (UTP) cable. Cable pair color shall follow industry standards for color coding and consist of 24 AWG strands of copper. Each strand must have a PVC insulation coating and contain a cable sheath of plenum rating for horizontal runs and riser rating for vertical runs. Cable run between floors must be contained in conduit or fire rated penetrations such as EZ-PATH™ meeting local fire codes for the type of penetration.
- B. Install armored type cabling for cabling that passes through an exposed area where there is a potential for damage.

### 4 COPPER BACKFIELD TERMINATION EQUIPMENT

- A. Install 5-pair field terminated 110 style blocks for the termination of backbone multi-pair copper cable. Refer to "[Section 2 – Telecommunication Rooms](#)" for additional information and Sketches for general room layout of a BDF, IDF, TR, or Entrance Facility (EF).
- B. Confer with IST-Telecom for the placement of the copper backbone backfield within the room's 110 style termination towers, leaving a minimum of 10% additional spare capacity for future growth in 100-pair increments.

## INSTALLATION PARAMETERS

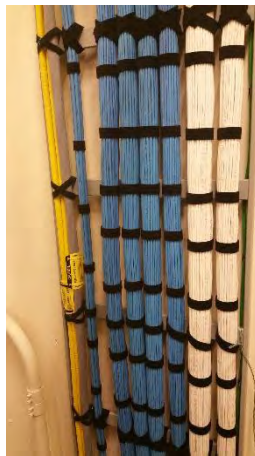
### 1 GENERAL

All cables must contain a continuous sheath and be homogeneous in nature. Splices are not permitted.

### 2 ROUTING

- A. Do not support or attach cables to piping or structures not specifically designed and intended for the support of telecommunications backbone cabling while routing vertically or horizontally.
- B. When routing horizontally, utilize the overhead cable tray/runway designed for support of communications cabling. Keep backbone cabling, when routing in cable tray/runway, to the side and separate from other types of low voltage cabling.
- C. When routing within a TR and exposed vertically more than 18 inches, utilize the wall mounted vertical cable runway, supporting the cable at the runway every 18 inches using VELCRO® style wrap. If routing vertically in a non-rated riser space, support cable using Millipede™ plenum rated reusable wraps.

## SECTION 6 – INSIDE PLANT (ISP) BACKBONE CABLING



- D. For managing cabling horizontally or vertically on a wall that is not supported by runway, install open access style “D-Rings”...

### 3 CABLE DROP-OUTS

Install cable drop-outs for cabling that transitions more than 6 inches to a different level of support, or when transitioning over the side of the cable tray/runway. Install drop-outs from the same manufacturer of the cable tray/runway that the cable is supported from. Install a graduated bend radius equal to or greater than that specified by the manufacturer’s guidelines. Install the drop-outs properly so they remain in place over the life of the supporting tray/runway.

### 4 COPPER BACKBONE TERMINATION

- A. Route copper backbone into 110 style tower(s) from the top and terminate on 5-pair field terminated blocks assigned by IST-Telecom for building backbone voice field in industry standard 25-pair groups ordered by color code of each pair. Use only a proper 110 style termination tool for terminations. Pairs must remain twisted within one half inch of the actual termination point.
- B. At each bend in the cable, maintain a bend radius according to manufacturer’s published guidelines for the cable type installed.
- C. Install grounding for any armored CAT3 cable at the originating end of the cable at the TR (refer to [Section 10 – Bonding and Grounding](#) for additional information).

## SECTION 7 – HORIZONTAL CABLING GENERAL REQUIREMENTS

### Section 7 - Horizontal Cabling General Requirements

#### SCOPE

This section describes the general design and installation requirements for the horizontal (outlet) cable segment of the telecommunications structured cabling system. The horizontal cabling segment provides the connectivity for voice and data from the serving telecom room (TR), either a Building Distribution Facility (BDF) or an Intermediate Distribution Facility (IDF), to the user space (US) work area.

This section further breaks-down into sub-sections addressing different cable types and criteria for selecting the horizontal cable appropriate for the project.

#### DESIGN PARAMETERS

The basic types of horizontal cable are unshielded twisted pair (UTP) Category 5e (Cat5e) and foil wrapped twisted pair (F/UTP) Category 6A (F/UTP Cat6A) cabling. Building function and user bandwidth requirements dictate the type and configuration of horizontal cabling.

##### 1 CABLE TYPE DETERMINATION

- A. EXISTING BUILDINGS (prior to 2014) SERVICED FROM AN EXISTING TR (refer to [Section 7A](#))

Traditionally, University of California Berkeley (UCB) has deployed the following configuration.

- 1. Data = UTP Cat5e plenum rated cabling terminated on wall mounted Cat5e rated 110 style blocks
- 2. Voice = UTP Cat5e plenum rated cabling terminated on wall mounted Cat5e rated 110 style blocks

- B. NEW BUILDINGS OR NEW TRs IN EXISTING BUILDINGS (as of 2014) UCB deploys a mixed cabling configuration (refer to [Section 7B](#))

University of California Berkeley (UCB) has deployed the following configuration.

- 1. Data = Siemon's UTP Cat5e plenum rated cabling terminated on rack mounted Cat5e rated patch panel
- 2. Data = Siemon's F/UTP Cat6A plenum rated cabling terminated on rack mounted Cat6A rated modular patch panels (for 10GBASE-T)
- 3. Voice = Siemon's UTP Cat5e plenum rated cabling terminated on wall mounted Cat5e rated 110 style blocks

##### 2 OUTLET/FACEPLATE CONFIGURATION

- A. Each standard telecom outlet receives a complement of three cables (unless otherwise approved), with two cables dedicated to data and one cable dedicated to voice, terminated in a T568A configuration at the outlet and TR. Non-standard configurations are allowed based on customer specification. Confirm port locations for Data and Voice cables with IST-Telecom prior to installation.
- B. IST-Telecom's standard for cable jacket color is BLUE for data and WHITE for voice.
- C. Data cables are terminated at the outlet on ports 1 and 2 of the faceplate. Voice cable is always placed in the bottom right port of the faceplate. For new TRs, data cabling is terminated on equipment rack mounted patch panels, keeping cable types on their own patch panel separate from each other.

##### 3 OUTLET/FACEPLATE DEPLOYMENT

Final user requirements and equipment layout determine the outlet configuration and cable quantity per faceplate. As a guide for the outlets configuration, UCB recommends the following, each with a complement of three cables unless otherwise noted.

## SECTION 7 – HORIZONTAL CABLING GENERAL REQUIREMENTS

- A. Standard Offices: two outlets
- B. Large Offices: three outlets
- C. Cubicle: one outlet
- D. Small Conference Rooms: two outlets
- E. Large Conference Rooms: three outlets, one floor outlet beneath the conference table and two additional outlets to support audiovisual equipment
- F. Copy/Fax Rooms: One outlet minimum
- G. Classrooms: One outlet per presenter location and as required to support audiovisual equipment. Typically, student desk do not receive hard-wired data connections. For wireless coverage the recommended standard is one wireless access point for every 24 non-hardwired seats, or portion of, in a class room when using dual radio access points.
- H. Labs: One outlet per presenter location and as required to support audiovisual and lab specific equipment. For wireless coverage the recommended standard is one wireless access point for every 24 non-hardwired stations, or portion of, in a lab when using dual radio access points.
- I. Building Support Rooms: one outlet
- J. Building Systems: one to two cables per control panel (e.g. elevators, fire alarm, security, dashboards, etc.)
- K. Wireless: one outlet with one Cat5e cable per location as identified on the predictive wireless survey

See end of this section for outlet and cabling requirements for building systems and Wi-Fi wireless access point (WAP) outlets.

### 4 PATCH CORDS

IST-Telecom provides and installs patch cords required in the TR. Users must provide and install patch cords for outlet locations. If horizontal cable is F/UTP Cat6A (yellow jack), patch cable must be Siemon Cat6A to match the horizontal cabling if connection is 10GBASE-T. ..If connection is 1GBASE-T, it is recommended, though not required, that a matching Cat6A patch cord be used.

## INSTALLATION PARAMETERS

### 1 GENERAL

- A. Cables shall be of the same type and manufacturer. Route cables with a continuous sheath. Splices are not permitted.
- B. Maintain a minimum bend radius equal to published requirements of the manufacturer of the cabling. In the absence of published guidelines, provide a minimum of 6 inch bend radius during and after installation.
- C. Maintain manufacturer's published guidelines for pulling tension.
- D. Place cables without kinks, twists, or impact damage to the sheath, as such cabling is considered damaged according to IST-Telecom standards. Replace cable if damaged during installation.
- E. Install a pull string along with cables when routing through conduit. Tie off ends of pull string in accessible ceiling space to prevent the string from falling into the conduit, or becoming inaccessible.
- F. Install a pull string in any empty telecommunication, security, or audiovisual conduit.
- G. Install a pull string in any empty telecommunication, security, or audiovisual cable trays.



## SECTION 7 – HORIZONTAL CABLING GENERAL REQUIREMENTS

### 2 ROUTING

- A. Maintain maximum tested cable length of 90 meters (295 feet) from the termination in the BDF/IDF/TR to the termination at the user's outlet faceplate.
- B. When routing horizontally within a TR, utilize the overhead cable runway system as described in Section 2. Utilize the wall mounted vertical cable runway and support cables every other ladder rung using VELCRO® style wraps.
- C. Place and suspend cables in a manner to protect them from physical interference or damage.
- D. Route cables 6 or more inches from sources of electromagnetic interference (EMI) and 4 or more feet from any motor or transformer.
- E. When routing cables in areas without cable tray or conduit, support cables utilizing cable hangers intended for Cat5e or higher communication cables. Route these cables under building infrastructure such as ducts, pipes, conduits, etc., to provide cable accessibility in the future. Do not route cables over building infrastructure if possible. Do not route telecommunications cabling such that it obstructs access to service points for mechanical, electrical, plumbing, (MEP) utilities and access hatches, panels, valves, smoke and fire alarms, etc. Place hangers every 4 feet.
- F. Do not tie cables to building infrastructure components such as, pipes, ducts, support wire and rods, conduits, wall studs, etc.
- G. Route cables parallel with natural building lines at 90-degree angles, allowing for mandatory bending radius. Do not route through a work space if a corridor borders at least one wall of the work space/room.
- H. Provide 4 feet minimum sheathed cable slack loop at the work space end of the cable route. Place slack within accessible space above the ceiling and within 18 inches of the transition into the outlet pathway conduit.
- I. Place a plenum rated cable tie (VELCRO® style or Millepede) at the bottom of the slack loop to keep cable units together.
- J. When exiting the cable/basket tray in the user space, exit over the top of the tray, not through the tray. Lightly secure the cable(s) to the cable/basket tray's edge using an approved plenum rated VELCRO® style cable wrap.

### 3 TERMINATION

- A. Terminate cable according to T568A wiring scheme.
- B. Properly strain relieve cables at termination points per the manufacturer's published guidelines.
- C. Install a 4-port faceplate for standard outlets mounted to single-gang mud rings, providing blank inserts for unused ports at the faceplate. 6-port faceplate mounted to double-gang mud ring may be used if higher density is required.
- D. For outlets in modular furniture, install the requisite adapters or bezels applicable to the specific furniture type. Select adapters that have a built-in window for the faceplate label if possible. For building systems type outlets, refer to paragraphs below for requirements.
- E. Perform terminations in accordance with manufacturer's instructions and ANSI/TIA-568-B/C standard installation practices. Use only recommended termination tools for both cable preparation and termination.
- F. Label each cable at both ends according to labeling standards [Section 9 Labeling](#).
- G. Test and report test results for each cable according to IST-Telecom standards (refer to [Section 8B Testing](#)).

## SECTION 7 – HORIZONTAL CABLING GENERAL REQUIREMENTS

### WI-FI WIRELESS ACCESS POINT (WAP) CONNECTIONS

Each new building or remodel project will require outlets deployed throughout the building for IST-Telecom to activate UCB's wireless network, currently using Cisco dual radio access points. Typically, the project installs the cabling and outlets, and IST-Telecom installs and configures the Wi-Fi access points (refer to [Section 11 – Wireless Access Points](#) for additional information).

### BUILDING SYSTEMS CONNECTIONS

#### 1 FIRE ALARM PANEL

Terminate the cable connections for the fire alarm control panel on a surface mounted biscuit block outlet box with a jack for each required cable. Determine the size of the biscuit block box based on the quantity of cables required for the system. IST-Telecom does not accept hard-wired connections directly to the panel's connection points unless over-ruled by the Inspector of Record (IOR). Place the biscuit block outlet box inside the panel or in an adjacent secure box that is directly connected to the fire alarm panel with a conduit sized to easily allow the insertion of a manufacturer terminated patch cord (based on the quantity of cables).

#### 2 ELEVATOR CONTROL PANEL

Terminate the cable connection(s) for the elevator control panel(s) on a surface mounted biscuit block style outlet box with a jack per required cable. Determine the size of the box based on the quantity of cables required for the system. IST-Telecom does not accept hard-wired connections to any elevators control system unless over-ruled by the IOR. Place the biscuit block outlet box inside the cabinet for elevator panel or in an adjacent secure box that is directly connected to the elevator control panel with a conduit sized to easily allow the insertion of a manufacturer terminated patch cord (based on the quantity of cables).

#### 3 SECURITY SYSTEMS CONTROL PANEL

For wall mounted equipment, terminate the cable connection(s) for the security control panel(s) on a surface mounted biscuit block style outlet box with a jack per cable. IST-Telecom does not accept hard-wired connections. Place the biscuit block style outlet box inside the security cabinet or inside the cable management gutter channel dedicated to the security system. This typically applies to the security access control and alarms monitoring system panels.

#### 4 LIGHTING CONTROL PANEL

Terminate the cable connection for the lighting control panel on a surface mounted biscuit block style outlet box with a jack per cable, or install a wall outlet with the standard rough-in. Determine the size of the box based on the quantity of cables required for the system. IST-Telecom does not accept hard-wired connections. Locate the outlet adjacent to the lighting control panel.

#### 5 EMERGENCY "BLUE LIGHT" PHONES

- A. For each emergency blue light phones who's pathways may be underground or below slab, install and terminate two OSP rated Cat5e 4 pair UTP cables on a surface mounted biscuit block style outlet box with one jack per cable. Place the biscuit block inside the connection box for communications within the base of the emergency "blue light" phone column so that the connection is easily accessible.
- B. IST-Telecom will install the final connection and ensure dial tone is active, program, and test each phone.

## SECTION 7 – HORIZONTAL CABLING GENERAL REQUIREMENTS

### SKETCHES

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements for the horizontal cabling segment.

[SK200](#) – Faceplate, Four-port Labeling

[SK201](#) – Faceplate, One-port Wall Phone Type

[SK203](#) – Horizontal Cable Labeling

[SK805](#) – 110 Tower Bonding

[SK900](#) - Wall-mounted Emergency Blue Light Phone Enclosure Wall Installation Cut-Out Info

[SK901](#) – Wall-mounted Emergency Blue Light Phone

[SK902](#) – Emergency Blue Light Phone Base

## SECTION 7A – HORIZONTAL CABLING CAT5E – EXISTING TR PRIOR TO 2014

### Section 7A - Horizontal Cabling CAT5E – Existing TR Prior to 2014

#### SCOPE

This paragraph describes the specific design and installation requirements for Category 5e (Cat5e) horizontal (outlet) cable segment of the telecommunications structured cabling system for **existing buildings from an existing Telecommunications Room (TR)**. Refer to Section 7 for general design and installation requirements for the horizontal (outlet) cable segment of the telecommunications structured cabling system. The following design and installation criteria is intended only for existing buildings whose infrastructure will remain, and originating from an existing TR to the User Space (US) for data and voice services.

Always contact and receive written approval for the use of **non-Siemon's** Category 5e cabling at the beginning of a project and prior to specifying the structured cabling system appropriate for the installation.

#### DESIGN PARAMETERS

Standard outlet locations receive Cat5e cabling for voice and data.

##### 1 ROUTING

- A. Route incoming horizontal Cat5e cabling into the TR on the upper most cable runway toward the 110 wall field and transition down off the runway on the wall side of the runway, utilizing drop-out waterfalls to maintain proper bend radius, into the backside of the vertical 300-pair, or 900-pair 110 tower, designated for voice or data. Dress cables as they transition down the wall.
- B. Where cabling transitions more than 18 inches from the point the cabling enters the TR to the upper most runway, install wall mounted open access style D-Rings for cable management and support, lash the cable bundle to D-ring using VELCRO® style wraps.

##### 2 OUTLET CONFIGURATION

Each standard telecom outlet receives a complement of three cables, with two Cat5e cables dedicated to data and one Cat5e cable dedicated to voice. Locate the data cables in ports 01 and 02 and the voice cable in port 04 of the four-port faceplate. Non-standard configurations are allowed based on customer specification. Confirm port locations for Data and Voice cables with IST-Telecom prior to installation.

##### 3 CAT5E HORIZONTAL CABLING

IST-Telecom uses an unshielded twisted pair (UTP) Cat5e plenum rated 4-pair cable with 24 AWG solid copper conductors.

- A. All cables shall be plenum rated, suitable for indoor installation, in an air-plenum environment.
- B. Each and every cable run shall be a continuous single cable. Splices are not permitted.
- C. The cable shall contain four twisted pairs. Each twisted pair shall consist of two conductors insulated with a flame retardant thermoplastic material. All twisted pairs shall be individually color coded to industry standards (ANSI/ICEA Publication S-80-576, and EIA-230). All conductors shall be 24 AWG solid copper.
- D. The cable sheath shall be unshielded, and shall be covered with a seamless overall outer jacket consisting of a flame-retardant material, such as low-smoke polyvinyl chloride (LS-PVC).
- E. The cable shall be NEC rated as CMP, and UL listed as such.
- F. The electrical performance of the overall cable & twisted pairs shall comply with ANSI/TIA/EIA-568-A requirements for Category 5e UTP cabling.

## SECTION 7A – HORIZONTAL CABLING CAT5E – EXISTING TR PRIOR TO 2014

- G. Cabling shall have foot markers the entire length of the cable spaced one foot on center maximum.
- H. Cabling manufacturer to match existing installation of Cat5e cable. Install white cable for voice and blue cable for data. Cable shall be the same product in all aspects as existing.
  - 1. Belden: Data Twist 1200, Nonbonded-pair, 4-pair, 24 AWG, CMP Cat 5e
    - a. P/N 1213D15U1000 Blue 1,000 ft box
    - b. P/N 1213009U1000 White 1,000 ft box
  - 2. Panduit: 4-pair, 24 AWG, CMP Cat 5e
    - a. P/N PUP5C04BU-U Blue 1,000 ft box
    - b. P/N PUP5C04WH-U White 1,000 ft box
  - 3. Nexans (Berk-Tek): HyperPlus 5e Plenum Rated Category 5e UTP
    - a. P/N 10032227 Blue 1,000 ft box
    - b. P/N 10032223 White 1,000 ft box
  - 4. Siemon: Solution 5e Plenum Cable
    - a. P/N: 9C5P4-E1-06-RXA (BL)
    - b. P/N: 9C5P4-E1-02-RXA (WH)
  - 5. Superior Essex: Marathon LAN Plenum Category 5e
    - a. P/N: 51-241-28 Blue 1,000 ft. POP box
- 4 P/N: 51-241-48 WHITE 1,000 FT. POP BOXCAT5E TERMINATION EQUIPMENT - USER SPACE
  - A. At outlets, terminate the Cat5e cables on Cat5e rated, 8 position Panduit Mini-Com modular connectors, regardless of cable manufacturer used.
  - B. Install a Panduit white 8-position modular connector for voice at the user station, terminated on port 4 of a 4 port faceplate or port 6 of a 6-port faceplate for standard outlets.
  - C. Install a Panduit blue 8-position modular connector for data, terminated on ports 1 and 2 of a 4-port or 6-port faceplate for standard outlets.
  - D. Terminate voice and data cabling per T568A standard
  - E. See product list for acceptable part numbers.
  - F. Flush Mount Outlets – Standard Faceplates
    - 1. Standard workstation faceplates shall have 4 ports.
    - 2. Faceplates shall include all required accessories, such as, blank inserts, labels and label windows.
    - 3. Color: Bright White
    - 4. See product list for acceptable part numbers
- 5 CAT5E TERMINATION EQUIPMENT – TR’S
  - A. At Building Distribution Facility (BDF) and Intermediate Distribution Facility (IDF) TR(s), terminate the Cat5e blue data cables on wall-mounted 4-pair field terminated Cat5e rated 110 style termination blocks farthest from the backbone voice termination, organized into 300-pair or 900-pair towers, whichever is existing and providing additional 110 blocks as required.
  - B. At the BDF/IDF, terminate the Cat5e white voice cables on wall-mounted 4-pair field terminated Cat5e rated 110 style termination blocks adjacent to the voice backbone field and organized into 300-pair or 900-pair towers, whichever is existing, providing additional 110 blocks as required.
  - C. Install vertical wire manager towers in between 300/900-pair 110 block tower(s) and at each end of the termination field for cross-connect wire management.
  - D. Terminate voice and data cabling as T568A.

## SECTION 7A – HORIZONTAL CABLING CAT5E – EXISTING TR PRIOR TO 2014

### SEE PRODUCT LIST FOR ACCEPTABLE TERMINATION EQUIPMENT. INSTALLATION PARAMETERS

#### 1 CAT5E TESTING

Perform Cat5e post-installation testing as described in [Section 8 - Testing](#).

#### 2 CAT5E LABELING

- A. Label Cat5e cables as described in [Section 9 - Labeling](#).
- B. Label modular faceplates as described in Section 9 - Labeling.
- C. Label 110 blocks as described in Section 9 - Labeling.

## SECTION 7B – HORIZONTAL CAT5E – NEW BLDG OR TR AS OF 2014

### Section 7B - Horizontal Cabling CAT5E – New Bldg or TR as of 2014

#### SCOPE

This paragraph describes the specific design and installation requirements for the Category 5e (Cat5e) horizontal (outlet) cable segment of the telecommunications structured cabling. Refer to Section 7 for general design and installation requirements for the horizontal (outlet) cable segment of the telecommunications structured cabling system. The following design and installation criteria is intended only for existing buildings whose infrastructure terminates in a new Telecommunications Room (TR) or a new building with all new TRs.

#### DESIGN PARAMETERS

Standard outlet locations receive Cat5e cabling for voice and data.

##### 1 TYPICAL OUTLET CONFIGURATION

Each standard 4-port telecom outlet receives a complement of three Cat5e 4-pair UTP plenum rated cables. Port 1 and 2 of the faceplate receives the Cat5e cable dedicated to data and Port 4 receives a Cat5e cable dedicated to voice, unless otherwise requested by IST-Telecom.

##### 2 CAT5E HORIZONTAL CABLING

IST-Telecom uses an unshielded twisted pair (UTP) Cat5e plenum rated cable with eight 24 AWG solid copper conductors.

- A. The cable shall contain four twisted pairs. Each twisted pair shall consist of two conductors insulated with a flame retardant thermoplastic material. All twisted pairs shall be individually color coded to industry standards (ANSI/ICEA Publication S-80-576, and EIA-230). All conductors shall be 24 AWG solid copper.
- B. The cable sheath shall be unshielded, and shall be covered with a seamless overall outer jacket consisting of a flame-retardant material, such as low-smoke polyvinyl chloride (LS-PVC).
- C. The cable shall be NEC rated as CMP, and UL listed as such.
- D. The electrical performance of the overall cable & twisted pairs shall comply with ANSI/TIA/EIA-568-A requirements for Category 5e UTP cabling.
- E. Cabling shall have foot markers the entire length of the cable space one foot on center maximum.
- F. See product list for acceptable termination equipment
- G. Acceptable Cable Types
  1. Belden: Data Twist 1200, Nonbonded-pair, 4-pair, 24 AWG, CMP Cat 5e
    - a. P/N 1213D15U1000 Blue 1,000 ft box
    - b. P/N 1213009U1000 White 1,000 ft box
  2. Panduit: 4-pair, 24 AWG, CMP Cat 5e
    - a. P/N PUP5C04BU-U Blue 1,000 ft box
    - b. P/N PUP5C04WH-U White 1,000 ft box
  3. Nexans (Berk-Tek): HyperPlus 5e Plenum Rated Category 5e UTP
    - a. P/N 10032227 Blue 1,000 ft box
    - b. P/N 10032223 White 1,000 ft box
  4. Siemon: Solution 5e Plenum Cable
    - a. P/N: 9C5P4-E1-06-RXA (BL)
    - b. P/N: 9C5P4-E1-02-RXA (WH)

**SECTION 7B – HORIZONTAL CAT5E – NEW BLDG OR TR AS OF 2014**

5. Superior Essex: Marathon LAN Plenum Category 5e
  - a. P/N: 51-241-28 Blue 1,000 ft. POP box
  - b. P/N: 51-241-48 White 1,000 ft. POP box
- 3 CAT5E TERMINATION EQUIPMENT - USER SPACE
  - A. At outlets, Cat5e cables terminate on Cat5e rated, 8 position Siemon modular connectors, regardless of cable manufacturer used.
  - B. IST-Telecom uses a white 8-position modular jack to denote a Cat5e voice port and a blue 8-position modular jack to denote a Cat5e data port.
- 4 CAT5E TERMINATION EQUIPMENT - TELECOM ROOM
  - A. At Building Distribution Facility (BDF) and Intermediate Distribution Facility (IDF) type telecommunication room(s) (TR), Cat5e cables for voice terminate via wall-mounted, Cat5e rated 4-pair field termination 110 style blocks, organized into 300-pair or 900-pair towers, depending on total pair count required. Place wall-mounted vertical wire manager towers between each 300/900-pair tower and on the outer-most ends of the wall fields for cross-connect wire management.
  - B. Install 2RU 48 port discrete port patch panels suitable for installation within a telecommunication room (BDF/IDF) for the termination of the Category 5e horizontal data cables, horizontally oriented for an equipment rack-mounted configuration.
  - C. Install 2RU horizontal cable manager capable of supporting, organizing and patching between the horizontal termination field and network equipment or the equipment termination field.
  - D. See product list for acceptable termination equipment
- 5 USER SPACE – FLUSH MOUNT FACEPLATES
  - A. Standard Faceplates
    1. Standard workstation faceplates shall have 4 ports.
      - a. Faceplates shall include all required accessories, such as, blank inserts, labels and label windows
      - b. Standard faceplates shall be compatible with both the UTP Cat5e and F/UTP Cat6A modular jacks used to terminate horizontal cabling.
      - c. Color: Bright White.
      - d. See product list for acceptable termination equipment
    2. Flush Mount Outlets – Standard Wall Phone Faceplates
      - a. Wall phone faceplates shall come equipped with 1 modular jack and two mounting studs.
      - b. Maintain clearances around outlet during construction according to sketch [SK103](#).
      - c. Color: Stainless Steel.
      - d. See product list for acceptable termination equipment
  - B. Modular Furniture Mount Outlets – Standard Adapters
    1. Standard adapter faceplates for modular furniture shall have four ports.
    2. Standard furniture adapter faceplates shall be compatible with both the UTP Cat5e and F/UTP Cat6A modular jacks used to terminate horizontal cabling.
    3. Color: Black.
    4. Siemon as manufacturer
    5. Modular furniture adapter will need to be confirmed with furniture vendor
  - C. Modular Furniture Feed Point
    1. Single gang faceplate with 1.406 inch pass through hole for cables
    2. Color: Bright White
    3. Wrap cable bundle in spiral wrap for cable protection



## SECTION 7B – HORIZONTAL CAT5E – NEW BLDG OR TR AS OF 2014

### INSTALLATION PARAMETERS

#### 1 CAT5E TESTING

Perform Cat5e post-installation testing as described in [Section 8 - Testing](#).

#### 2 CAT5E LABELING

- A. Label Cat5e cables as described in [Section 9 - Labeling](#).
- B. Label modular connectors/faceplates as described in Section 9 - Labeling.
- C. Label patch panels as described in Section 9 - Labeling.
- D. Label 110 blocks as described in Section 9 - Labeling.
- E. Label equipment racks/cabinets as described in Section 9 - Labeling.

## SECTION 7C – HORIZONTAL CABLING F/UTP (SHIELDED) CAT6A

### Section 7C - Horizontal Cabling F/UTP (Shielded) CAT6A

#### SCOPE

This paragraph describes the specific design and installation requirements for the F/UTP CAT6A horizontal (outlet) cable segment of the telecommunications structured cabling system. Refer to [Section 7](#) for general design and installation requirements for the horizontal (outlet) cable segment of the telecommunications Structured Cabling System (SCS).

#### DESIGN PARAMETERS

F/UTP Cat6A is only installed on an as needed basis. Coordinate outlet locations that receive F/UTP Cat6A cabling with IST-Telecom and user groups for the building being designed at the beginning of the project design. Verify cable quantities for the various room types and the outlet configurations of each.

##### 1 F/UTP CAT6A HORIZONTAL CABLING

Provide Siemon's foil over twisted pair (F/UTP) Cat6A plenum rated cable with the following parameter:

- A. Insulated Conductors: 23 AWG solid copper, fully insulated with a flame retardant thermoplastic material (material = FEP, or equivalent).
- B. Twisted Pairs: Two insulated conductors "twisted" into a "pair" (twisted pair) with individually color-coded twisted pairs to industry standards (ANSI/ICEA Publication S-80-576-1994, and EIA-230).
- C. Flame Rating: NEC (Article 800) rated as CMP, and UL listed as such.
- D. Shield: single overall aluminum/poly with tinned copper drain wire.
- E. Outer Jacket: seamless outer jacket (material = LS-PVC, or similar) applied to and completely cover the internal components (twisted pairs).
- F. Meet or exceed TIA/EIA-568-C.2, ISO 11801 Class E Edition 2.1, and IEEE Std. 802.3an channel requirements for supporting 10GBASE-T.
- G. Siemon Part#:
  1. 9A6P4-A5-06-R1A; Cat6A 4 pair F/UTP cable, "Z-MAX", shielded, CMP – Blue

##### 2 F/UTP CAT6A MODULAR CONNECTORS (PATCH PANEL AND USER OUTLET)

- A. Install yellow modular connectors (jacks) for termination of 4-pair F/UTP cables that are compatible with the cables used.
- B. Install yellow 8-position modular jacks compliant to ANSI/TIA-568-C.2
- C. Each jack shall meet or exceed TIA/EIA-568-C.2 and ISO/IEC 11801 requirements for F/UTP Cat6A cabling. Wire modular connectors as T568A
- D. Siemon Part#:
  1. Z6A-S05; Cat6A 8-position jack, shielded "Z-MAX" jack, hybrid flat/angled, yellow.

##### 3 F/UTP CAT6A TERMINATION EQUIPMENT - TELECOM ROOM (TR)

At Building Distribution Facility (BDF) and Intermediate Distribution Facility (IDF), Siemon's F/UTP Cat6A cables shall terminate on Siemon's Cat6A rated, 8 position, shielded, modular connectors within rack-mounted, 1RU, 24-port discrete port patch panels.

- A. Install discrete port patch panels horizontally oriented on equipment rack and capable of supporting, organizing, labeling and patching between the horizontal termination field and network equipment.

## SECTION 7C – HORIZONTAL CABLING F/UTP (SHIELDED) CAT6A

- B. Flat 1RU patch panels shall support 24-ports, be completely metallic, and suitable for shielded modular connectors.
- C. Bond to rack mounted bus bar following Siemon’s published guidelines.
- D. Siemon Part#:1. 6AS-PNL(X)-24K; Cat6A flat shielded patch panel “Z-MAX”, 24 ports, 1U, black

### INSTALLATION PARAMETERS

#### 1 F/UTP CAT6A TESTING

Perform F/UTP Cat6A post-installation testing as described in [Section 8 - Testing](#).

#### 2 F/UTP CAT6A LABELING

- A. Label F/UTP Cat6A cables as described in [Section 9 - Labeling](#).
- B. Label modular connectors/faceplates as described in Section 9 - Labeling.
- C. Label patch panels as described in Section 9 - Labeling.
- D. Label equipment racks/cabinets as described in Section 9 - Labeling.

#### 3 CAT6A PATCH PANELS

Bond the patch panels to a vertical rack-mounted grounding bus bar with #6 AWG Telecommunication Bonding Conductor (TBC).

## SECTION 8 - GENERAL TESTING INFORMATION

### Section 8 - General Testing Information

#### SCOPE

This section covers general information for cable testing requirements for both Inside Plant (ISP) and Outside Plant (OSP) cabling. Each cabling component requires testing based on industry established testing standards and processes.

It is highly recommended that the designer and contractor contact IST-Telecom directly at the beginning of a project for confirmation on the type and performance requirements meeting UCB IST-Telecom standards.

#### PRE-TEST REQUIREMENTS

This paragraph describes requirements that must be accomplished prior to commencement of any cable testing process for the project's Structured Cabling System (SCS). This pertains to fiber optic cables, as well as copper multi-pair cables either within a building, or between buildings under the support of IST-Telecom.

##### 1 PREPARATION

- A. Adhere to IST-Telecom instructions for test equipment setup.
- B. For OSP fiber cable provide IST-Telecom with manufacturer's test results of their cable that was performed prior to the shipment of the cabling.
- C. Perform required pre-installation cable testing on fiber optic cabling only.
- D. Prior to any testing of fiber optic cabling, the contractor shall notify IST-Telecom by emailing a scheduled date and time for testing, five business days, prior to a scheduled test session. The contractor shall phone IST-Telecom three business days prior to the scheduled testing to determine if IST-Telecom personnel wishes to be present for the beginning of a test session.
- E. Ensure labeling is complete for the cable type being tested.
- F. Provide certificate of calibration on all test equipment prior to testing. Annual calibration is required.
- G. Allow tester to acclimate to the area's current temperature prior to commencing any test.
- H. Confirm with IST-Telecom and UC Berkeley Real Estate Division in writing that the tester being used is capable of exporting the test data to an Excel™ spreadsheet format (tester must be a Fluke DSP 1800 for Cat5e and F/UTP Cat6A).
- I. Confirm with IST-Telecom and UC Berkeley Real Estate Division in writing that the tester being used is capable of performing each test required by IST-Telecom for the cable type being tested.
- J. Submit one test result to IST-Telecom for the cable type being tested prior to continuing with the complete test sequence to ensure the results meet all of IST-Telecom's requirements.
- K. Obtain proper test cords specifically intended for the cable type being tested. Provide 300m launch and receive cables for single mode fiber passive link testing. Provide 100 m launch and receive cables for multi mode fibers. Verify test cords and connectors meet manufacturer requirements prior to beginning any test sequence, include pretest sample for IST-Telecom and UC Berkeley Real Estate Division.
- L. For copper backbone cabling, fill out spreadsheet for each cable and estimate the expected cable length to compare to the actual test results, identifying cable origin and destination.

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

### Section 8A - Testing Backbone Inside Plant (ISP) and Outside Plant (OSP) Fiber

#### SCOPE

This section covers the testing requirements for Inside Plant (ISP) and Outside Plant (OSP) Fiber cabling, a subset of the telecommunications Structured Cabling System (SCS). Each cabling component requires testing based on industry established testing standards and processes established by University of California Berkeley (UCB) Information Services and Technology (IST-Telecom) group.

#### BACKBONE FIBER OPTIC CABLING – ISP/OSP

This paragraph describes the testing requirements and process for ISP and OSP fiber optic cabling between Telecommunication Rooms (TRs) as well as between buildings.

#### 1 GENERAL REQUIREMENTS

##### A. REFERENCES

1. TIA/EIA-526-7 (“OFSTP-7”) Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant
2. TIA/EIA-455-171 Attenuation By Substitution Measurement – For Short-Length Multimode Graded-Index And Single-Mode Optical Fiber Cable Assemblies (a.k.a., FOTP-171)
3. BICSI Telecommunication Distribution Methods Manual

#### 2 DEFINITIONS

- A. “Adapter” (associated with fiber connectivity): Shall mean a connecting device joining 2 fiber connectors, either like or unlike.
- B. “Connect”: Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
- C. “Cord”: Shall mean a length of cordage having connectors at each end. The term “Cord” is synonymous with the term “Jumper”.
- D. “OTDR”: Shall mean Optical Time Domain Reflectometer.
- E. “Passive Link Segment”: Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
- F. “System Cord”: Shall mean the cord used in the operating electrical or optical circuit.
- G. “Test Cord”: Shall mean the cord certified for use in testing, as described in this section.

#### 3 SUBMITTALS

##### A. Submittal Requirements at Start of Construction:

1. Testing Procedures Submittal, describing step-by-step procedures used by the field technicians.
2. Product Submittal, including cut sheets of testing equipment to be used (note all software/firmware versions as applicable).
3. Tester Calibration Certificates for both OTDR and Power Meter Light Source.

##### B. Submittal Requirements at Closeout:

1. Record Documents

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

- a. Submit one soft copy of test reports, of both OTDR and Power Meter and Light Source tests in bi-directional and dual wavelength manner, including all tested parameters. List each cable by UCB IST cable ID, origin, and destination.
- b. Submit one hard copy of test reports, of both OTDR and Power Meter and Light Source tests in bi-directional and dual wavelength manner, including all tested parameters. List each cable by UCB IST cable ID, origin, and destination.
  - 1) Submit one hard copy of warranty certificate from the manufacturer and the Contractor.
2. Format – Soft Copy:
  - a. “Burn” onto one CD-ROM test report files as native data format (for example, an \*.FLW file from a Fluke tester).
  - b. Include onto CD-ROM ‘Viewer’ software necessary to view, sort, filter, and print individual and summary test results from test results native format.
  - c. Clearly label the CD-ROM with the following information:
    - Client Name
    - Project Name and Address
    - CD-ROM Name (e.g., “Test Reports for Backbone Cabling System”)
    - Cable ID Number provided by UCB-IST
    - Date of Submittal – date format: <month> <day>, <year> (e.g., “January 1, 2010”)
    - Contractor Name

### 4 QUALITY ASSURANCE

Under no circumstances shall any cable’s and/or conductor’s test results be substituted for another’s. If a single instance of falsification is confirmed, the Contractor is liable for a complete retest of the cabling system at no additional cost to the Owner. This includes the retaining the services of a neutral party to observe all retesting.

### 5 WARRANTY

Warrant the validity of the test results.

### 6 PRODUCTS

- A. FIBER OPTIC LIGHT SOURCE
  1. Connection interfaces shall be factory installed.
  2. Output shall be continuous wavelengths.
  3. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures
  4. LASER-based light source for singlemode fiber testing shall have a:
    - a. Center wavelength of 1310nm and 1550nm.
    - b. Spectral width (FWHM) of 5nm at 1310nm and 5nm at 1550nm.
    - c. Minimum output power level of 3dBm.
  5. Equipment:
    - a. Corning Cable Systems
      - 1) OS-404RXD; dual wavelength (1310 / 1550) light source for singlemode
    - b. Fluke Networks

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

- 1) "OptiFiber" Test Kit
- 2) DTX-SFM2 Fiber Module, for Singlemode Fiber
- c. Agilent Technologies' WireScope 350 test set
  - 1) 450-2020 Fiber SmartProbe testing adapter, singlemode 1300nm.
  - 2) ScopeData management software (version 5.20).
    - a) Laser Precision
    - b) 5150 test set

### B. FIBER OPTIC POWER METER

1. Power meter for both multimode and singlemode testing shall be capable of measuring relative or absolute power (or both), and must be independent of modal distributions.
2. Power meter used shall have a:
  - a. Dynamic range of 0dBm to -40dBm, minimum
  - b. Accuracy of  $\pm 0.2$ dB
3. Power meter shall be factory calibrated.
4. Equipment:
  - a. Corning Cable Systems
    - 1) OTS-410R power meter
  - b. Fluke Networks
    - 1) "OptiFiber" Test Kit
    - 2) DTX-SFM2 Fiber Module, for Singlemode Fiber
  - c. Agilent Technologies' WireScope 350 test set
    - 1) 450-2020 Fiber SmartProbe testing adapter, singlemode 1300nm.
    - 2) ScopeData management software (version 5.20).
  - d. Laser Precision
5. 5025 test set

### C. FIBER OPTIC OTDR

1. Singlemode Source Module:

Wavelength	Dynamic Range	Attenuation Deadzone	Reflective Deadzone	Loss Resolution	Distance Accuracy
1310nm	40dB	6.0mt	3.5mt	0.001dB	0.1mt
1550nm	28dB	12.0mt	3.5mt	0.001dB	0.1mt

2. Equipment
  - a. Fluke Optifiber OF-500-35 OTDR
3. Agilent Technologies #8147, for singlemode systems
4. Corning Cable Systems
  - a. 2001HR, for singlemode systems
  - b. 340 OTDR Plus Multitester II
  - c. MiniOTDR+, for singlemode systems
5. Tektronix
  - a. TFP2A FiberMaster
  - b. TFS3031 TekRanger2

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

6. Reader Software: Windows-based software capable of reading stored traces and is fully functional with the testing equipment.

### D. FIBER OPTIC TEST CORDS

1. Singlemode Fiber Optic Test Cord
  - a. Singlemode test cords shall comply with TIA-526-14A, 3.1.3.
  - b. The fiber of the singlemode test cord(s) shall have the mode field diameter nominally equal to that of the singlemode fiber optic passive link.
  - c. Connectors of the test cords shall be compatible (the same type) with the connector types of the light source and the power meter, and with the cabling plant.
  - d. The connectors shall exhibit  $\leq 0.5\text{dB}$  loss per connection @ both 1310nm and 1550nm, as measured per FOTP-171 D3. The connectors shall inhibit Fresnel reflections (i.e., have a "PC" finish).
  - e. Test cord length for Optical Power Loss testing: 1m - 5m.

### E. FIBER OPTIC LAUNCH AND RECEIVE CABLES

1. Singlemode Fiber Optic OTDR Launch Cables
  - a. The fiber of the singlemode launch and receive cable(s) shall have the mode field diameter nominally equal to that of the singlemode fiber optic passive link.
  - b. Connectors of the launch and receive cables shall be compatible (the same type) with the connector types of the OTDR, and with the cabling plant.
  - c. The connectors shall exhibit  $\leq 0.5\text{dB}$  loss per connection @ both 1310nm and 1550nm, as measured per FOTP-171 D3. The connectors shall inhibit Fresnel reflections (i.e., have a "PC" finish).
  - d. The launch and receive cable length shall be greater than 300 meters.
  - e. Equipment: Fluke # SMC-9-SCST

## 7 EXECUTION

### A. FIELD QUALITY CONTROL

1. Calibrate test sets and associated equipment per the manufacturers printed instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.
2. Ensure test equipment and test cords are clean and undamaged during testing activities. Per the Engineer's discretion, halt testing activity and clean testing equipment, test cords, and related apparatus.
3. Permanently record test results.

### B. OPTICAL POWER LOSS TESTING REQUIREMENTS AND PROCEDURES

1. Precautions
  - a. Adhere to the precautions described in TIA-526-14A, 5.1.
  - b. Adhere to the equipment manufacturer's instructions during all testing.
  - c. Prior to any testing activity or any measurements taken:
    - 1) Ensure the test equipment is at room temperature – approximately 72 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set until the test equipment reaches room temp).
    - 2) Power on the light source and power meter for at least 5 minutes prior to obtaining measurements.



## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

- 3) Clean all connectors and adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
2. Do not power off the light source or the power meter during testing activity.
3. Do not remove Test Cord #1 from the light source at any time (unless the testing is complete or the equipment is being put away for the evening).
4. Do not bend the test cords smaller than 20 times the cord diameter (this may induce loss into the cord reducing the accuracy of the measurement).

### C. Test Cords Performance Verification

1. Connect Test Cord #1 to the light source and to the power meter.
2. Set this value into the power meter as the reference power (Pref).
3. Disconnect Test Cord #1 from the power meter. Do not disconnect Test Cord #1 from the light source.
4. Connect the 'open' end of Test Cord #1 to an adapter (of matching connector type). Connect one end of Test Cord #2 to that adapter and the other end of Test Cord #2 to the power meter.
5. The value displayed on the power meter represents the test cord #2 connection loss.
6. Flip the ends of Test Cord #2 so that the end connected to the power meter is now connected to the adapter (attached to test cord #1), and the end connected to the adapter is now connected to the power meter.
7. The value displayed on the power meter represents the test cord #2 connection loss on the opposite end.
8. Both connection loss measurements must be less than or equal to the value found in Table 16720-  
 a. Replace cord if measure losses exceed table values.

**Table 7.1:** Acceptable Test Cord Connection Attenuation

	ST or SC Connection	LC or other Mini-Connector
Singlemode	0.55 dB Max	0.30 dB Max

9. Repeat this test procedure from the beginning reversing the test cords in order to verify the performance of test cord #1.

### D. Test Equipment Set Up

1. Follow the test equipment manufacturer's initial adjustment and set up instructions.
2. Set the power meter to Relative Power Measurement Mode
3. Set the meter to display power levels in dBm.
4. Set the light source and power meter to the same wavelength.

### E. Singlemode Passive Link Insertion Loss Testing Procedures

1. Only use test jumpers that comply with the requirements TIA-526-7, 3.1.3.
2. Test Method:
  - a. For 'permanent' links, perform the optical power loss testing of singlemode fibers according to TIA-526-7 test method A.1 "One Jumper-Cable Measurement".

### F. Acceptable Measurement Values

1. Remove and replace any cabling links failing to meet the criteria described in this specification at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

2. The general insertion loss equation for any link segment is as follows:
    - a. Insertion loss = <cable loss> + <connection loss> + <splice loss> + <CPR adjustment>.
    - b. Note: A connection is defined as the joint made by two mating fibers terminated with remateable connectors (e.g., ST, SC, etc.).
  3. Singlemode Attenuation Coefficients
    - a. Cable Loss = Cable Length (km) x (0.50 dB/km @ 1310-nm or 0.50 dB/km @ 1550-nm).
    - b. Connection Loss (ST or SC Connectors) = (Connections x 0.44 dB) + 0.42 dB
    - c. Connection Loss (Other mini-connectors) = (Connections x 0.24 dB) + 0.24 dB
    - d. Splice Loss = Splices x (0.07 dB for fusion or 0.15 dB for mechanical)
    - e. CPR Adjustment = Not applicable for singlemode.
- G. Record Documents:
1. Permanently record all test results.
  2. Submit test results in a format acceptable to the Owner, or Owner's Representative, or Engineer before system acceptance.
  3. Cable and fiber identifiers of the test reports shall match the identifiers as labeled in the field – i.e., use the same ID on the cable label/fiber port label as what is entered into the stored test result in the power meter.
  4. Measurements shall carry a precision through one significant decimal place, minimum.
  5. Passive Link Insertion Loss Testing: Each test report shall contain the following information (not necessarily in this order):
    - a. Project name
    - b. Cable identifier, fiber number, and fiber type (e.g., "singlemode")
    - c. Operator (company and name)
    - d. Date measurement were obtained,
    - e. Measurement direction
    - f. Wavelength
    - g. Loss measurement
    - h. Test equipment model and serial number(s)
  6. Measurements shall carry a precision through one significant decimal place, minimum.
- 8 CHARACTERIZATION TESTING REQUIREMENTS AND PROCEDURES
- A. Safety: Use test equipment containing a laser or LED in accordance with ANSI Z136.2.
  - B. Precautions
    1. Adhere to the equipment manufacturer's instructions during testing.
    2. Prior to testing activity or measurements taken, complete the following activities:
      - a. Ensure the test equipment is at room temperature – approximately 72 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set until the test equipment reaches room temp).
      - b. Turn the light source and power meter power on for at least 5 minutes prior to obtaining measurements.
      - c. Clean test/launch cords' and system cords' connectors and the cabling system adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
    3. Do not power off OTDR's light source during testing activity.
    4. Do not remove launch cord from the OTDR's light source at any time (unless the testing is complete or the equipment is being put away for the evening, or during trouble shooting).
    5. Do not bend the launch cord smaller than 20 times the cord diameter during testing activities (this may induce loss into the cord reducing the accuracy of the measurement).

## SECTION 8A - TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) FIBER

- C. Characterization Testing Procedures
1. Equipment settings / measurement parameters:
    - a. Index of Refraction: match cable-under-test fiber parameters; default settings as follows:
      - 1) Singlemode
        - a) Corning SMF-28e+            1.4670 @ 1310nm    1.4677 @ 1550nm
        - b) CommScope TeraSPEED    1.466 @ 1310nm    1.467 @ 1550nm
    - b. Pulse Width: singlemode: 50 ns
      - 1) Singlemode
        - a) 10 ns for cable lengths up to 2,000 meters
        - b) 50 ns for cable lengths between 2,000 meters and 10,000 meters
    - c. Backscatter
      - 1) singlemode: -74dB @ 1310nm and 1550nm.
    - d. Event Threshold: 0.05dB.
    - e. Reflection Threshold: singlemode: -60dB.
    - f. Fiber Break/End-Of-Fiber: 3dB.
  2. Set the distance units (i.e., the “X” axis of the graph) to feet.
  3. Waveform: The waveform shall be real-time and normal density.
  4. Obtain measurements using ‘launch’ and ‘receive’ cords connected to the test instrument and the cable-under-test.
- D. Record Test Measurements:
1. Permanently record all test data per strand, including the following (minimum):
    - a. Project name
    - b. Contractor name
    - c. Testing technician’s name
    - d. Date measurements were obtained
    - e. Cable identifier, strand number, and fiber type (e.g., “multimode”)
    - f. Wavelength
    - g. Measurement direction
    - h. Full data set
    - i. Curve
    - j. Test equipment model and serial number(s)
  2. Measurements shall carry a precision through one significant decimal place, minimum.

### 9 TESTING FORMS

- A. Fiber Optic Test Instrument Data Sheet
- B. Fiber Optic Reference Power Measurement Method Form
- C. Fiber Optic Relative Power Measurement Method Form

## SECTION 8B - TESTING HORIZONTAL ISP

### Section 8B - Testing Horizontal ISP

#### SCOPE

This section covers the testing requirements for Inside Plant (ISP) cabling subset of the telecommunications Structured Cabling System (SCS). Each cabling component requires testing based on industry established testing standards and processes established by University of California Berkeley (UCB) Information Services and Technology (IST-Telecom) group.

#### HORIZONTAL CABLING – CAT5E

This paragraph describes the testing requirements and process for the Cat5e horizontal cabling segment. This pertains to horizontal data and voice cables for this category. The test to be performed is Cat5e Permanent Link.

##### 1 GENERAL REQUIREMENTS

- A. Adhere to the equipment manufacturer's instructions during all testing.
- B. Permanently record test results and provide them in an electronic report to IST-Telecom. Provide test results on a memory card, thumb drive, or as an email attachment (in LinkWare native format) to IST-Telecom after testing for test results download to UCB's cabling database.
- C. Cable identifiers of the test reports must match the identifiers as labeled in the field. Use the same ID on the tester and test report as it appears on the cable label and cable termination.
- D. Testing may require use of Fluke Permanent Link Adapter (DTX-PLA001) and 110 Adapter (T568A)

##### 2 TEST EQUIPMENT SET UP

- A. Calibrate the test set per the manufacturer's instructions.
- B. Work with IST-Telecom to setup tester, and verify any procedures, naming conventions, etc. **PRIOR** to beginning any testing.

##### 3 ACCEPTABLE TEST RESULT MEASUREMENTS

- A. Overall Test Results:
  1. Links which report a Fail, Fail\* or Pass\* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
  2. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
  3. Remove and replace any cabling links failing to meet the criteria described in this section.
- B. Wire Map: Provide continuous pairs and terminate all of the cabling link correctly at both ends. No exceptions accepted.
- C. Length: Ninety (90) meters, 295 feet tested, is the maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration, including test cords.
- D. Insertion Loss: The acceptable insertion loss measurements for any Cat5e cabling link is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- E. Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss: The acceptable worst pair-to-pair NEXT loss for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- F. Power Sum NEXT Loss: The acceptable power sum PS-NEXT loss for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.

## SECTION 8B - TESTING HORIZONTAL ISP

- G. Worst Pair-to-Pair ELFEXT and FEXT Loss: The acceptable worst pair-to-pair ELFEXT and loss for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- H. Power Sum ELFEXT and FEXT Loss: The acceptable PS-ELFEXT and loss for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- I. Return Loss: The acceptable return loss measurements for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- J. Propagation Delay and Delay Skew: The acceptable propagation delay and delay skew measurements for any Cat5e cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.

### HORIZONTAL CABLING – F/UTP CAT6A

This paragraph describes the testing requirements and process for the F/UTP Cat6A horizontal cabling segment. This pertains to horizontal data cables for this category. The test to be performed is Cat6A shielded Permanent Link.

#### 1 GENERAL REQUIREMENTS

- A. Adhere to the equipment manufacturer's instructions during all testing.
- B. Permanently record test results and provide them in an electronic report to IST-Telecom. Provide memory card, thumb drive, or email attachment (in LinkWare native format) to IST-Telecom after testing for test results download to UCB's cabling database. Contractor is responsible for keeping a backup copy of all test results until UCB-IST-Telecom has signed off on them.
- C. Cable identifiers of the test reports must match the identifiers as labeled in the field. Use the same ID on the tester and test report as it appears on the cable label and cable termination. Provide data for all cables for the installation at the time of submittal.

#### 2 TEST EQUIPMENT SET UP

- A. Calibrate the test set per the manufacturer's instructions.
- B. Work with IST-Telecom to setup tester, and verify any procedures, naming conventions, etc. **PRIOR** to beginning any testing.

#### 3 ACCEPTABLE TEST RESULT MEASUREMENTS

- A. Overall Test Results:
  - 1. Links which report a Fail, Fail\* or Pass\* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
  - 2. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
  - 3. Remove and replace any cabling links failing to meet the criteria described in this section.
- B. Wire Map: Provide continuous pairs and terminate the entire cabling link correctly at both ends. No exceptions accepted.
- C. Length: Ninety (90) meters, 295 feet tested, is the maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration, including test cords.
- D. Insertion Loss: The acceptable insertion loss measurements for any F/UTP Cat6A cabling link is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- E. Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss: The acceptable worst pair-to-pair NEXT loss for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- F. Power Sum NEXT Loss: The acceptable power sum PS-NEXT loss for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.

## SECTION 8B - TESTING HORIZONTAL ISP

- G. Worst Pair-to-Pair ELFEXT and FEXT Loss: The acceptable worst pair-to-pair ELFEXT and loss for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- H. Power Sum ELFEXT and FEXT Loss: The acceptable PS-ELFEXT and loss for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- I. Return Loss: The acceptable return loss measurements for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3.
- J. Propagation Delay and Delay Skew: The acceptable propagation delay and delay skew measurements for any F/UTP Cat6A cable is that which is no greater than that listed in ANSI/EIA-568-C.2, 6.3

## SECTION 8C – TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) COPPER

### Section 8C - Testing Backbone Inside Plant (ISP) and Outside Plant (OSP) Copper

#### SCOPE

This section covers the testing requirements for Inside Plant (ISP) and Outside Plant (OSP) copper cabling, a subset of the telecommunications Structured Cabling System (SCS). Each cabling component requires testing based on industry established testing standards and processes established by University of California Berkeley (UCB) Information Services and Technology (IST-Telecom) group.

#### BACKBONE COPPER CABLING

This paragraph describes the testing requirement and process for copper backbone cabling. This pertains to Category 3 (CAT3) multi-pair cables between or within buildings.

- 1 GENERAL REQUIREMENTS
  - A. Adhere to the equipment manufacturer's instructions during all testing.
  - B. Permanently record test results and provide them in an electronic report to IST-Telecom.
  - C. Identifiers recorded in the test and reports must match the identifiers existing on the cable labels in the field for the project.
  - D. Use the same ID on the tester and test report as it appears on the cable labels and termination.
- 2 TESTING PROCEDURES
  - A. Test continuity and wire map for 100% of cable pairs.
  - B. To properly test the length of each CAT3 cable, test a minimum 2% of pairs of each cable. Perform the test on pairs from different 25-pair binder groups.
- 3 ACCEPTABLE TEST RESULT MEASUREMENTS
  - A. Overall:
    1. Wire map testing consists of continuity, opens, shorts, crossed pairs, and split pairs.
    2. Any reconfiguration of a link component required as a result of a test Fail, must be re-tested for conformance.
  - B. Length
    1. Wire Map: Terminate all pairs correctly at both ends of the cable run and test continuity on 100% of pairs. No exceptions accepted.
    2. Attenuation: The acceptable attenuation measurements for any CAT3 cabling link is no greater than that listed in ANSI/EIA-568-C.2, 6.3 and as adjusted to length measurement of the cable.
    3. Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss: The acceptable worst pair-to-pair NEXT loss is no greater than that listed in ANSI/EIA-568-C.2, 6.3 for CAT3 cabling.
- 4 TEST REPORT INFORMATION
  - A. Provide the following fields of information on each test report (not necessarily in this order):
    1. Project name
    2. Cable identifier, pair number(s)
    3. Date measurement were obtained
    4. Operator (company and name)
    5. Test equipment model and serial number(s)
    6. Measurement results

## SECTION 8C – TESTING BACKBONE INSIDE PLANT (ISP) AND OUTSIDE PLANT (OSP) COPPER

Test Report template can be obtained from IST-Telecom.

Project Name / Number / Other: PIR XX-XXX

Cable Label: Cable Ori - Des XXX pair



University of California, Berkeley

Pair No.	Continuity end-end (Yes/No)	Short (Yes/No)	Pair Reversal (Yes/No)	Cross Pairs (Yes/No)	Split Pairs (Yes/No)	Loop Resistance (Ohms)	Transposition (Yes/No)	Ground [Protector panel fuse] (Yes/No/NA)	Test/Observation Comments: [If pair fails record distance at fail point, in FT]
1									
2									
3									
4									
5									
6									
7									
8									
9									
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## SECTION 9 - LABELING

### Section 9 - Labeling

#### SCOPE

This section describes the scope of work related to the identification and labeling methodology of the various components that form part of the telecommunications infrastructure and Structured Cabling System (SCS) and pathway systems.

Components addressed in this section include, but are not limited to, equipment racks and cabinets, termination components, patch panels and plates, conduit and junction boxes, housings, and fiber, copper and bonding conductors and bus bar.

#### DESIGN PARAMETERS

Labels utilized for the purpose of identifying the various components listed in the Installation Parameters section below shall be machine-manufactured and machine-printed with permanent indelible ink. Labels shall match the hardware identification dimensions specified by the manufacturers. Attention to the font size is required in order to provide readable font sizes while maintaining the specified label size. Handwritten labels are not acceptable except for temporary identification purposes.

Products that are part of the systems included in the standards are expected to be Restriction of Hazardous Substances (RoHS) compliant where applicable.

Manufacturers are required to be International Organization for Standardization (ISO) 9001:2008 compliant.

#### 1 COMPONENTS INCLUDED

Label the components listed below as described in the Installation Parameters section:

- A. Copper / Fiber / Bonding Conductors
- B. Conduits
- C. Junction Boxes/Vaults
- D. Fiber Optic Patch Panels
- E. Horizontal Patch Panels / Housings
- F. Horizontal Cable Outlet Housings / Faceplates
- G. 110 Style Termination Blocks
- H. Equipment Racks / Equipment Cabinets
- I. Firestop Systems

#### INSTALLATION PARAMETERS

##### 1 INDOOR COMPONENTS

- A. Copper / Fiber / Bonding Conductors

Label cable sheaths. Labels shall be machine printed, wrap around, self-laminating, and made of a polyester material. For horizontal distribution cables, position label within 1 inch of the termination. For backbone distribution, position label within 12 inches from the entrance, or exit to terminations, junction boxes, and wall or floor sleeves.

- B. Conduits

## SECTION 9 - LABELING

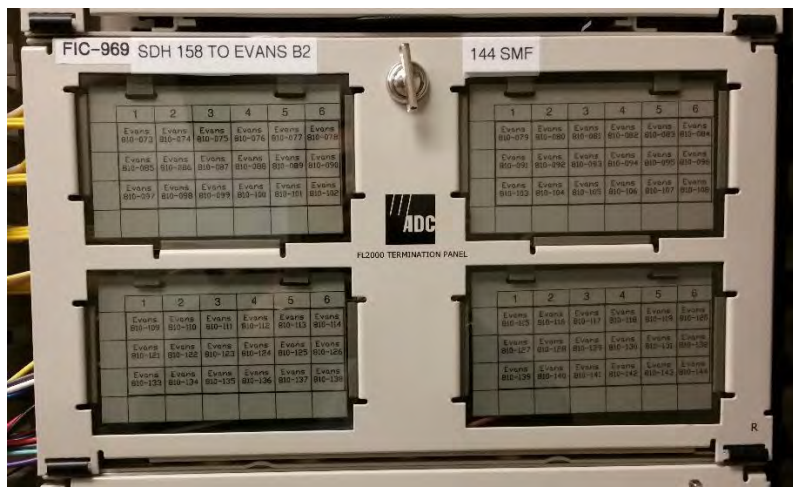
Label each section of conduit with wrap-around labels positioned on the outside, unobstructed and easily readable. The labels shall be machine-generated, self-laminating, made of a polyester material. The labels shall identify the origin and destination of the corresponding section.

### C. Junction Boxes/Vaults

1. Each box is to be labeled with a Marker Plate, attached with mechanical fasteners, positioned on the outside cover or door panel, unobstructed and easily readable.
2. Install non-adhesive marker plate, labeled using a thermal transfer method capable of withstanding harsh environments and exposure to solvents. The labels shall identify the building location or ID corresponding to the project's labeling scheme.

### D. Fiber Optic Patch Panels

Label each fiber optic patch panel and fiber port. Confer with IST-Telecom in advance of labeling to obtain the format and proper label information.



### E. Horizontal Copper Patch Panels

1. Label each horizontal panel on the front and rear top left corners using 3/8 inch lettering, starting with "01" (refer to [SK203](#)).
2. Install machine-generated labels made of a polyester material.



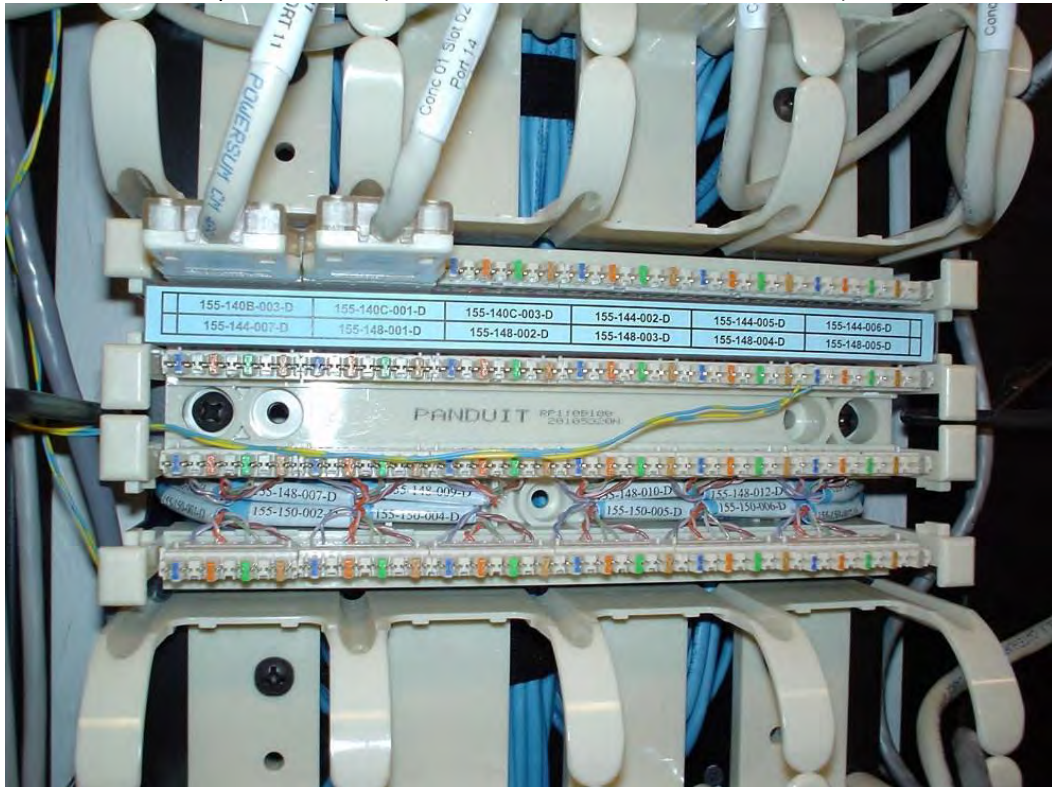
3.

### F. Horizontal Cable and Faceplates

1. Label each terminated cable with a wrap label behind the faceplate. Label each faceplate utilizing the manufacturer-provided installation window (refer to [SK200](#)).
2. Install machine-generated labels made of a polyester material.

## SECTION 9 - LABELING

- G. 110 Style Termination Blocks
1. Label the front rows of each 110 style termination block.
  2. Install machine-generated labels made of a polyester material. The labels shall follow BICSI or project-specific standards for the color selection of the block designation strip.
    - a. Place labeling on cables so they are visible from the front of the 110 style block as shown in the picture below. (Refer to [SK203](#) for additional information).



- H. Equipment Racks / Cabinets
1. Label each rack and equipment cabinet on the top front and rear horizontal bar utilizing a decal strip holder system. Install adhesive-backed reflective labels consisting of individual letters and numbers. The labels shall identify the cabinet location or ID corresponding to the project's labeling scheme.
  2. The rack nearest the wall shall be designated as the first rack in the numbering scheme. Confirm with IST-Telecom for the actual label ID (refer to [SK205](#)).



Rack Label Bracket

## SECTION 9 - LABELING

### I. Firestop Systems

Each through penetration or joint firestop system in fire-rated construction is to be labeled on both sides of the penetration utilizing adhesive-backed labels. The labels shall be bright red to allow for easy Identification of fire-rated systems and provide required information to facilitate firestop maintenance, repair, and inspection.

### EQUIPMENT LABELING SCHEMES

Equipment labeling differs between the type of equipment located in the TR or at the workstation outlet.

- 1 PATCH PANELS:
  - A. Labeled with a 2-digit number starting at 01 in each TR on a 3/8 inch white label placed to the left of the ports (refer to [SK203](#)) e.g., 01, 02...
  - B. Each port labeled 1-24 or 1-48. (Factory stamped labeling is fine).
  - C. There will be no other labeling on the Patch panels.
- 2 110 BLOCKS:
  - A. Machine printed Desi Strips™ showing Cable ID's specified in the project. Starting at 001 in each TR (refer to [SK203](#))
- 3 OUTLETS:
  - A. Full cable ID label machine printed and applied under plastic viewing window (refer to [SK200](#) and [SK201](#)).

### CABLE LABELING SCHEMES

Cable labeling differs whether the project is for an existing building prior to January 2014, a building completely renovated or built after January 2014, or a new TR. The following are the current labeling schemes for data and voice for each condition:

- 1 GENERAL:
  - A. Full cable ID label. Label must be legible without having to disturb cables when Desi Strip is removed.
  - B. Voice cables terminated on wall-mounted 110 blocks in the TR
  - C. Full cable ID label within 6 inches of jack.
- 2 EXISTING BUILDING PRIOR TO JANUARY 2014
  - A. Data or Voice Category 5e
    1. Label Nomenclature

**BUILDING - TR - ROOM – SEQUENCE# - PURPOSE**

**BUILDING:** Is the standard short designator for the building, as acquired from IST-Telecom.

**TR:** Is the TR Room number where the cable Originates.

**ROOM:** Is the room where the Cable/Service Point terminates.

**Sequence#:** Is a numerical value representing the sequence# within the room

**PURPOSE:** Indicates whether the cable is a Data (D) or Voice (V) cable.
- 3 NEW BUILDING OR TELECOM ROOM AS OF JANUARY 2014
  - A. Data Category 5e

## SECTION 9 - LABELING

### 1. Label Nomenclature

#### **BUILDING - TR - ROOM - nnFmmxx - PURPOSE**

**BUILDING:** Is the standard short designator for the building, as acquired from IST-Telecom.

**TR:** Is the TR Room number where the cable Originates.

**ROOM:** Is the room where the Cable/Service Point terminates.

#### **nnFmmxx:**

**nn:** Is the two digit Patch Panel Identifier within the TR.

**F:** Is the letter indicating that the panel is Cat5e (F)

**mm:** Is the two digit Patch Panel Port Number for the cable.

**xx:** Is the character string added to identify special use cables.

**W=WAP**

**C=Camera (UCPD security)**

**D = Distributed Antenna System**

**L=Over Length (cables longer than 295 feet)**

**N=non-standard (e.g., cables that do not go to IST-Telecom Telecom Rooms)**

**PURPOSE:** Indicates the cable is a Data (D) cable.

### B. Data F/UTP Category 6A

#### 1. Label Nomenclature

#### **BUILDING - TR - ROOM - nnSmmxx - PURPOSE**

**BUILDING:** Is the standard short designator for the building, as acquired from IST-Telecom.

**TR:** Is the TR Room number where the cable Originates.

**ROOM:** Is the room where the Cable/Service Point terminates.

#### **nnSmmxx:**

**nn:** Is the two digit Patch Panel Identifier within the TR.

**S:** Is the letter indicating that the panel is Cat6A (S)

**mm:** Is the two digit Patch Panel Port Number for the cable.

**xx:** Is the character string added to identify special use cables.

**W = WAP**

**C = Camera (UCPD security)**

**D = Distributed Antenna System**

**L=Over Length (cables longer than 295 feet)**

**N=non-standard (e.g., cables that do not go to IST-Telecom Telecom Room)**

**PURPOSE:** Indicates the cable is a Data (D) cable.

## SECTION 9 - LABELING

- C. Voice Category 5e
  - 1. Label Nomenclature

### **BUILDING - TR - ROOM - nnn - PURPOSE**

- BUILDING:** Is the standard short designator for the building, as acquired from IST-Telecom.
- TR:** Is the TR Room number where the cable Originates.
- ROOM:** Is the room where the Cable/Service Point terminates.
- nnn:** Is a numerical value representing the port number on the 110 block wall mounted termination field
- PURPOSE:** Indicates the cable is a Voice (V) cable.

## OUTSIDE PLANT (OSP) COMPONENTS

### 1 COPPER / FIBER CABLES

Label cable sheaths with marker plates attached with mechanical fasteners or nylon cable ties, positioned within 12 inches of the entrance or exit to terminations, junction boxes, and access vaults. Install non-adhesive marker plates, labeled using a thermal transfer method, capable of withstanding harsh environments and exposure to solvents.



### 2 CONDUIT

Label each section of conduit with marker plates attached with mechanical fasteners positioned on the inside of the corresponding junction box or vault, unobstructed and easily readable. Install non-adhesive marker plates,

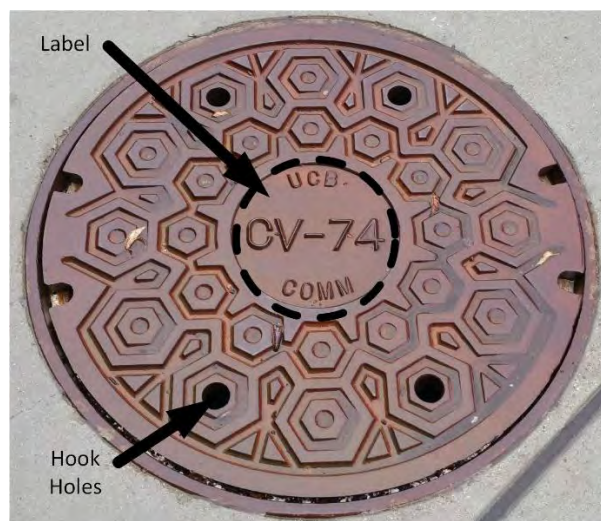
## SECTION 9 - LABELING

labeled using a thermal transfer method, capable of withstanding harsh environments and exposure to solvents. The labels shall identify the origin and destination of the corresponding section (refer to [SK202](#)).



### 3 VAULT

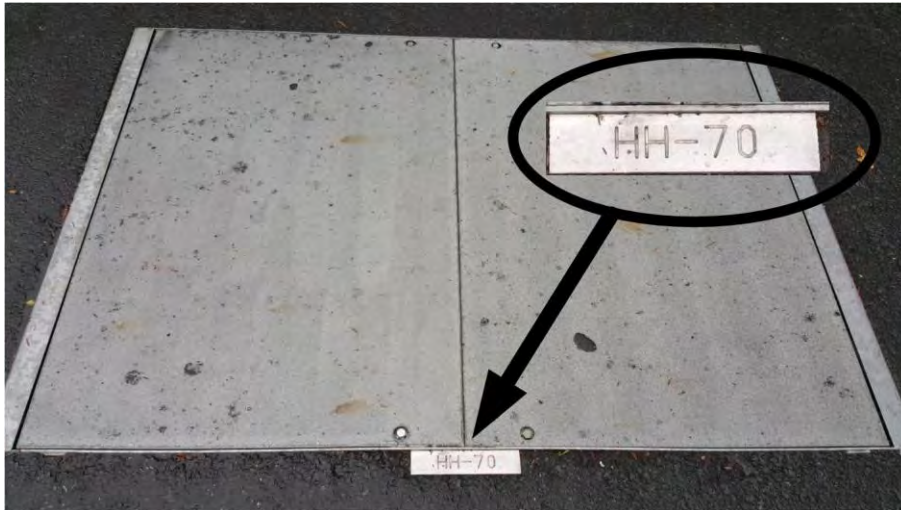
- A. Confer with IST-Telecom for each vault provided on the project to obtain the exact vault ID required.
- B. The designing engineer shall provide a schedule on the drawing set, or within the specifications for each vault identification and type approved by IST-Telecom.
- C. The Contractor shall order each vault lid according to the type specified and with the identification label embedded on the lid by the manufacturer according to the vault schedule.



## SECTION 9 - LABELING

### 4 JUNCTION BOXES

- A. Label each box with a marker plate attached with mechanical fasteners, positioned on the outside cover or door panel, unobstructed and easily readable.



- B. Install non-adhesive marker plate, labeled using a thermal transfer method, capable of withstanding harsh environments and exposure to solvents. The labels shall identify the facility location or ID corresponding to the project's labeling scheme.

### SKETCHES

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements for labeling.

**SK200** – Standard Faceplate 4-port and 6-port with Labels

**SK201** – Standard Faceplate 1-port with Label

**SK202** – OSP Vault Conduit Labeling

**SK203** – Patch Panel and 110 Field Labeling

**SK204** – Example Floorplan Labeling

**SK205** – Equipment Rack Labeling

**SK206** – Room Naming Conventions



## SECTION 10 – BONDING AND GROUNDING

### Section 10 - Bonding and Grounding

#### SCOPE

This section describes the scope of work related to the bonding of the various components that form part of the telecommunications infrastructure and Structured Cabling System (SCS) and pathway systems.

Bonded components addressed in this section include, but are not limited to, cables, equipment racks and cabinets, termination equipment, patch panels, conduit, runway, etc.

#### DESIGN PARAMETERS

##### 1 GENERAL

- A. All bonding details are diagrammatic in nature, but provide the important installation criteria for each piece of equipment generally found in a basic telecommunication room (TR). Additional equipment may exist within a TR, however the installer should follow the manufacturer's published guidelines and notify IST-Telecom any time the manufacturer guidelines differ from the details shown on the contract documents (to include sketches) for clarification prior to completing the installation.

##### 2 BONDING COMPONENTS

- A. The Communications Grounding Backbone system contains grounding two-hole bus bars, grounding conductors, bonding conductors, and connecting devices (including but not limited to pressure connectors, lugs, clamps, or exothermic welds). These components provide a low impedance path to ground for stray voltages or spurious signals present on telecommunications media and equipment.
- B. Telecommunication Main Ground Bus (TMGB) is typically located in the Entrance Facility (EF) room. The EF may be included in the Building Distribution Facility (BDF). Regardless of named location, the TMGB has a connection to the following:
  1. Main Building Reference Ground Bus (MBRGB), typically located in the main electrical room.
  2. Overhead and vertical cable support within a TR, by way of a Telecommunication Bonding Conductor (TBC).
  3. Ground bushings installed on each entrance conduit within the EF/BDF by way of a TBC.
  4. Dedicated power panels within the EF/BDF serving telecommunication equipment, by way of a TBC.
  5. Each Telecommunication Bonding Backbone (TBB) riser.



## SECTION 10 – BONDING AND GROUNDING

- C. TBBs originate in EF/BDF and route to the BDF (if separate for the EF) and each Intermediate Distribution Facility (IDF) with a connection to each Telecommunication Grounding Bus (TGB), typically a 20 inch grounding bus bar mounted on the wall at 90 inches above the finished floor, near either end of the equipment bay (usually next to the electrical panel servicing the TR).
- D. Bond and ground the cable tray system as per NEC 70 Article 250. Install approved bonding apparatus between sections and at other locations where system continuity is interrupted. .
- E. Splice system sections using UL Classified connector splice kits, supplied by the same manufacturer. If the manufacturer does not manufacturer UL Classified splice kits, then install proper bonding UL Classified splice kits from a single manufacture for all slice kits used.

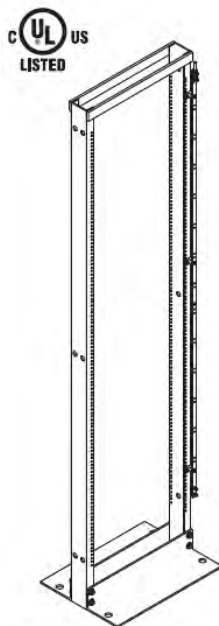
### BONDING BACKBONE RISER

- A. The grounding system's backbone riser is needed for a multi-story building containing TR's on multiple floors. The backbone riser should connect the TRs on multiple floors in a linear fashion. If there are two TRs per floor, as an example, there would be two riser backbones.
- B. Each TR must contain a ground bus bar with multiple two-hole connections and must be exothermically welded to the riser backbone wire using an AWG #4 bonding wire (refer to [SK800](#)).
- C. When a building contains more than three floors, a backbone wire connecting the TR's riser backbones on the same floor is used to mitigate a failure in one of the riser backbones. Place the connection on the mid-floor only, as performing this on multiple floors can produce a ground loop under certain conditions (needs to be placed on every 3<sup>rd</sup> floor for taller buildings).

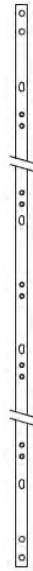
### 2 EQUIPMENT COMPONENTS WITHIN A TR

- A. Within each TR each equipment component that can carry a static charge needs to be bonded to the room's TGB directly, meaning that bonding between equipment components can cause ground loops that can cause problems. Each piece of equipment requiring a ground is connected to the room's ground bus bar using an AWG #6 green jacketed ground wire with a compression two-hole lug at each end.
- B. Cable runway within the TR requires bonding straps between runway segments to ensure a continuous bond in addition to the runway being bonded to the room's TBB. Use a bonding strap from the same provider as the cable runway. Ensure there is a proper bond between the TBC and the equipment by properly preparing the attachment according to manufactures guidelines. If bonding washers are available from the manufacturer, install these when bonding the runway to the TGB.
- C. Each component within the TR that can potentially carry a static charge must be bonded to the room's TGB, which includes the following:
  - 1. Equipment Rack bonded independently to the room's TGB (refer to sketch [SK807](#)).
  - 2. Equipment Rack bonding for new TRs require a vertical bonding bus bar in racks containing F/UTP Cat6A cabling terminations.

## SECTION 10 – BONDING AND GROUNDING



Shown mounted to rack



### Vertical Rack Busbar Kits

Vertical Rack Busbar Kits isolate the Busbar from the rack to help control current paths from passing through one piece of equipment to another.

- Other configurations are available on request
- UL Listed, File E236184, Category KDER (US), KDER7 (Canada) - Grounding and Bonding Equipment

**Kit consists of:**

- (1) Vertical Rack Busbar
- (1) #2 AWG two-hole ground compression lug with 3/8" (9.53 mm) holes on 1" (25.4 mm) centers
- (3) white Delrin® insulator blocks
- (3) self-tapping screws
- (3) #12-24 mounting screws
- (2) stainless steel lock washers, 5/16"
- (2) nuts

Part Number	Description H x W x D in (mm)	Shipping Weight lb (kg)
40161-036	5/8 x 1/4 x 36 (15.88 x 6.4 x 910)	6 (2.7)
40161-072	5/8 x 1/4 x 72 (15.88 x 6.4 x 1830)	7 (3.2)

3. Patch Panels for foil wrapped cabling, such as Siemon's F/UTP Cat6A 4-pair cabling must be bonded to a vertically mounted ground bus bar, who's bus bar is bonded independently to the room's TGB (refer to sketch [SK806](#))
4. Each level of overhead cable runway bonded independently to the room's TGB
5. Wall mounted 110 towers and vertical managers can be bonded in series to the rooms TGB
6. Conduits penetrating the TR walls or floors must have a bonding clip and can be bonded in series to the room's TGB.



### SKETCHES

Refer to the sketches as listed in this paragraph for further requirements applicable to this section. These sketches depict component configuration requirements for Bonding and Grounding.

[SK800](#) – TR Ground Bus Bar (two-hole) and Labeling

[SK801](#) – Conduit Bonding

[SK802](#) – Riser Conduit Bonding

[SK804](#) – Cable Runway Section Bonding

[SK805](#) – 110 Wall Field Bonding

[SK806](#) – Equipment Rack Bonding

[SK807](#) – Equipment Rack Bonding – No Bus Bar

## SECTION 11 – WIRELESS ACCESS POINTS

### Section 11 - Wireless Access Points

#### SCOPE

This section describes the scope of work related to the installation requirements for wireless access points and covers the telecommunications infrastructure and Structured Cabling System (SCS).

#### DESIGN PARAMETERS

IST-Telecom wireless engineer will provide and/or review all wireless surveys used to determine the location(s) of the wireless access points. The IST-Telecom wireless engineer shall approve all software packages, such as AirMagnet, used in the design of wireless systems. Program the software with architectural components and quantity of user wireless devices expected.

Generate wireless heat maps and provide to IST-Telecom for review and approval prior to applying the locations to the contract documents and installing the outlets. Include a report listing the input criteria used within the software to create the heat maps.

All special cases (concrete walls, inaccessible locations) need to be approved by IST prior to installation. It is always preferable to have the devices mounted in a horizontal aspect for optimum performance. Wall or vertical mounting should only be used when no other reasonable option exists. Coordinate outlet locations with ceiling and other building architectural components. In general, deploy outlets in the following configurations:

##### 1 CEILING OUTLETS

- A. For drop ceilings, such as acoustical tiles, terminate the Cat5e horizontal cable on a single-port surface-mount style box (such as a biscuit block), and suspend from a cable-hanger 12 inches above the drop ceiling. This same cable-hanger may also support the cable slack loop.
- B. Identify the access point's location by placing a removable non-marking tag, such as a piece of blue colored painter's tape or paper flag, on the underside of the ceiling grid to indicate location. This will assist IST-Telecom's Wi-Fi installation unit deployment by indicating exact locations of the data connection outlets.
- C. For hardcap ceilings, flush-mount the outlet using a steel 5 inch by 5 inch by 2-7/8 inch deep backbox with a one-gang mud ring capable of supporting 5-pounds. Route the outlet conduit to an accessible ceiling space and store the cable slack on a cable-hanger at that location (refer to [SK903](#) for hardcap mounting).

##### 2 WALL MOUNTED OUTLETS

- A. Terminate the horizontal Cat5e cable on a steel 5 inch by 5 inch by 2-7/8 inch deep backbox with a single-gang mud ring, capable of supporting five pounds (approximate weight of the Wi-Fi access point). Route the outlet's conduit pathway to an accessible ceiling space and store the 10 feet of cable slack on a cable-hanger at this location. Place a marker at the accessible ceiling space on the underside of the ceiling noting the room location of the actual data outlet it supports.
- B. In concrete or other non-gypsum type walls, this backbox and conduit may be surface-mounted.
- C. In existing buildings, IST-Telecom will allow a ring-&-string approach with a single-gang ring for non-insulated walls.
- D. Locate the wall mounted outlet approximately 12 inches below the ceiling, or 10 feet above finished floor maximum. The 10 foot maximum height will allow IST-Telecom to install and service the Wi-Fi access point with a standard six foot ladder.

## SECTION 11 – WIRELESS ACCESS POINTS

### 3 MOUNTING REQUIREMENTS:

#### A. T-Bar or Channel Grid Type ceilings

1. Install a minimum of 10 feet of Cat5e UTP 4-pair plenum rated cable service loop.
2. Support the cabling and slack on a 1 inch cable hanger suspended from the deck above by either 12 gauge wire or ½ inch threaded rod properly affixed from the structure deck above and no higher than 18 inches above any suspended acoustical ceiling. Do not suspend or support from other structures.
3. Install a biscuit type telecommunications box and Cat5e modular jack at the cable hanger dedicated for the wireless antenna
4. Mark the location of the wireless antenna on the underside of the T-Bar grid of the acoustical ceiling using a blue colored painter's tape one inch by one inch.

#### B. Wall Mount (New Install)

1. Install Terrawave V-HWM-11113C [http://www.terra-wave.com/shop/enclosures-wall-mount-enclosures-c-229\\_949.html?osCsid=nplcppd5ckfnf1ps08nu2g2q0](http://www.terra-wave.com/shop/enclosures-wall-mount-enclosures-c-229_949.html?osCsid=nplcppd5ckfnf1ps08nu2g2q0)



2. Install a double-gang 5 inch by 5 inch by 2-7/8 inch deep back box with single-gang metal mud ring.
3. Height should be the lower of 10ft AFF or 3in below finished ceiling.
4. Install a 1 inch conduit from the back box to accessible ceiling space with a conduit bushing and pull string. Structure shall support a minimum 5 pound device attached to the back box.
5. If the wall is concrete, surface mount the back box with equivalent 1 inch pathway to accessible ceiling space.
6. Terminate Cat5e station cable inside enclosure, 3-5ft service loop, biscuit cover over jack
7. Do not attach biscuit cover to enclosure
8. Install 10 feet of cable slack at accessible ceiling space suspended from a 1 inch cable hanger affixed from the structure above using either a 12 gauge wire or ½ inch threaded rod.

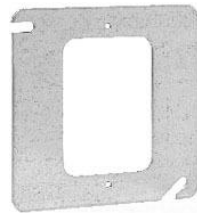
#### C. Wall Mount (Existing prior to January 2014)

1. For a non-rated, uninsulated wall, install a ring-and-string Cat5e plenum rated UTP 4-pair cable between the outlet and the nearest TR and with a maximum cable length of 295 feet, including a 10 foot service loop above accessible ceiling space.
2. Place the terminated connector end at the outlet, temporarily taped to the wall with a removable tape to allow for IST-Telecom to connect the wireless access point without having to fish for the terminated end. Install an Allen-Tel AT90, Carlon™ SC100R, or equivalent.



## SECTION 11 – WIRELESS ACCESS POINTS

- D. Custom ceiling (wood panel, large drop tile, hard cap, etc.)
  - 1. Install a metal double-gang outlet box with a single mud-ring (by Crouse-Hinds TP404 or equivalent) installed in the wall for new installations, capable of supporting 5 pounds.
  - 2. Install a metal mud-ring (Cooper Crouse-Hinds TP482, TP484 or equivalent) to make the ring flush with surface.



- 3. If custom ceiling is not to be altered, wall mount at nearest location.
- E. All cable pathways to termination points are to be in accordance with BICSI standards, NEMA regulations, and customer preferences. This may include conduit and/or additional surface raceway to be installed.

## SECTION 12 – PRODUCT LISTING

### Section 12 - Product Listing

**While every effort has been made to include the necessary parts and part numbers in this section, manufacturer parts and their associated numbers change over time. Please verify that all required parts and their associated part numbers have not changed prior to ordering. Confirmation with IST Telecom is best accomplished by a product submittal with parts, pictures and numbers listed with a request for approval.**

#### SECTION 2 - TELECOM ROOMS

Equipment	MFG	Part/Model #	Description	Date
Equipment Rack	CPI	48353-503	2-post, 7'-0"H x 19", UL listed, clear, "Universal Rack"	7/1/2014
Seismic Gusset Kit	CPI	11592-101	Gray, compatible with Universal Rack, includes (4) gussets	7/1/2014
6"W Vertical Management Section	CPI	30095-703	7'-0"H x 6"W, double sided, black, "MCS Master Cabling Section"	7/1/2014
10"W Vertical Management Section	CPI	30096-703	7'-0"H x 10"W, double sided, black, "MCS Master Cabling Section"	7/1/2014
Cable Runway	CPI, B-Line or Equal	10250-118	18"W cable runway, "Universal", UL classified, gray	7/1/2014
		10259-124	24"W cable runway, "Universal", UL classified, gray	7/1/2014
		10608-001	Vertical wall bracket kit, gold	7/1/2014
		10642-001	Protective end caps, (1) pair	7/1/2014
		10596-106	6"H cable retaining post, gray	7/1/2014
		16302-001	Junction-splice kit, UL classified, gold	7/1/2014
		16301-001	Butt splice kit, UL classified, gold	7/1/2014
		16487-001	Butt-swivel splice kit, UL classified, gold	7/1/2014
		11085-001	Threaded rod cover	7/1/2014
		12101-101	Radius drop, stringer, gray	7/1/2014
		10595-018	channel rack-to-runway attachment kit, 15" to 18"W runway, gold	7/1/2014

## SECTION 12 – PRODUCT LISTING

Equipment	MFG	Part/Model #	Description	Date
Radius Dropout	CPI, B-Line, or equal	12100-112 and 12100-118	Runway must mounted to provided runway according to manufacturer	7/1/2014
Fiber Trough	ADC, Panduit, or Equal	FGS-MSHS-A	4"H x 4"W straight section, "FiberGuide", yellow	7/1/2014
		FGS-HMEC-A	4"H x 4"W end cap, yellow	7/1/2014
		FGS-MHRT-A	4"H x 4"W horizontal T	7/1/2014
		FGS-MHXP-A	4"H x 4"W horizontal cross	7/1/2014
		FGS-MH9E-A	4"H x 4"W horizontal 90 degree elbow	7/1/2014
		FGS-MDSP-A	down spout, yellow	7/1/2014
		FGS-MCDS-AB	4" down spout cover, yellow	7/1/2014
		FGS-HNTS-XX-LP	Low profile C-bracket	7/1/2014
		FGS-HTUB-XX	Center support bracket	7/1/2014
Rack Mounted PDU	APC	AP7830	20A metered PDU, output: (24) NEMA 5-20R, input: (1) NEMA L5-20P, 10' long cord, features: alarm thresholds, flash upgradeable, local current monitoring display, network managed, remote current monitoring	7/1/2014
		FGS-MFAW-A FGS-MSSC-	Fiber Raceway System 4x4 Snap-Fit Junction Fiber Raceway System Horizontal Straight Snap-on Cover	7/1/2014
Rack Shelf/Drawer	CPI	13084-519	4RU in height, storage drawer with keyed lock	7/1/2014
Fiber Optic patch Panel	ADC	FL2-48SPNL2 FL2-48SPNL-B FL2-12RPNL FL2-24RPNL FL2-12TS350 FL2-48TS875 FL2-24TS525 FL2-72TS140 FST-DRS12-HS FST-DRS24-HS FL2-6P7SC605R FL2-6PSMST FL2-6PSMSC	3RU, 48-port Single mode Splice Panel 3RU, 48-port Single mode Splice Panel (Black) 2RU, 12-port Fiber Panel – Rack or Cabinet Mount 2RU, 24-port Fiber Pane. – Rack or Cabinet Mount 2RU, 12-port Termination/Splice Panel 5RU – 48-port Termination/Splice Panel 3RU – 24-port Termination/Splice Panel 8RU – 72-port Termination/Splice Panel Splice wheel for 12-position heat shrink fusion Splice wheel for 24-position heat shrink fusion 6-pak plug-in with SC (blue), 5m 6-stranded pigtails 6-pak Connector Plug-ins ST Style 6-pak Connector Plug-ins SC Style 6-pak plug-in with ST connector pigtails	7/1/2014
Complete Systems	ADC	FL2-C270024PW-2A00	FL2 Panel Term/Splice SCUPC W/PIG 024 Ports Standard	7/1/2014
		FL2-C4700-48PW-4A00	FL2 Panel Term/Splice SCUPC W/PIG 048 Ports Standard	
		FL2-C4700-72PW-6A00	FL2 Panel Term/Splice SCUPC W/PIG 072 Ports Standard	



## SECTION 12 – PRODUCT LISTING

Equipment	MFG	Part/Model #	Description	Date
Complete Systems	ADC	FL2-C270024PW-2A00	FL2 Panel Term/Splice SCUPC W/PIG 024 Ports Standard	7/1/2014
		FL2-C4700-48PW-4A00	FL2 Panel Term/Splice SCUPC W/PIG 048 Ports Standard	
		FL2-C4700-72PW-6A00	FL2 Panel Term/Splice SCUPC W/PIG 072 Ports Standard	
Fiber Storage Reel	Leviton	48900-OFR	24 inch fiber optic storage reel	7/1/2014
FPC Connector		1-1734742-6 4-1734742-0 6-520315-6	FPC Connector, Receptacle 6-position 0.5 Pitch FPC Connector, Contact Plate, Mating Area Flexible Film Connector Contact Type = Socket	7/1/2014
AC Fire treated plywood			AC Fire treated plywood with stamp on A side Dolans Lumber 2231 Monument Blvd, Concord, CA 94520 (925) 686-1734	12/2/14
Wall Cabinet	DAMAC	WS36AKP1VVV-3GP	HD Wall Cabinet 36in. High. Has what they call a "gland plate" instead of knockouts on top which allows easy removal of cable. Nice cabinet.	11/24/14
Mr. Slim Split-ductless Cooling	Mitsubishi	varies	Mr. Slim Split-ductless: M-Series Cooling-only	12/2/14

### SECTION 3 - OSP PATHWAYS

Equipment	MFG	Part/Model #	Description	Date
Duct Plugs	Jack Moon	JM-BLA-40D402U JM-QUA-40Q136S JM-TRI-40B136S JM-SIM-10S136S JM-BLA-10D104U	4 inch blank plug 4 inch Quadplex plug 4 inch Triplex plug 1 inch Simplex plug 1 inch blank plug	7/1/2014
Manhole Frames & Covers	Neenah Foundry Company	R-1751a or R-1751c	Round HS20 cover and frame with an inner sealing lid, 'O' ring and outer HS20 grade cover.	12/2/14

### SECTION 4 - ISP PATHWAYS

Equipment	MFG	Part/Model #	Description	Date
Basket Style Cable Tray	Cablofil	EZ-Tray series	Basket Style Cable Tray	7/1/2014
	B-Line	WB series	Basket Style Cable Tray	7/1/2014
	GS-Metals	FlexTray series	Basket Style Cable Tray	7/1/2014

## SECTION 12 – PRODUCT LISTING

Equipment	MFG	Part/Model #	Description	Date
EZ-Path Firestop	STI	EZDP133FK	EZ-Path Series 33 Pathway Kick-In Floor Kit	7/1/2014
		RCM33	Radius control for EZ-Path	7/1/2014
EZ-Path Firestop Devices	STI	EZD22	EZ PATH® Series 22 Fire Rated Pathway with wall plate	7/1/2014
EZ-Path Firestop Devices	STI	EZDP44	EZ-Path 44 fire rated pathway device with wall plate Designed for new or existing cable installations through up to 10" thick walls, or floors, the EZ-Path Series 44+ pathway holds up to 240 CAT 5E cables.	7/1/2014
		EZD44	EZ-Path 44 fire rated pathway device without wall plate	7/1/2014
		EZP544W	Multi-gang wall bracket/plate	7/1/2014
		EZRCM44S	Radius control module	7/1/2014
Cable Hangers	B-Line	BCH21	1-5/16" cable support hanger with retainer	7/1/2014
		BCH32	2" cable support hanger with retainer	7/1/2014
	Erico	CAT12	3/4" cable support hanger with retainer	7/1/2014
		CAT21	1-5/16" cable support hanger with retainer	7/1/2014
		CAT32	2" cable support hanger with retainer	7/1/2014
		CAT425	Adjustable 4"-6" cable support loop	7/1/2014
	Panduit	JMJH2-X20	2" cable support hanger with retainer	7/1/2014
Surface Raceway	Panduit	LD10WH10-A	Surface Raceway, LD10	12/2/14
EMT Bushings	Arlington or similar	Various	Arlington Industries Insulating EMT Bushings (used for conduits less than 2")	7/1/14
Conduit Spillway	Bejed	BJ-2049B	Spillway, 2" or 4" diameter EMT sizes maintains proper bend radii for fiber/cable. NOTE 1. Manufacturer indicates that with slight field modification the 2" fitting can be used for 1.5" EMT conduit and the 4" fitting can be used for 3" EMT conduit.	7/1/2014
5"x5" Backbox	SteeleCity	82181T-1-114-CV	Back box with side mount bracket	7/1/2014
5"x5" Backbox	Randl	T55017	Back box with side mount bracket	11/24/14

## SECTION 12 – PRODUCT LISTING

### SECTION 5 - OSP BACKBONE CABLING

Equipment	MFG	Part/Model #	Description	Date
OSP Fiber Optic Cable	Corning	XXXEU4-T4101D20	"Altos" gel-free, outdoor cable, loose tube, OS2 single mode fiber, either MIC or DX type.	7/1/2014
Fiber Optic Patch Panel	Corning	PCH-04U	Fiber optic 4 rack unit patch panel	7/1/2014
OSP Innerduct	Carlou, or Equal		HDPE innerduct, smooth outside/ribbed inside, pre-installed pull tape, colors: white, orange, black, and yellow	7/1/2014
Fiber Storage Reel	Leviton	48900-OFR	24 inch fiber optic storage reel	7/1/2014

### SECTION 6 - ISP BACKBONE CABLING

Equipment	MFG	Part/Model #	Description	Date
ISP Fiber Optic Cable	Corning	XXXE88-33131-A3	"MIC" , OFCP rated, tight buffer, interlocking armor, OS2 single mode fiber	7/1/2014
Cat3 Cable - Plenum	Systimax	2010 series	Cat3 UTP, 24 AWG, CMP rated	7/1/2014
	General Cable	Category 3 Plenum series		7/1/2014
	BerkTek	Multi-Pair PowerSum series		7/1/2014
Cat3 Cable - Riser	Systimax	ARMM series	Cat3 UTP, 24 AWG, CMR rated, ALVYN sheath	7/1/2014
	Superior Essex	AR ARMM series		7/1/2014
	General Cable	Foam Skin ALVYN Riser Cable series		7/1/2014
Cat5e 110 Termination Tower Kit	Panduit	P110KT9004Y	110-type termination blocks, trough mounted, 900-pair capacity, Cat5e	7/1/2014
Termination Tower Vertical Manager	Panduit	P110VCM900	Vertical management backboard for 900- pair tower	7/1/2014

## SECTION 12 – PRODUCT LISTING

### SECTION 7 - HORIZONTAL CABLING

Equipment	MFG	Part/Model #	Description	Date
Flush Mount Faceplate	Siemon	10GMX-FPD06-02	6-port, double-gang, "10G MAX", white	12/1/2014
Wall-phone Faceplate	Siemon	MX-WP-K5-SS	Equipped with one modular jack and two mounting studs, single-gang, stainless steel	7/1/2014
Wall Faceplate Blanks	Siemon	MX-BL-02	MAX outlet faceplate blanks	
Z-MAX Surface Mount Boxes	Siemon	MX-SMZ(X)-(XX)-(X)	"Z-MAX Surface Mount Boxes	Z-MAX Surface Mount Boxes
Modular Furniture Mount Adapter	Siemon	MX-UMA-(01) Coordinate with furniture	Compatible with UTP Cat5e and F/UTP Cat6A modular connectors, 4-port (Use (XX) To specify color: 01 = black, 02 = white, 04 = gray, 20 = ivory, 80 = light Ivory)	7/1/2014
Modular Furniture Feed Point Faceplate	Leviton	88004	Single-gang, 1.406" pass through hole, white	7/1/2014
VELCRO® Cable Ties	Panduit	HLS-15R-6	15' roll, 3/4" wide, blue or black	7/1/2014
Plenum tie wraps	Millipede	UL1565	12" long, 0.35" wide, plenum mille-ties	7/1/2014
Horizontal Cable Labels	Panduit	PLL-40-Y3-1	Self-laminating with 2" x 0.5" printable area, compatible with 0.16-0.32" O.D. cables, white	7/1/2014

### SECTION 7A - Horizontal Cabling CAT5E – Existing TR Prior to 2014

Equipment	MFG	Part/Model #	Description	Date
Cat5e 110 Termination Tower Kit	Panduit	P110KT9004Y	110-type termination blocks, trough mounted, 900-pair / 216 horizontal cable capacity, Cat5e	7/1/2014
Termination Tower Vertical Manager	Panduit	P110VCM900	Vertical management backboard for 900- pair tower	7/1/2014
4-port Faceplate	Panduit	CFP4WH	4 Module Space Single Gang Faceplate	12/2/14
6-port Faceplate	Panduit	CFPL6WHY	6 Module Space Single Gang Faceplate	12/1/14
Cat5e Jack - Blue	Panduit	CJ5E88TGBU	UTP Jack Module, Blue	12/1/14
Cat5e Jack - White	Panduit	CJ5E88TGWH	UTP Jack Module, White	12/1/14

## SECTION 12 – PRODUCT LISTING

Equipment	MFG	Part/Model #	Description	Date
Cat5e Cable	Belden	1585AD15U1000 Blue	Category 5e Nonbonded-Pair Cable 4-pair, 24 AWG, UTP CMP, Flamarrest® Jacket, 1,000' Box	12/1/14
		1213009U1000 White		
	Panduit	PUP5C04BU-U Blue	4-pair, 24 AWG, CMP Cat 5e	12/1/14
		PUP5C04WH-U white		
	Nexans (Berk- Tek)	10032227 Blue 10032223 White	HyperPlus 5e Plenum Rated Category 5e UTP	
Siemon	9C5P4-E1-06- RXA (BL) 9C5P4-E1-02- RXA (WH)	Solution 5e Plenum Cable		
Superior Essex	51-241-28 Blue 51-241-48 White	Marathon LAN Plenum Category 5e		

### SECTION 7B - Horizontal Cabling CAT5E – New Bldg or TR as of 2014

Equipment	MFG	Part/Model #	Description	Date
Cat5e Cable	Belden	1585AD15U1000 Blue	Category 5e Nonbonded-Pair Cable 4-pair, 24 AWG, UTP CMP, Flamarrest® Jacket, 1,000' Box	12/1/14
		1213009U1000 White		
	Panduit	PUP5C04BU-U Blue	4-pair, 24 AWG, CMP Cat 5e	12/1/14
		PUP5C04WH-U white		
	Nexans (Berk- Tek)	10032227 Blue 10032223 White	HyperPlus 5e Plenum Rated Category 5e UTP	
Siemon	9C5P4-E1-06- RXA (BL) 9C5P4-E1-02- RXA (WH)	Solution 5e Plenum Cable		
Superior Essex	51-241-28 Blue 51-241-48 White	Marathon LAN Plenum Category 5e		
Cat5e Modular Connector	Siemon	MX5-02	Cat5e, 8-position, angled, "MAX 5e", white	7/1/2014
	Siemon	MX5-06	Cat5e, 8-position, angled, "MAX 5e", blue	7/1/2014
Wall Phone Faceplate	Siemon	MX-WP-K5-SS	MAX Series Stainless Steel Wall Phone Faceplate with keystone MAX module included.	12/2/14
Cat5e Patch Panel	Siemon	HD5-48	Cat5e 48-port patch panel with 2 RMS	7/1/2014

## SECTION 12 – PRODUCT LISTING

### SECTION 7C - Horizontal Cabling F/UTP (Shielded) CAT6A

Equipment	MFG	Part/Model #	Description	Date
Cat6A Cable	Siemon	9A6P4-A5-06-R1A	Cat6A, 4-pair 23 AWG, F/UTP, CMP rated, "Z- MAX", blue	7/1/2014
Cat6A Discrete Port Patch Panel	Siemon	TM-PLNZ-24-01	TERA-MAX 24 port patch panel, 1 RMS, Black (for use with Cat6A)	7/1/2014
Cat6A Modular Connector	Siemon	Z6A-S05	Cat6A, 8-position, shielded, hybrid flat/angled, "Z-MAX", yellow	7/1/2014

## SECTION 13 – SKETCHES

### Section 13 - Sketches

#### SCOPE

Sketches provided under this section are illustrations of installation examples. Exact measurements of components may vary from the actual product provided, however the purpose is to demonstrate key components and their general relationship for an installation that meets University of California Berkeley's (UCB) Information Services and Technology (IST-Telecom) standards

The sketches are not intended to provide direction to the contractor over the contract documents, but rather as additional information to help a designer or contractor understand IST-Telecom standards and promote clarification in understanding between IST-Telecom and the project parameters.

When something differs between contract documents and published IST-Telecom standards, the designer or contractor is encouraged to obtain confirmation from IST-Telecom.

#### DESIGN PARAMETERS

##### 1 USER PATHWAY SUPPORT (100 SERIES)

Support member sketches are related to the IST-Telecom User space and not the Telecommunication Rooms (TRs) within the building. Support details are general and may not include each and every type of support required for a complete installation, but rather the basic components typically found in the User space. Some projects may require specialized support systems and would be found on design documents for the specific project, but should be reviewed with IST-Telecom for ease of use and functionality so as not to obstruct access to the cabling within User space, as other systems exist, such as mechanical and piping, etc.

##### 2 LABELING (200 SERIES)

- A. Labeling details are intended for components maintained by IST-Telecom over the life of a building and therefore may change from time to time.
- B. Labeling details include such items as telecommunications equipment, cables, faceplates, patch panels, and 110 field (refer to sketches [SK200](#), [SK201](#), [SK203](#), and [SK205](#). Other items may exist but not listed here.
- C. Labeling details also include items for telecommunications OSP conduit within vaults (refer to [SK202](#)).

##### 3 FIRESTOPPING (400 SERIES)

- A. IST-Telecom has standardized on STI EZ-Path™ due to its ability to maintain a consistent fire barrier through the life of a TR where new cables may be pulled or old ones removed.
- B. The EZ-Path™ firestop system does not rely on firestop material being removed and replaced during modifications. Cables can be introduced or removed without touching the actual firestop material. For this reason, IST-Telecom finds this to be a unique application that ensures a high degree of Life Safety and reliability that no other product provides.
- C. The sketches show an elevation view of the EZ-Path™ to familiarize the contractor with an accurate view of the system in a riser situation (refer to [SK400](#) and [SK401](#)).

##### 4 TELECOM ROOM LAYOUTS

Telecommunications rooms have basic components that are consistent between the different types of TR functions, such as fiber tray or runway.

- A. General TR Layout

## SECTION 13 – SKETCHES

1. There are sketches that show the basic configuration of a TR used by IST-Telecom. They demonstrate the direction the front of the equipment racks face, the size of vertical cable managers, the optimum placement of the room's electrical service panel and ground bus bar, and allocated wall space for placement of horizontal cabling termination field, and security.
  2. The plan views show required clearances that must be maintained around equipment for proper access to equipment (refer to [SK500](#) for general plan view). These views show the preferred location for equipment relative to the room's door.
  3. The elevation sketches show the required elevation of primary equipment typically found in an IST-Telecom telecommunications room. They show placement of the 110 wall termination field and relative location to any incoming cable services, such as AT&T voice cable and lightning protection devices (refer to sketches [SK504](#), [SK505](#), and [SK507](#)).
- B. Equipment Rack Runway
1. The overhead cable runway contains 7 inch retaining posts for the purpose of keeping cabling within the runway (refer to sketch [SK510](#) and [SK511](#)). This allows the use of runway over cable tray that is more difficult to manage within a typical TR. The retaining posts must contain protectors on the open ends to avoid any potential for sharp edges being exposed to workers in the TR.
  2. The first level of cable support is the runway over the equipment rack bay that serves as a pathway for copper patch cables between racks and their vertical cable managers, as well as patch cables between the racks and wall mounted 110 style termination blocks (refer to sketch [SK510](#)).
  3. The upper most runway cable support serves to support horizontal cabling from User space that transitions from the runway to either wall mounted 110 style termination blocks, or equipment rack patch panels typically. This may also support backbone cabling.
- C. Fiber Trough
1. Fiber trough is located above the equipment rack's cable runway and is used for routing fiber optic patch cables between equipment racks in a rack bay. It is supported from the upper cable runway support system. Fiber optic patch cables can transition downward into the vertical cable managers and then to the terminating equipment, such as network switches (refer to [SK502](#) and [SK504](#)).
  2. There may be circumstances where the ceiling of the TR is too low (less than 10 feet) to allow for the levels of cable support typically found. In these cases, the situation must be brought to IST-Telecom's attention in order to determine the best solution.
- D. Vertical Cable Runway
1. For management of cables rising from a floor penetration to the overhead cable runway, runway is mounted vertically on the wall between the floor and the overhead runway. (Refer to elevation [SK507](#)).
  2. For cabling that rises to the floor above, runway is placed vertically on the wall above the upper most horizontal runway to the beginning of the floor penetration system at the floor above.
  3. For situations where incoming horizontal cabling enters a TR more than 18 inches above the upper level of runway, vertically mounted runway should be utilized for cable support, or, depending on quantity of cable, open access style D-rings.
- 5 CABLE ROUTING
- A. Sketches for cable routing demonstrate the varying components for routing cable between the User's work space and the nearest TR. The actual project may differ in components, however the sketches aid in understanding the general combination of typical installations (refer to sketches [SK600](#) and [SK601](#)).



## SECTION 13 – SKETCHES

### 6 OUTSIDE PLANT

- A. All OSP details are diagrammatic in nature, but provide the important installation criteria for each piece of equipment generally found in a basic telecommunications OSP pathways. Additional equipment may be provided within vault, however the installer should follow the manufacturer's guidelines and should notify IST-Telecom any time the manufacturer guidelines differ from the details shown on the sketches for clarification on completing the installation.
- B. Vault Lids
  - 1. The contractor should confer with IST-Telecom prior to ordering any vault covers/lids to verify the proper labeling that is required. The labeling shall be provided by the manufacturer according to the contractor's ordering criteria.
  - 2. Confer with IST-Telecom for the requirement of vault security covers by Lockdown™ to determine if they are required for the project in question (refer to sketch [SK704](#)).
  - 3. Duct bank connections to vaults shall meet UCB IST-Telecom requirements for telecommunications pathways.

### 7 BONDING

- A. All bonding details are diagrammatic in nature, but provide the important installation criteria for each piece of equipment generally found in a basic telecommunications room. Additional equipment may be provided within a telecom room (TR), however the installer should follow the manufacturer's guidelines and should notify IST-Telecom any time the manufacturer guidelines differ from the details shown on the sketches for clarification on completing the installation.
- B. All bonding conductor lugs must be two-hole lugs to maximize the continuous bonding should one of the bolts loosen for any reason. Preparation for bonding should always include exposing of bare metal components, should any type of finish exist on the equipment in order to provide a proper bond to ground.
- C. Only ground one end of a conduit run, never both ends in order to avoid a ground loop of any kind.
- D. All bonding for telecommunications must include the testing of each bond.

### 8 SPECIALTY ITEMS

- A. Specialty items cover any item not typical to the Structured Cabling System (SCS) such as emergency phones and wireless access points. Other items may be included in this section if they do not fall within prior sketch categories.
- B. Sketches relative to emergency phones are intended to bridge the gap between typical telecommunications equipment normally found on projects and emergency phones used by UCB throughout the campus. These phones are directly linked to the campus police department and their location is typically specified by the University Campus Police Department (UCPD).
- C. The sketches contain an actual template for use in setting the in-ground pedestal with support anchors and conduit that feeds the required power and telecommunications voice cabling. The size of the pedestal base is shown, as well as basic components of the emergency phone for OSP installation (refer to sketch [SK902](#)).
- D. Accompanying the sketches is cut-out information for placement of wall mounted emergency phones (refer to sketch [SK901](#) printed on 11x17 inch paper).

## SECTION 13 – SKETCHES

### SKETCH IDENTIFICATION

Sketch documents are typically on an 8 1/2x11 inch format that is printed on almost any printer. The layouts are typically in portrait mode, but may also be found in landscape mode for items covering an expanded area.

Some sketches may be found in the 11x17 inch format based on the size of the sketch detail.

#### 1 GROUPED SKETCHES

Sketches are grouped together to make it easier to find related information as follows:

##### **SK001-SK099** General Sketches

[SK100-199](#) User Space

[SK200-299](#) Labeling

**SK300-399** Not Assigned

[SK400-499](#) Fire Stopping

[SK500-599](#) Telecommunications Rooms

[SK600-699](#) Pathway Cable Routing


[SK700-799](#) OSP Equipment

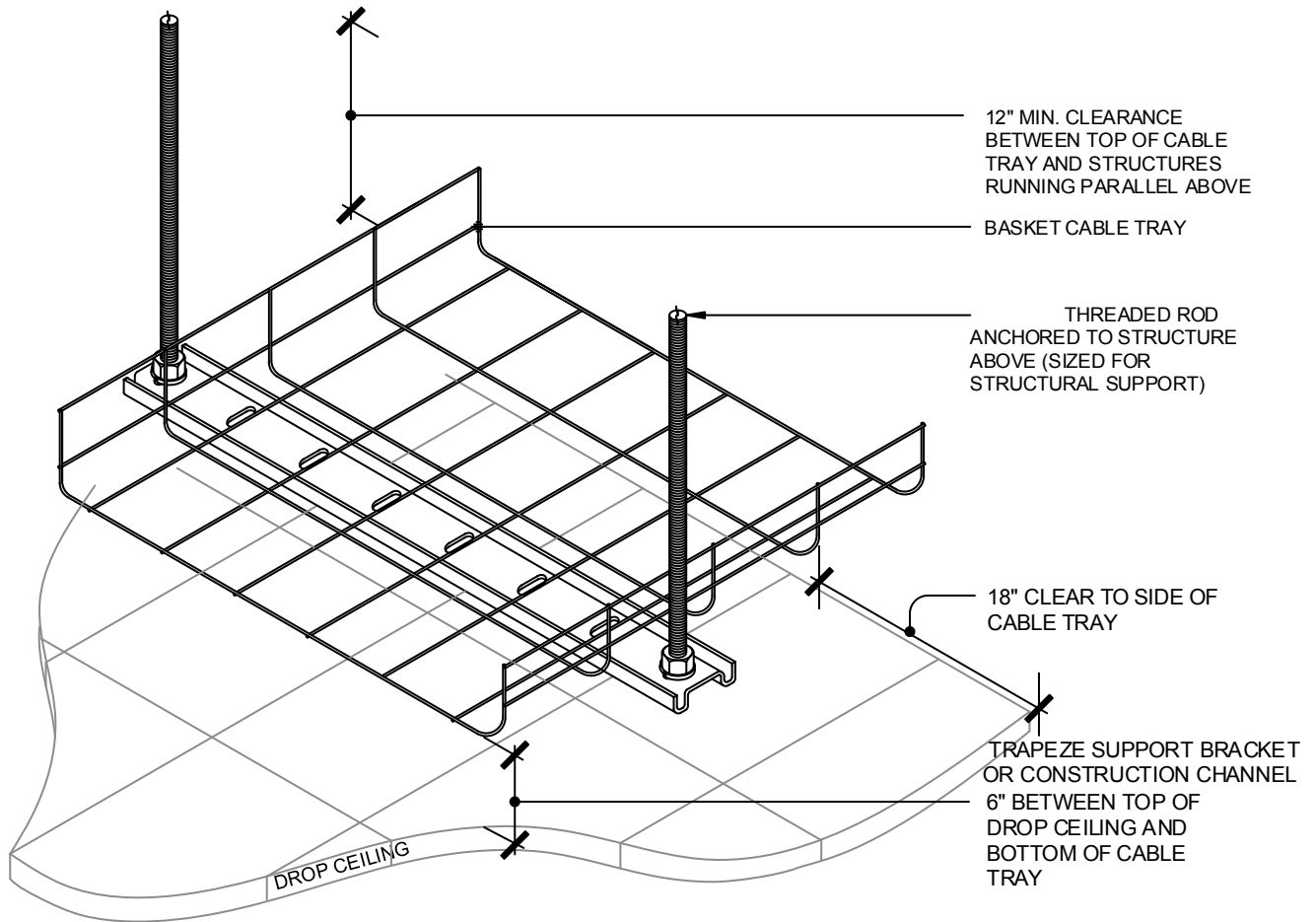
[SK800-899](#) Bonding and Grounding

[SK900-999](#) Specialty Items

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	Sketch 900 -

	<b>UNIVERSITY OF CALIFORNIA BERKELEY</b> Information Services and Technology	DESCRIPTION:  <b>TELECOMMUNICATIONS TABLE OF CONTENT TO SKETCHES</b>	SKETCH No: <b>SK000</b>
	<hr style="width: 80%; margin: auto;"/> <b>Communications Standards</b>		DATE:
			REVISION:
			SCALE: <b>NONE</b>



- NOTES: 1. TRAPEZE SUPPORT BRACKET MAY VARY. SHOWN HERE AS EXAMPLE ONLY.  
 2. LOCAL SEISMIC CODES.  
 3. ALSO DETERMINE BRACING REQUIREMENTS BASED ON LOCAL SEISMIC CODES.  
 4. SUPPORT CABLE TRAY WITHIN 24" ON BOTH SIDES OF ANY TWO JOINED SECTIONS.



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Information Services and Technology

Communications Standards

DESCRIPTION:

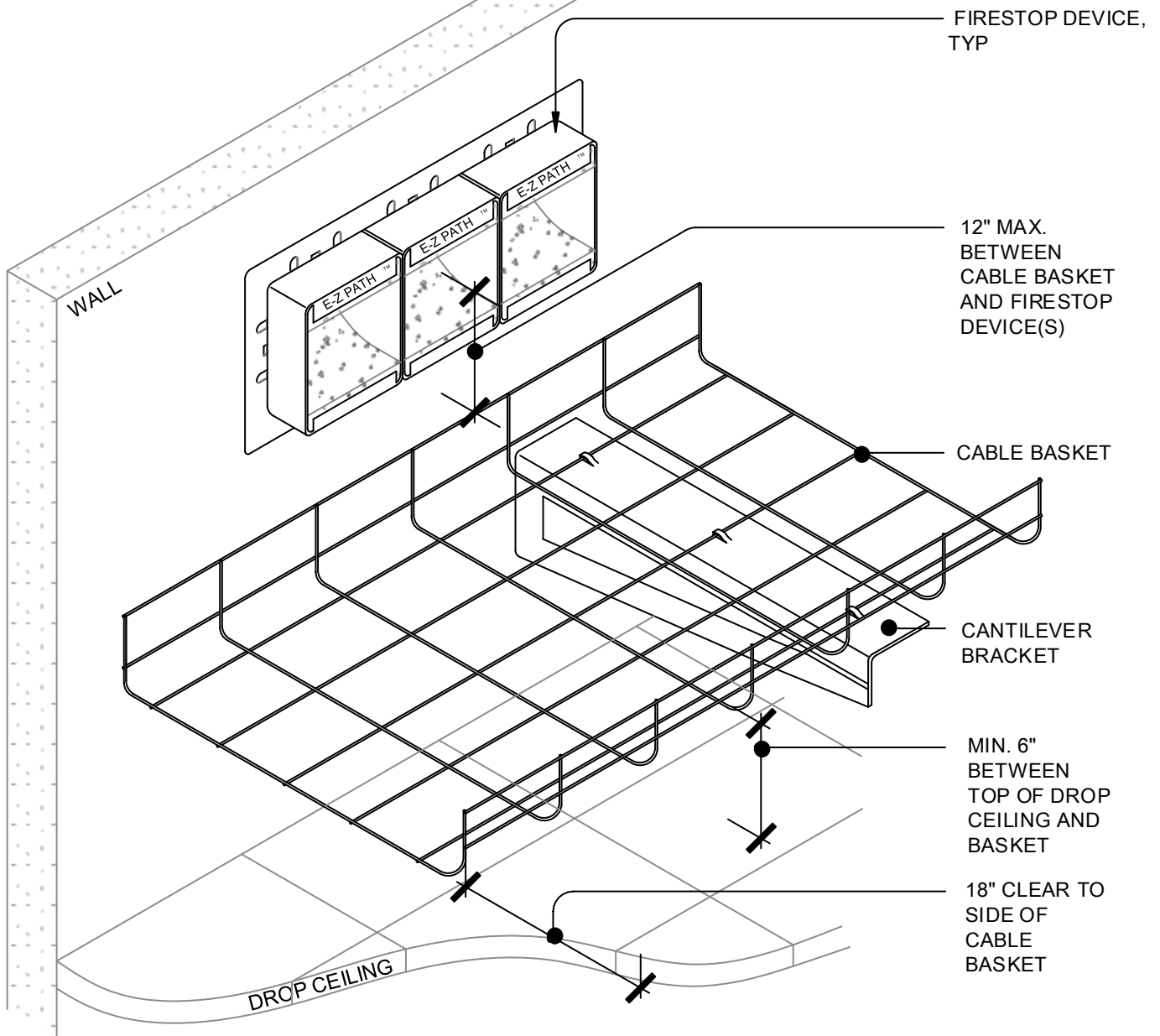
TELECOMMUNICATIONS  
BASKET TRAY SUPPORT  
DETAIL WITH TRAPEZE  
SUPPORT AND CLEARANCE  
REQUIREMENTS

SKETCH No: **SK100**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



- NOTES: 1. REFER TO FLOOR PLANS FOR CABLE BASKET SIZE AND ROUTE(S).  
 2. CANTILEVER BRACKET MAY DIFFER BETWEEN MANUFACTURERS. SHOWN HERE AS EXAMPLE.  
 3. REFER TO FLOOR PLANS FOR FIRESTOP DEVICE SIZE AND QUANTITY.  
 4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL TYPE AND CEILING TYPE. SHOWN HERE FOR CLARITY ONLY.



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Information Services and Technology

Communications Standards

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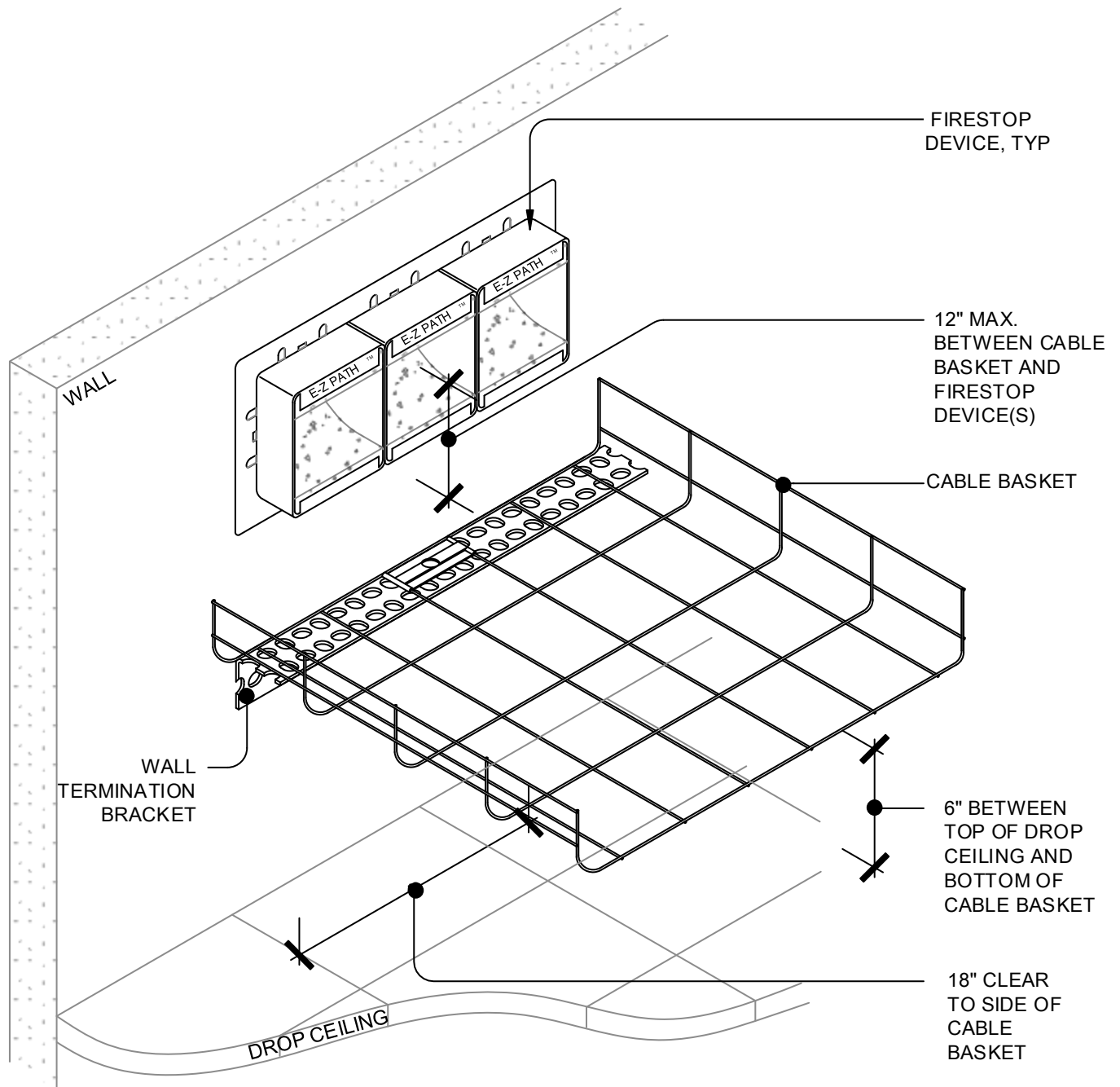
TELECOMMUNICATIONS  
 BASKET TRAY SUPPORT  
 DETAIL AT EZ-PATH –  
 PERPENDICULAR TO WALL

SKETCH No: **SK101**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



- NOTES: 1. ALIGN FIRESTOP DEVICE(S) WITH HORIZONTAL SECTION OF CABLE BASKET.  
 2. REFER TO FLOOR PLANS FOR CABLE BASKET SIZE AND ROUTE(S).  
 3. WALL TERMINATION BRACKET MAY DIFFER BETWEEN MANUFACTURERS. SHOWN HERE AS EXAMPLE.  
 4. REFER TO FLOOR PLANS FOR FIRESTOP DEVICE SIZE AND QUANTITY.  
 5. REFER TO ARCHITECTURAL DRAWINGS FOR WALL TYPE AND CEILING TYPE. SHOWN HERE FOR CLARITY ONLY.



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Information Services and Technology

Communications Standards

DESCRIPTION:

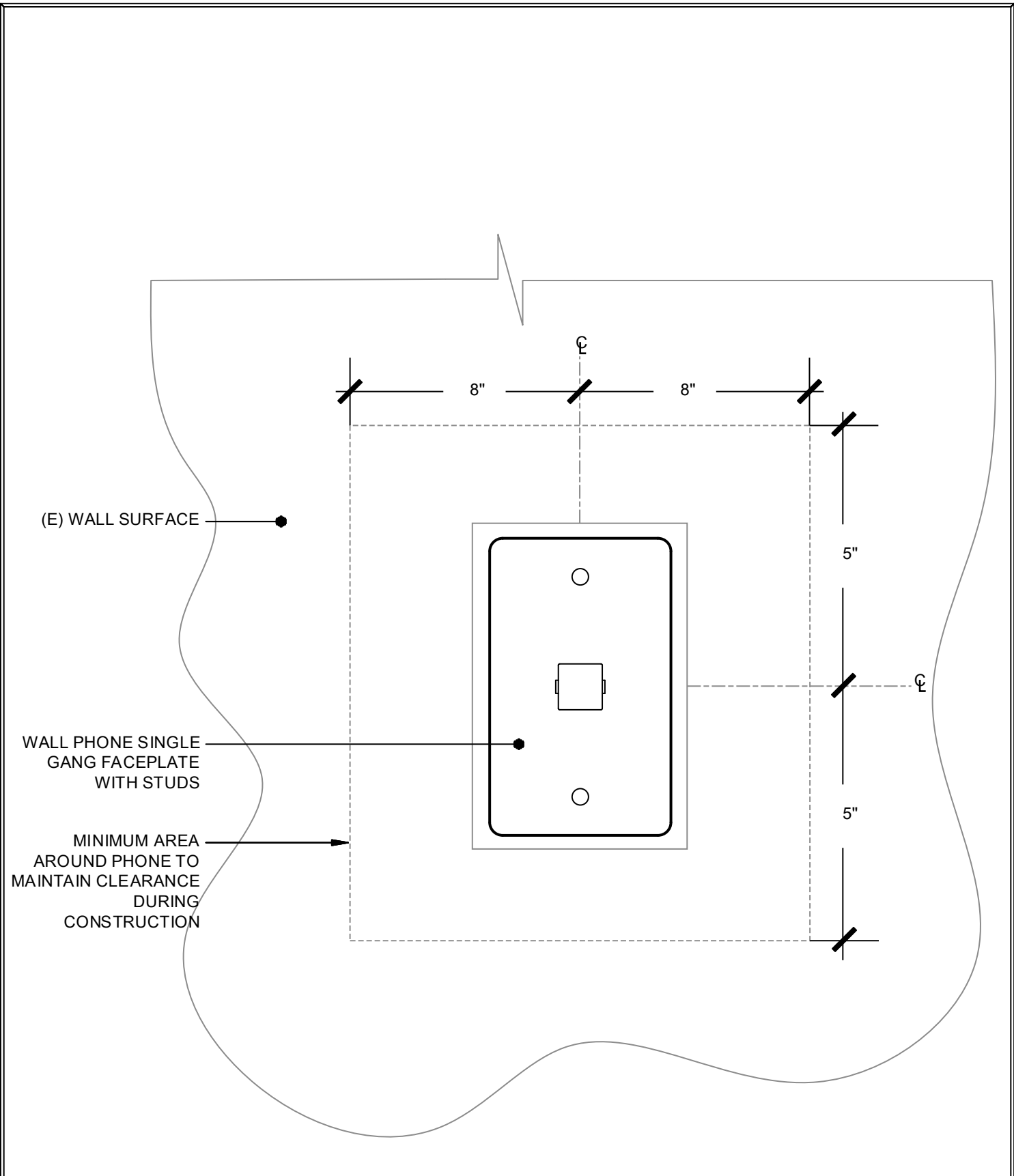
TELECOMMUNICATIONS  
 BASKET TRAY SUPPORT  
 DETAIL AT EZ-PATH –  
 PARALLEL TO WALL

SKETCH No: **SK102**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



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Information Services and Technology

Communications Standards

DESCRIPTION:

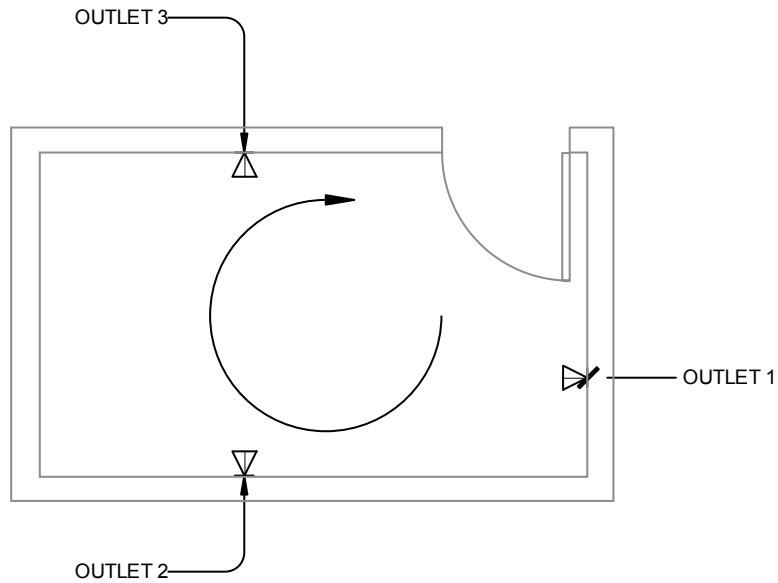
TELECOMMUNICATIONS  
CLEARANCE AROUND WALL  
PHONE OUTLET BOX  
DURING CONSTRUCTION

SKETCH No: **SK103**

DATE: 6/15/14

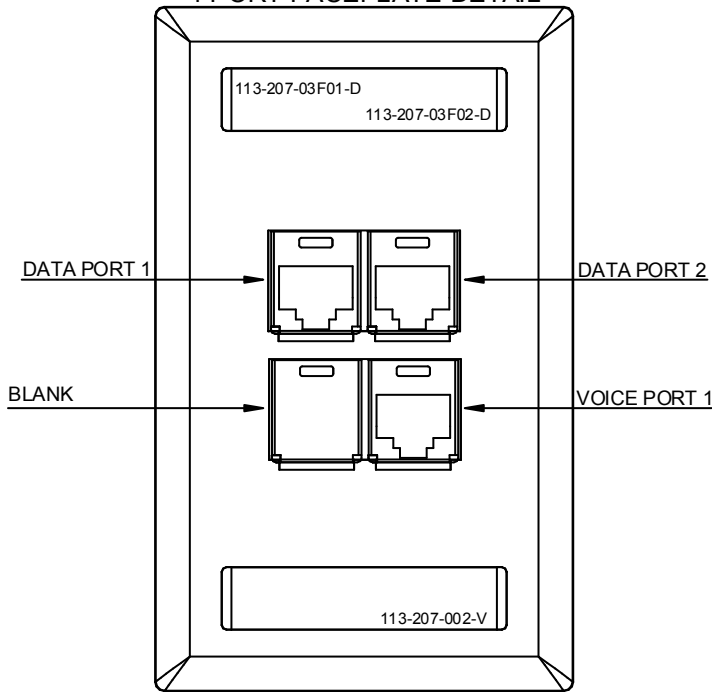
REVISION: 3

SCALE: NONE

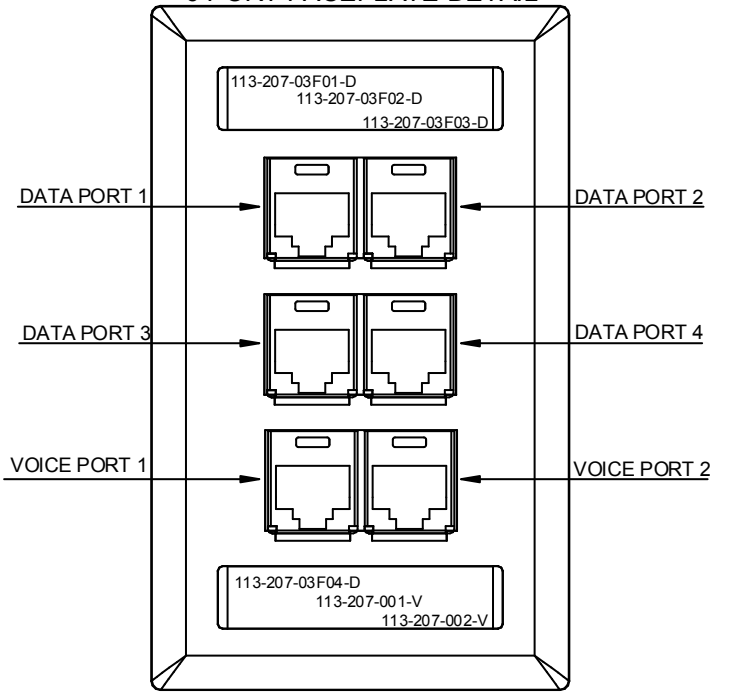


ROOM OUTLET LABELING ORDER

4 PORT FACEPLATE DETAIL



6 PORT FACEPLATE DETAIL



NOTES: 1. ROOM NUMBERS SHOWN IN DETAIL ARE AN EXAMPLE AND MAY NOT REFLECT ACTUAL ROOM NUMBERS.



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Information Services and Technology

Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
OUTLET FACEPLATE  
LABELING  
AND ROOM ORDER PLAN

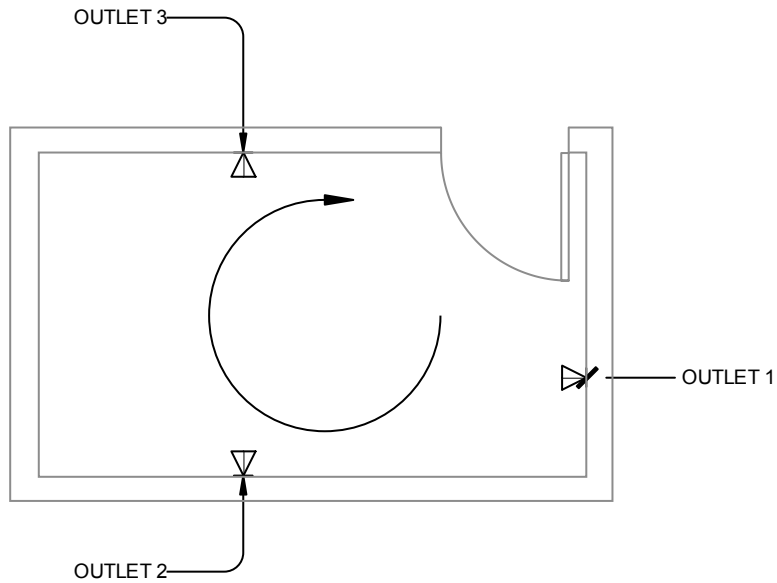
SKETCH  
No: **SK200**

DATE: 12/2/14

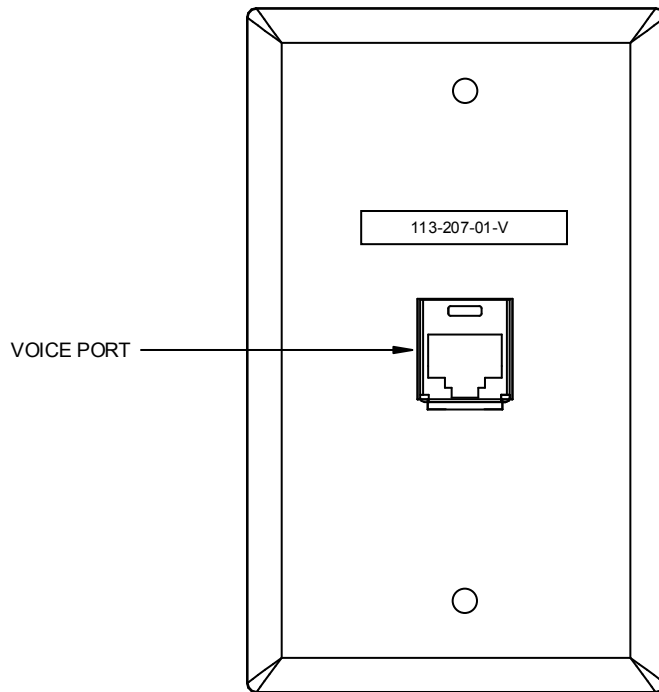
REVISION: 5

SCALE: NONE





ROOM OUTLET LABELING ORDER



NOTES:1. ROOM NUMBERS SHOWN IN DETAIL ARE AN EXAMPLE AND MAY NOT REFLECT ACTUAL ROOM NUMBERS.

## WALL PHONE FACEPLATE DETAIL



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Information Services and Technology

Communications Standards

**DESCRIPTION:**

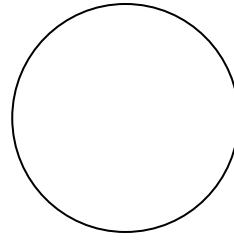
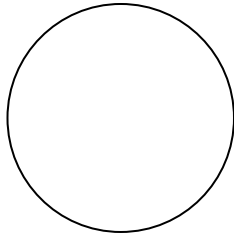
TELECOMMUNICATIONS  
OUTLET FACEPLATE  
LABELING – SINGLE PORT  
AND ROOM ORDER PLAN

SKETCH  
No: **SK201**

DATE: 6/15/14

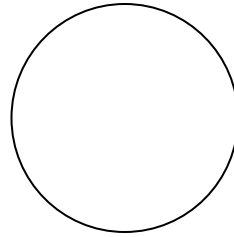
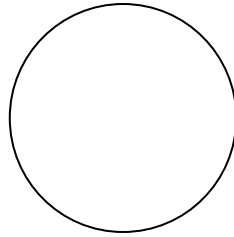
REVISION: 3

SCALE: NONE



70 - 71 - 01

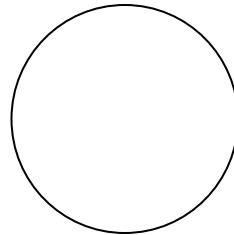
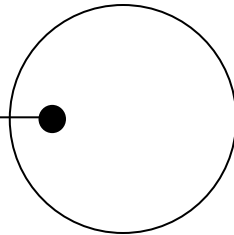
70 - 71 - 02



70 - 71 - 03

70 - 71 - 04

CONDUIT,  
TYP OF 6



70 - 71 - 05

70 - 71 - 06

LABEL UNIT  
APPLIED  
UNDER EACH  
CONDUIT, TYP  
12"X1"  
HOLDER

CURRENT VAULT ID, TYP

DESTINATION VAULT ID, TYP

CONDUIT SEQUENCE NBR, TYP



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DESCRIPTION:

TELECOMMUNICATIONS  
OSP VAULT CONDUIT  
LABELING

SKETCH  
No: **SK202**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

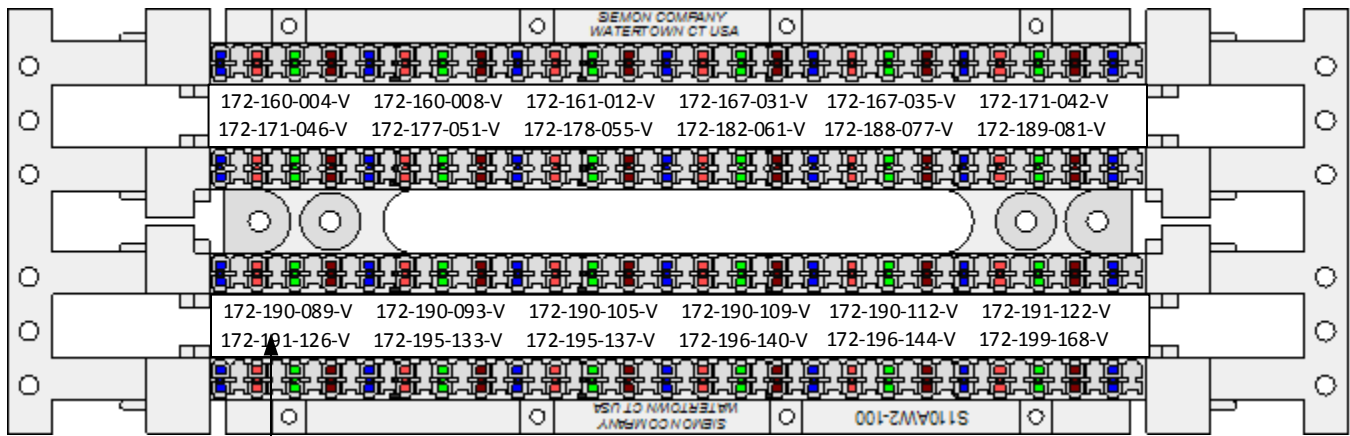
NUMERIC - POSITION PATCH  
PANEL LABEL AS SHOWN, TYP



24-PORT PATCH PANEL



48-PORT PATCH PANEL



110 STYLE WALL TERMINATION BLOCK

LABELING OF 110 STYLE BLOCK

FORMAT: TELECOM ROOM +  
STATION ROOM# + SEQUENCE# =  
"V" FOR VOICE, TYP



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Communications Standards

DESCRIPTION:

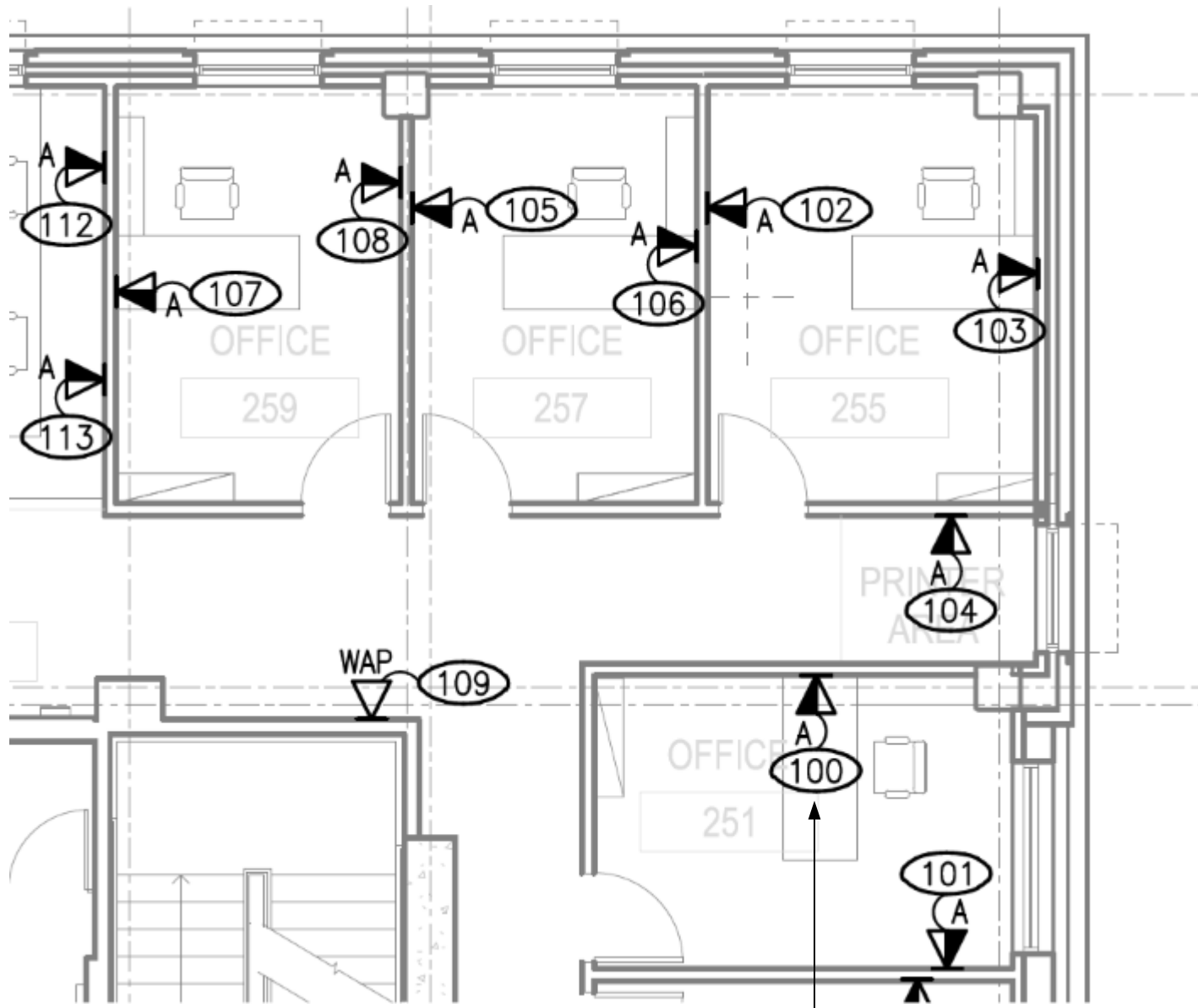
TELECOMMUNICATIONS  
LABELING FOR PATCH  
PANELS AND 110 WALL  
FIELD

SKETCH  
No: **SK203**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



OUTLET ASSIGNED A UNIQUE 3  
 DIGIT SEQUENTIAL NUMBER  
 BASED ON ENTERING THE  
 ROOM'S DOOR AND MOVING TO  
 THE LEFT AND AROUND THE  
 ROOM IN A CLOCKWISE  
 DIRECTION, TYP



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Communications Standards

DESCRIPTION:

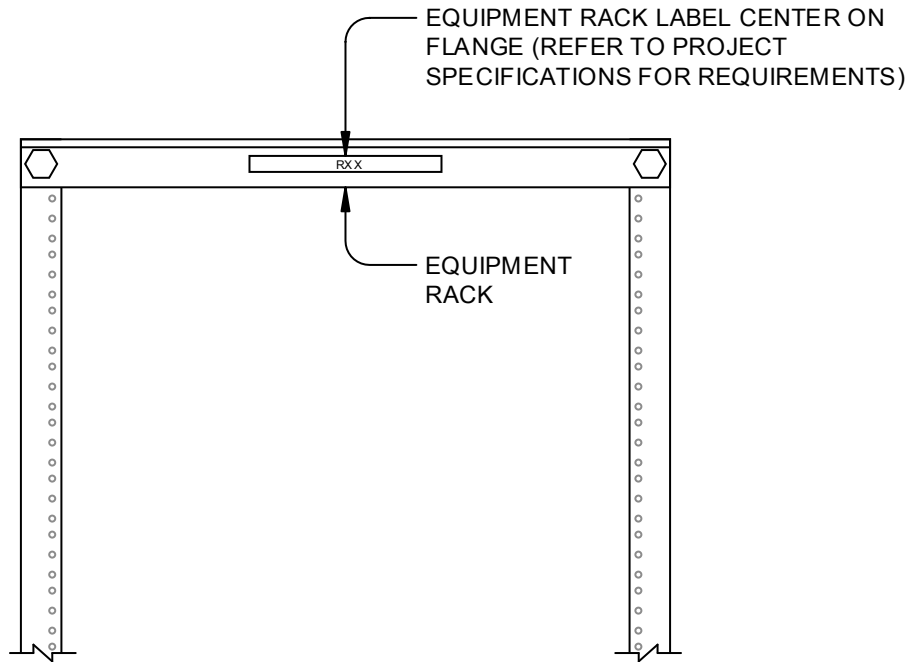
TELECOMMUNICATIONS  
 EXAMPLE OF FLOOR PLAN  
 DRAWING AS PART OF THE  
 100% CD SUBMISSION

SKETCH No: **SK204**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



## FRONT VIEW

NOTE: PROVIDE A PERMANENT LASER GENERATED LABEL APPLIED TO A LABEL RETAINING BRACKET

FORMAT:

START LABELING AS "R01" AT THE RACK NEAREST THE WALL.



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Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
EQUIPMENT RACK  
LABELING

SKETCH No: **SK205**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

Type of Room	Code for CCU	Description	IST Example (jack ID)	UCPD Example (includes 10 char BLDG + 9 char ROOM)	Usage
We do not allow more than one room per new analog lines.					
Blue Light/Emergency Phones	EM	EM used with the room number or direction indicator	SSL-EM	SSL EM	SSL EMERGENCY
Breezeway	BRZWY	BRZWY is used with the building it is associated with (could not find an example in Mysoft)	OBRIVN-BRZWY	O BRIEN BRZWY	O BRIEN HALL BREEZEWAY
Elevators	ELV N F	ELV's pace Directional indicator, an 'F' should be used for freight	WUR-ELV NE F	WURSTER ELV NE F	WURSTER HALL ELEVATOR NORTH EAST FREIGHT
Entrances	ENT	can be inside or outside	BOTA-ENT	BOT GDN A ENT	BOTANICAL GARDEN BUILDING A OFFICE ENTRANCE
Exterior	EXT	exterior, should have a directional indicator; exterior to the building referenced	CITRIS-EM EXT NE	CITRIS EM EXT NE	CITRIS EMERGENCY LINE EXTERIOR NE SIDE
Field	FLD	at this time, specifically for Underhill playing field	UNDER-FLD E	UNDER-FLD E	UNDERHILL PLAYING FIELD, EAST SIDE OF THE FIELD
Floor	FL	referencing a floor number in a building	EVANS-FL 9	EVANS FL 9	EVANS HALL FLOOR 9
Hallways	HL 105	HL is always followed by a room number that the phone is near	CK09-HL 105	CKC-9 HL 105	CLARK KERR CAMPUS, BUILDING 9, IN THE HALLWAY OUTSIDE ROOM 105
Level	LVL	indicates what level, or floor the phone line is located on	UNDER-LV L1	UNDERHILL LV L1	UNDERHILL PARKING GARAGE, LEVEL 1 EMERGENCY PHONE
Loading Docks	DOCK	Can use a directional indicator if there is more than one dock	RH1CH-DOCK	UNIT-1 CHE DOCK	RESIDENCE HALL 1-CHENEY LOADING DOCK
Lobbys	LBY	LBY	LSA-LBY	LSA LBY	LIFE SCIENCES ADDITION LOBBY
Parking Lot	LOT	As of 11/8/13 room type LOT is only used for 1608 4th St. Other parking lots have their own building designation.	4TH1608-LOT	1608 4th St LOT	1608 4TH ST PARKING LOT
Lower	LWR	This would follow the object of the location, i.e., "LOT LWR" for Parking lot the lower level. (COULD NOT FIND LOWER LEVEL IN PARKING LOTS IN DB)	BOAL TSA-LWR STK N	BOAL TSA LWR STK N	BOALT SOUTH ADDITION LOWER LEVEL STACK NORTH
On a street corner	CHAN BOWD	Use up to 4 chars of each street with a space between	C2547-EM Cha Bow	2547 CHAN CHAN BOWD	2547 CHANNING EMERGENCY LINE ON THE CORNER OF CHANNING AND BOWDITCH
One room bldgs	100	one room buildings always have room#100	RFS-155-100	RFS-155 100	RICHMOND FIELD STATION BUILDING 155
Plazas	PLZ	Can add UFR for upper or LWR for lower (could not find an example of plaza)	SPROUL-PLZ-LWR	SPROUL PLZ LWR	LOWER SPROUL PLAZA
Pool	POOL	to designate the pool for a recreation area	RSF-POOL	RSF POOL	Recreational Sports Facility-Pool
Sign Post	SP	For Fire Trails	don't have examples		SIGN POST NUMBER
Stairs, stairwell	STAR	Can use a directional indicator where needed	MTZ-2ESTAIR	MARTINEZ CO 2ESTAIR	MARTINEZ COMMONS 2ND FLOOR EAST STAIRCASE
Telecom Room	TELCO RM	Telecom communications room/closet	DUR-TELCO RM	DURANT TELCO RM	DURANT HALL TELCOM ROOM
Upper	UFR	This would follow the object of the location, i.e., "LOT UFR" for Parking lot the Upper level.	SPROUL-PLZ-UFR	SPROUL PLZ UFR	UPPER SPROUL PLAZA
Yard	YD	as in court yard, play yard	don't have examples		



UNIVERSITY OF CALIFORNIA  
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Communications Standards

DESCRIPTION:

ROOM TYPE NAMING CONVENTION

SKETCH  
No:

SK206

DATE:

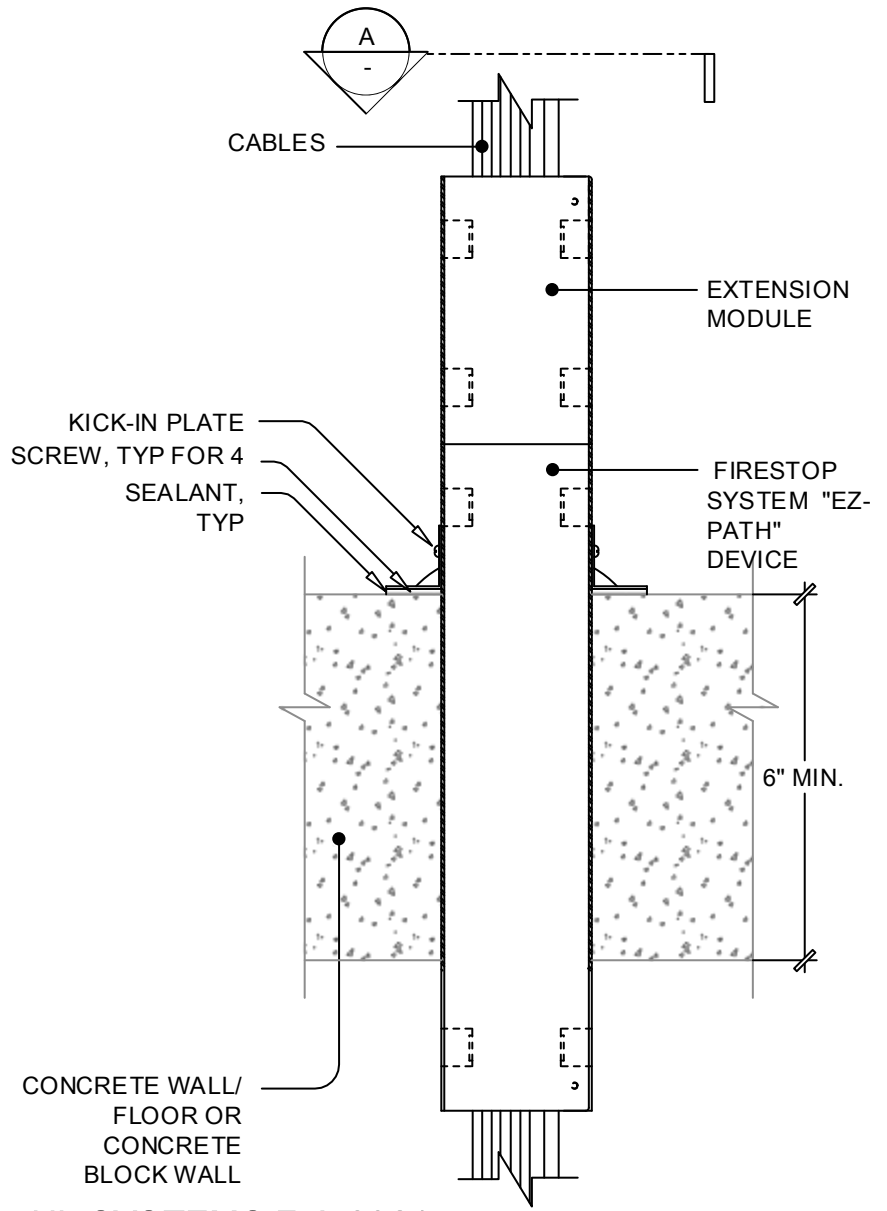
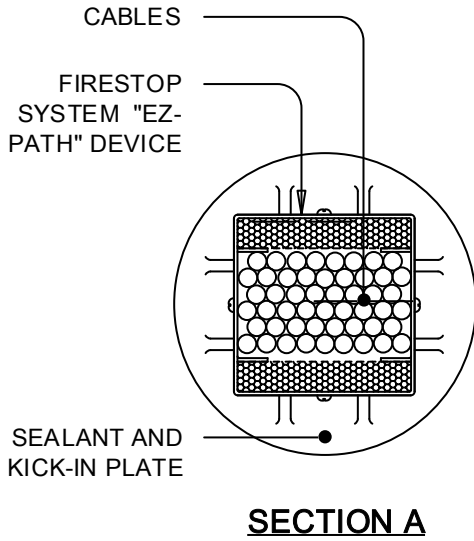
11/25/14

REVISION:

1

SCALE:

NONE



**UL SYSTEMS F-A-3021**

T = 2 HR

F = 3 HR

CONSULT CURRENT UNDERWRITERS LABORATORIES "FIRE RESISTANCE DIRECTORY" FOR DETAILS



**UNIVERSITY OF CALIFORNIA  
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Information Services and Technology

Communications Standards

DESCRIPTION:

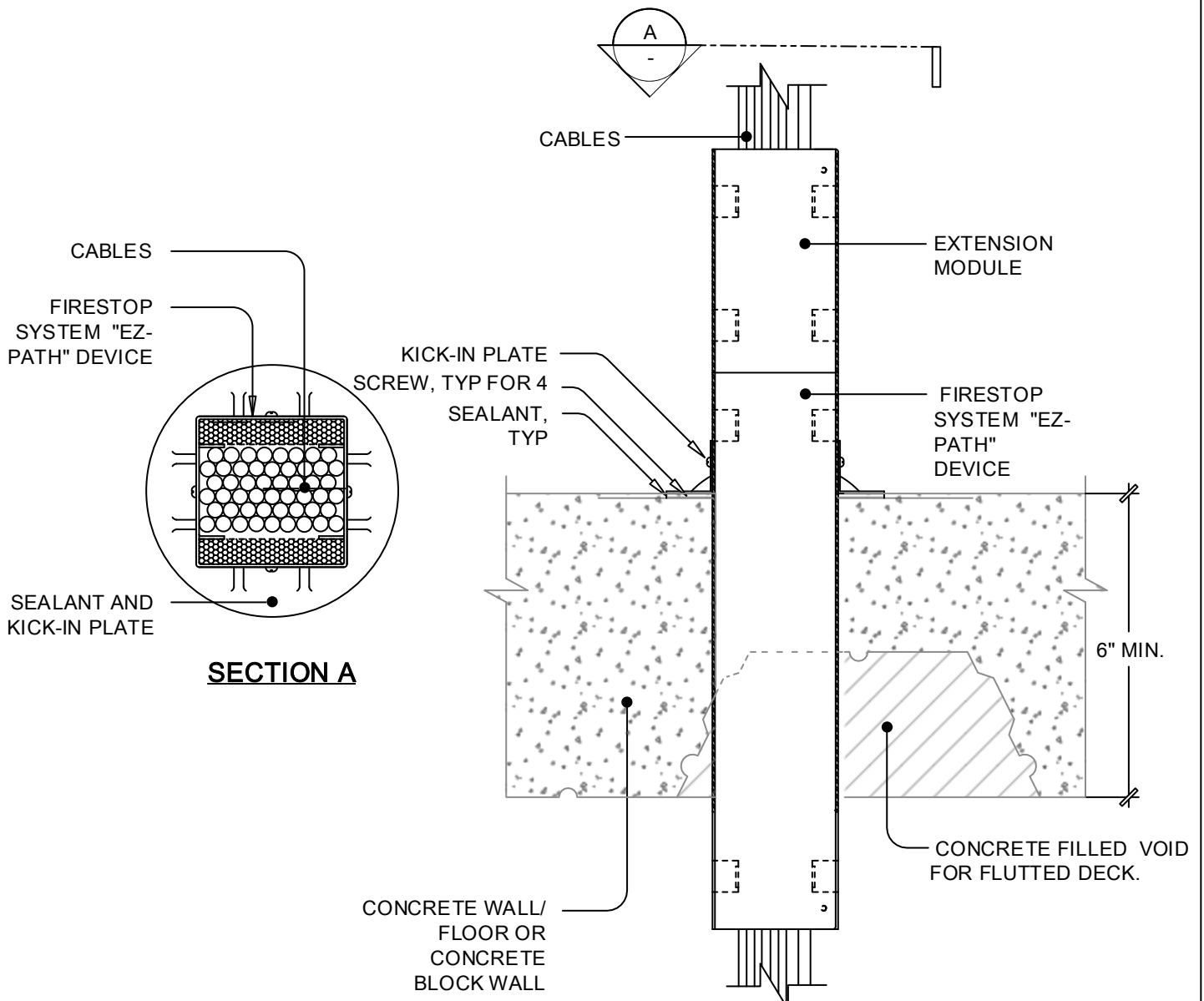
TELECOMMUNICATIONS  
EZ-PATH FLOOR  
PENETRATION FOR 2 HR  
TEMPERATURE 3 HR FIRE  
(NON-FLUTTED DECK)

SKETCH No: **SK400**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



**UL SYSTEMS F-A-3021**

T = 2 HR

F = 3 HR

CONSULT CURRENT UNDERWRITERS LABORATORIES "FIRE RESISTANCE DIRECTORY" FOR DETAILS



**UNIVERSITY OF CALIFORNIA  
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Information Services and Technology

Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
EZ-PATH FLOOR  
PENETRATION FOR 2 HR  
TEMPERATURE 3 HR FIRE  
FOR **FLUTTED DECK**

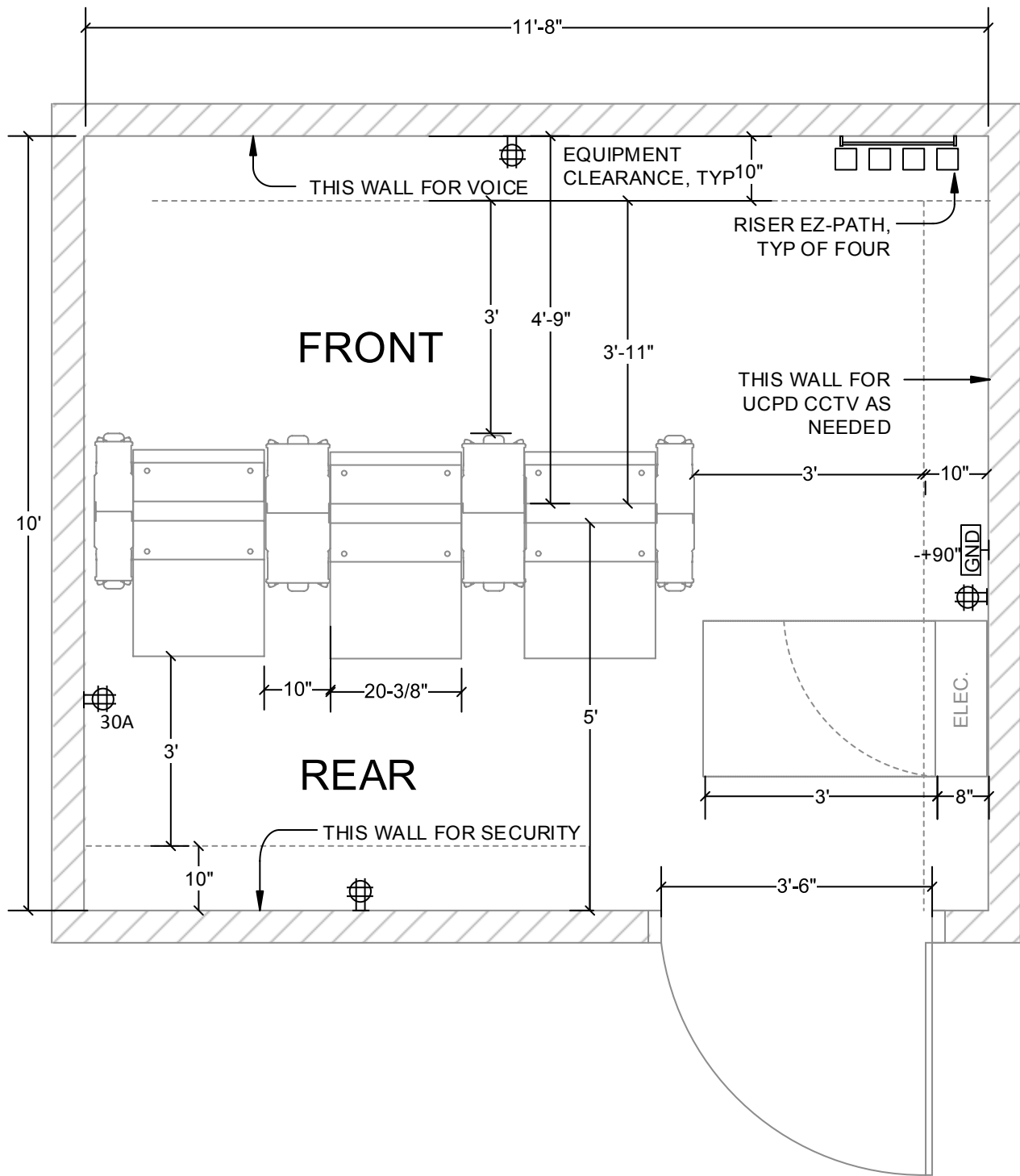
SKETCH No: **SK401**

DATE: 6/15/14

REVISION: 3

SCALE: NONE





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Communications Standards

DESCRIPTION:

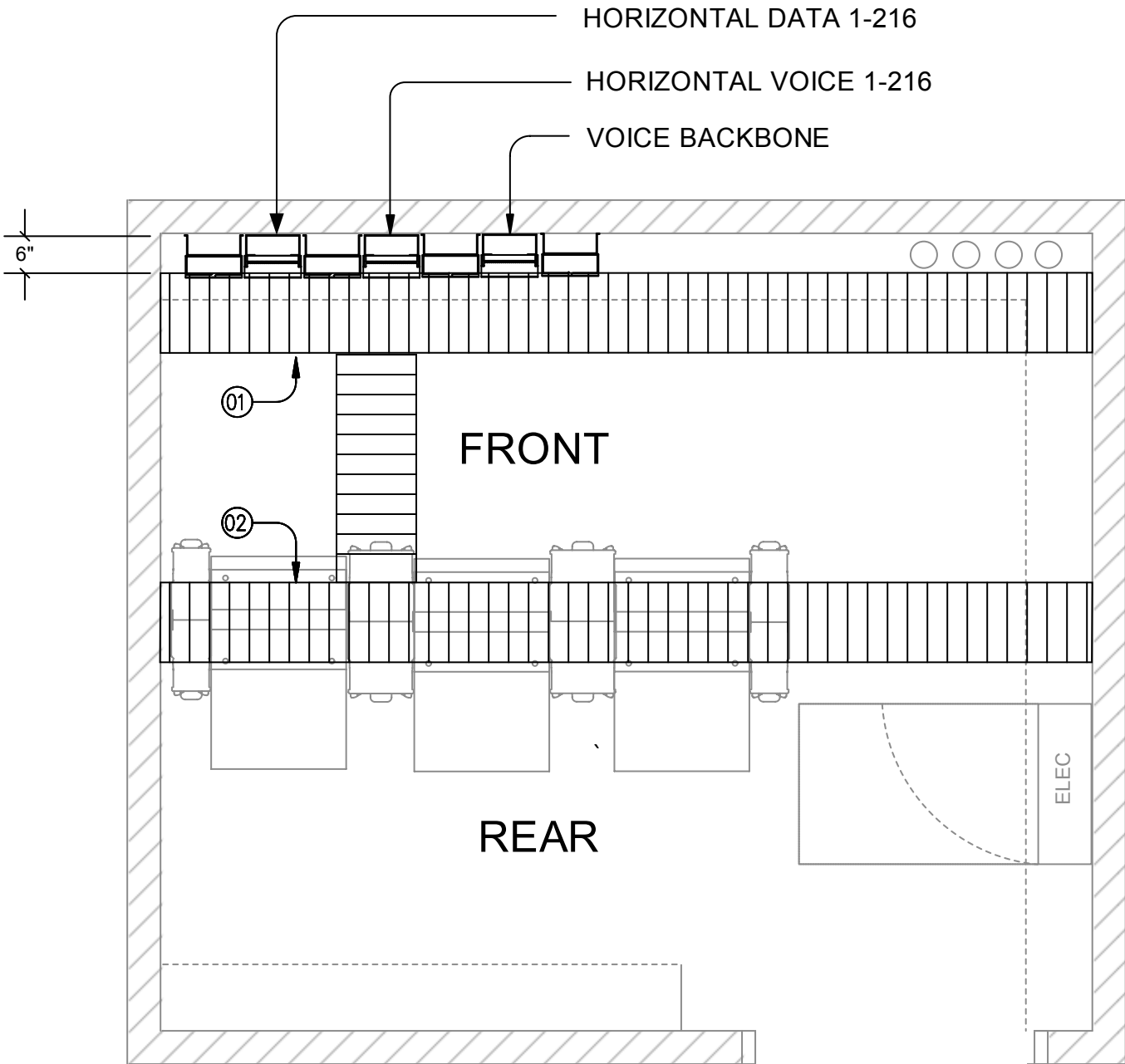
TELECOMMUNICATIONS  
BASIC TELECOM ROOM PLAN  
WITH THREE EQUIPMENT  
RACKS, VERTICAL MGRS, AND  
WALL MOUNTING SPACE

SKETCH No: **SK500**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



- ① RUNWAY AT 7 FT. AFF (6 INCHES OFF THE WALL)
- ② RUNWAY AT 7 FT. AFF (CENTER OVER CABLE MGRS)

NOTE: RUNWAY WIDTH BASED ON PROJECT REQUIREMENTS (TYP. 18 INCHES).



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Communications Standards

DESCRIPTION:

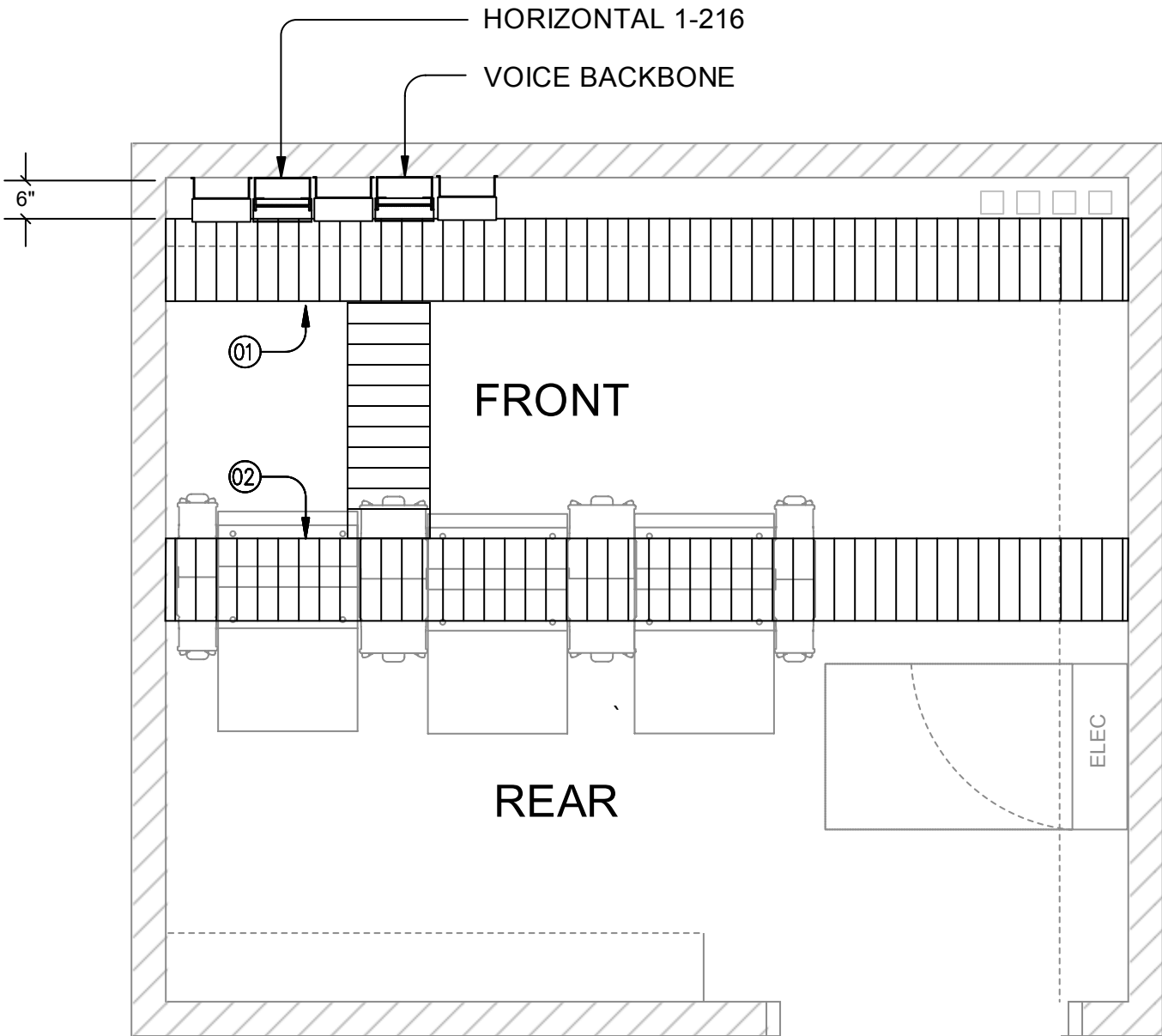
TELECOMMUNICATIONS  
BASIC TELECOM ROOM  
PLAN (EXISTING PRIOR  
2014)  
LEVEL-1 CABLE RUNWAY

SKETCH No: **SK501**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



- ① RUNWAY AT 7 FT. AFF (6 INCHES OFF THE WALL)
- ② RUNWAY AT 7 FT. AFF (CENTER OVER CABLE MGRS)

NOTE: RUNWAY WIDTH BASED ON PROJECT REQUIREMENTS (TYP. 18 INCHES).



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Information Services and Technology

Communications Standards

DESCRIPTION:

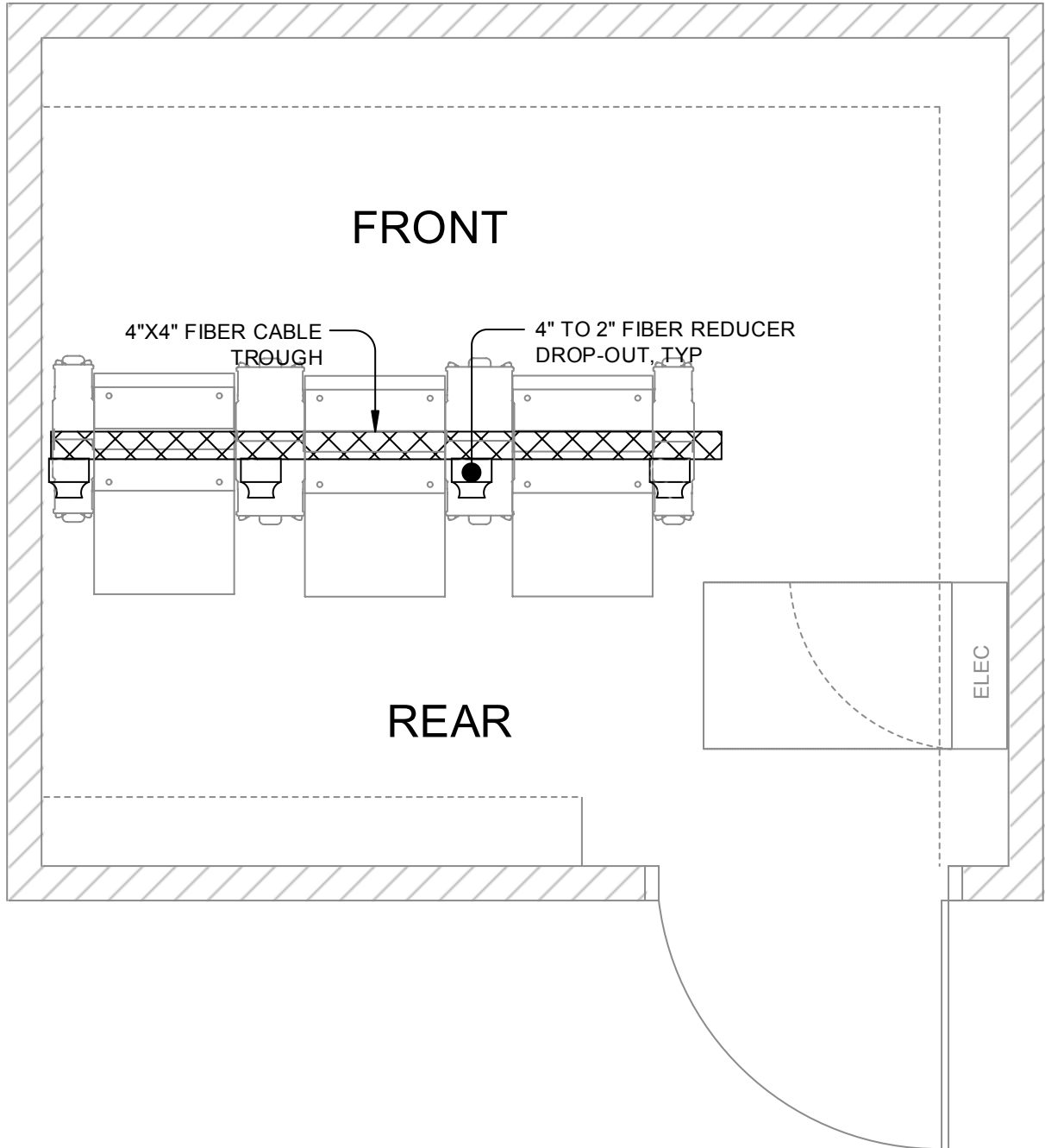
TELECOMMUNICATIONS  
BASIC TELECOM ROOM  
PLAN  
LEVEL-1 CABLE RUNWAY  
(NEW TRs ONLY)

SKETCH No: **SK501A**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



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Communications Standards

DESCRIPTION:

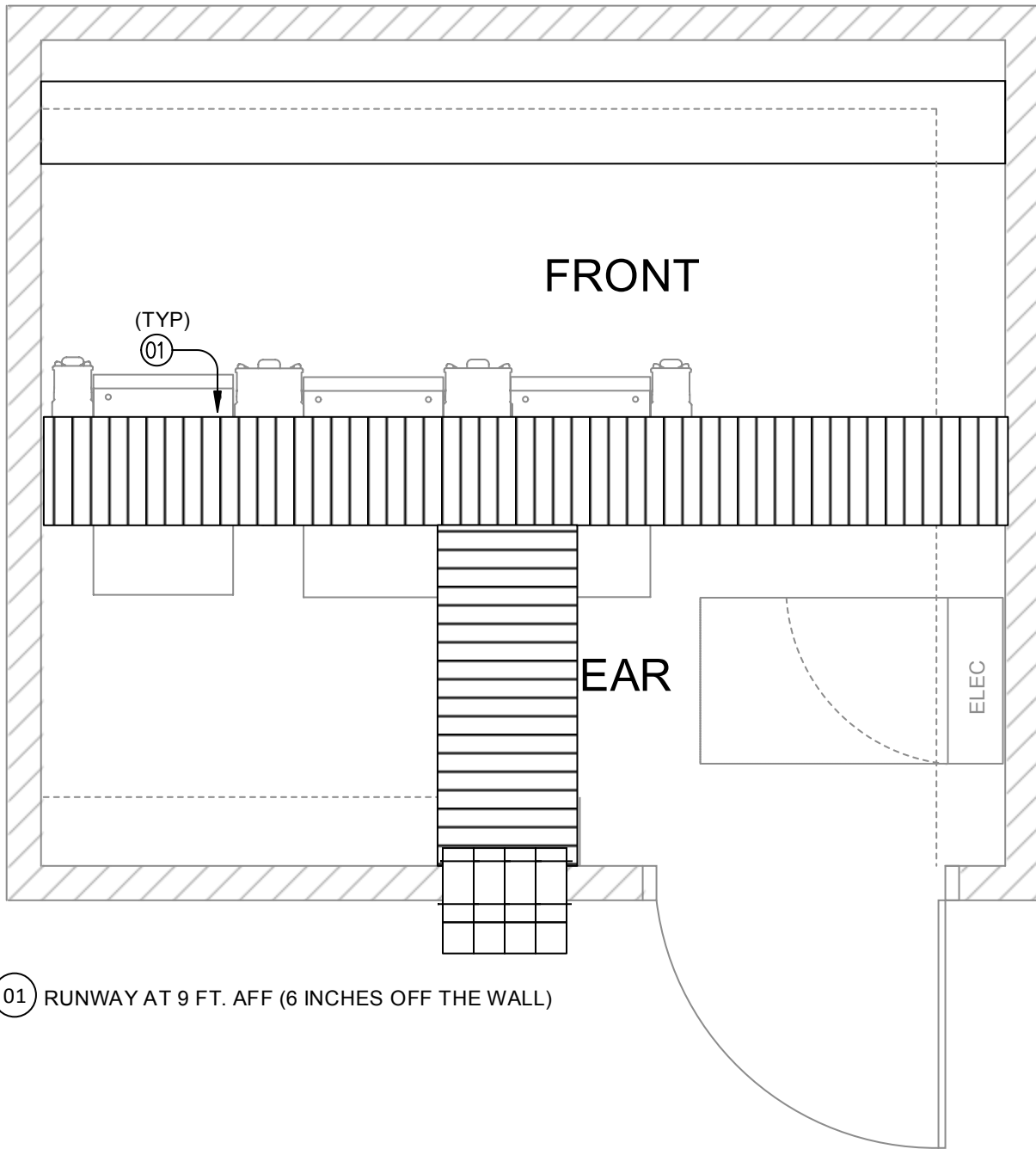
TELECOMMUNICATIONS  
BASIC TELECOM ROOM  
PLAN  
LEVEL-2 FIBER TROUGH

SKETCH No: **SK502**

DATE: 6/15/14


REVISION: 3

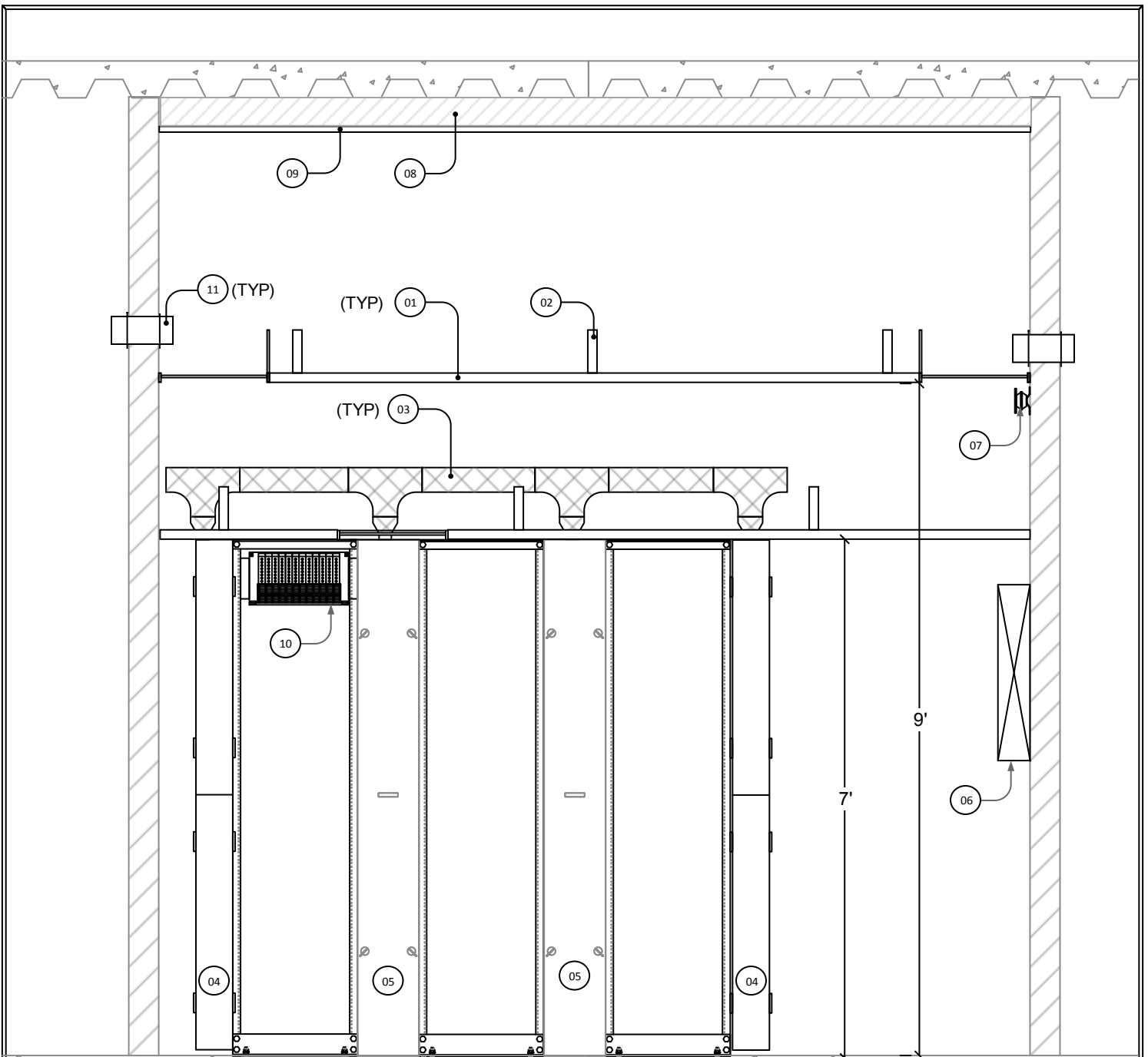
SCALE: NONE



01 RUNWAY AT 9 FT. AFF (6 INCHES OFF THE WALL)

NOTE: MIN. 18 INCH RUNWAY UNLESS OTHERWISE NOTED ( WIDTH BASED ON PROJECT REQUIREMENTS).  
CABLE RUNWAY ORIENTATION MAY DIFFER BASED ON ROOM PLAN AND CABLE ENTRY POINT(S).

 <p><b>UNIVERSITY OF CALIFORNIA BERKELEY</b> Information Services and Technology <hr/>Communications Standards</p>	DESCRIPTION:	SKETCH No: <b>SK503</b>
	TELECOMMUNICATIONS BASIC TELECOM ROOM PLAN	DATE: 6/15/14
	LEVEL-3 CABLE RUNWAY	REVISION: 3
		SCALE: NONE



- 01 CABLE RUNWAY - 18 INCH
- 02 CABLE RUNWAY - 7 INCH RETAINER POST
- 03 ACD FIBER RUNWAY - 4 INCH SECTIONS + DROPOUTS
- 04 VERTICAL CABLE MANAGER - 6 INCH WIDE W/COVER
- 05 VERTICAL CABLE MANAGER - 10 INCH WIDE W/COVER
- 06 ROOM'S ELECTRICAL PANEL
- 07 ROOM'S BONDING BUSBAR AT 90 INCHES AFF
- 08 INSULATION BATTING
- 09 GYPSUM BOARD CAPPED CEILING
- 10 ACD FIBER OPTIC PATCH PANEL
- 11 EZ-PATH 44



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Communications Standards

DESCRIPTION:

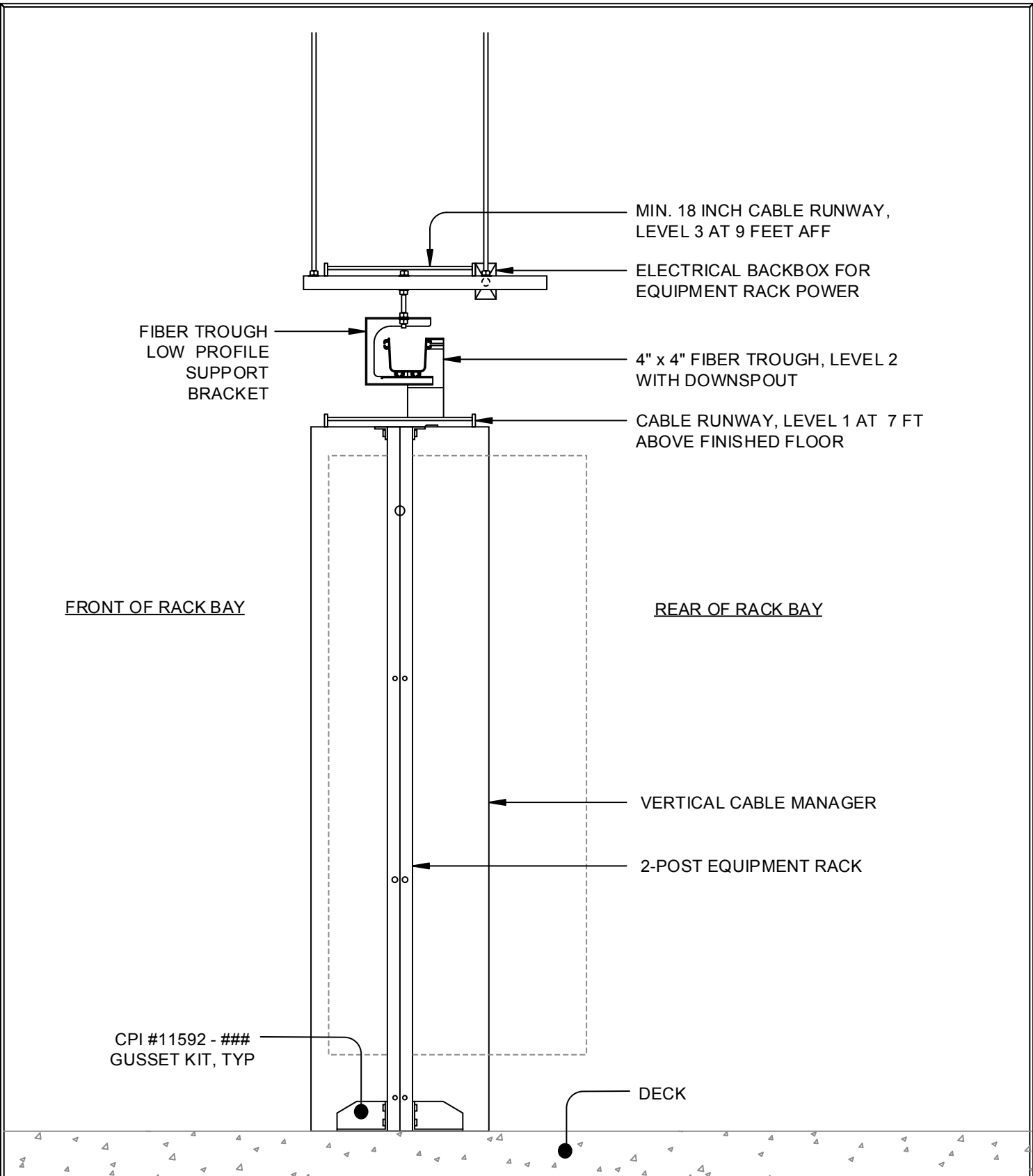
TELECOMMUNICATIONS  
BASIC TELECOM ROOM  
ELEVATION  
RACK-BAY


SKETCH No: **SK504**

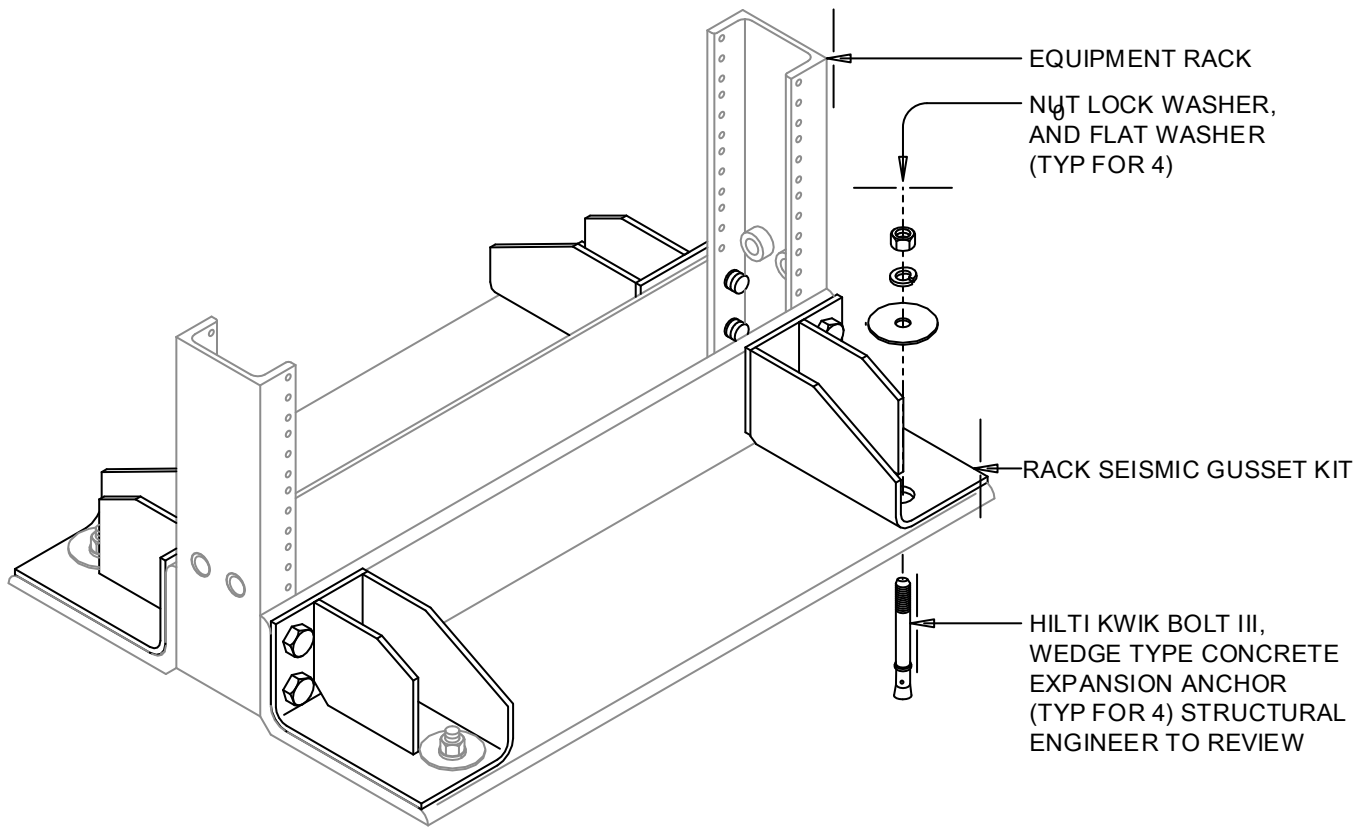
DATE: 6/15/14

REVISION: 3

SCALE: NONE



 <p><b>UNIVERSITY OF CALIFORNIA BERKELEY</b> Information Services and Technology <hr/>Communications Standards</p>	DESCRIPTION:	SKETCH No: <b>SK505</b>
	TELECOMMUNICATIONS EQUIPMENT RACK AND OVERHEAD CABLE MANAGEMENT SECTION VIEW	DATE: 6/15/14
		REVISION: 3
		SCALE: NONE



NOTE:1. REFER TO ROOM PLANS FOR EQUIPMENT RACK TYPE, SIZE, AND LOCATION(S).



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DESCRIPTION:

TELECOMMUNICATIONS  
EQUIPMENT RACK  
ANCHORING – 2-POST WITH  
GUSSET KIT

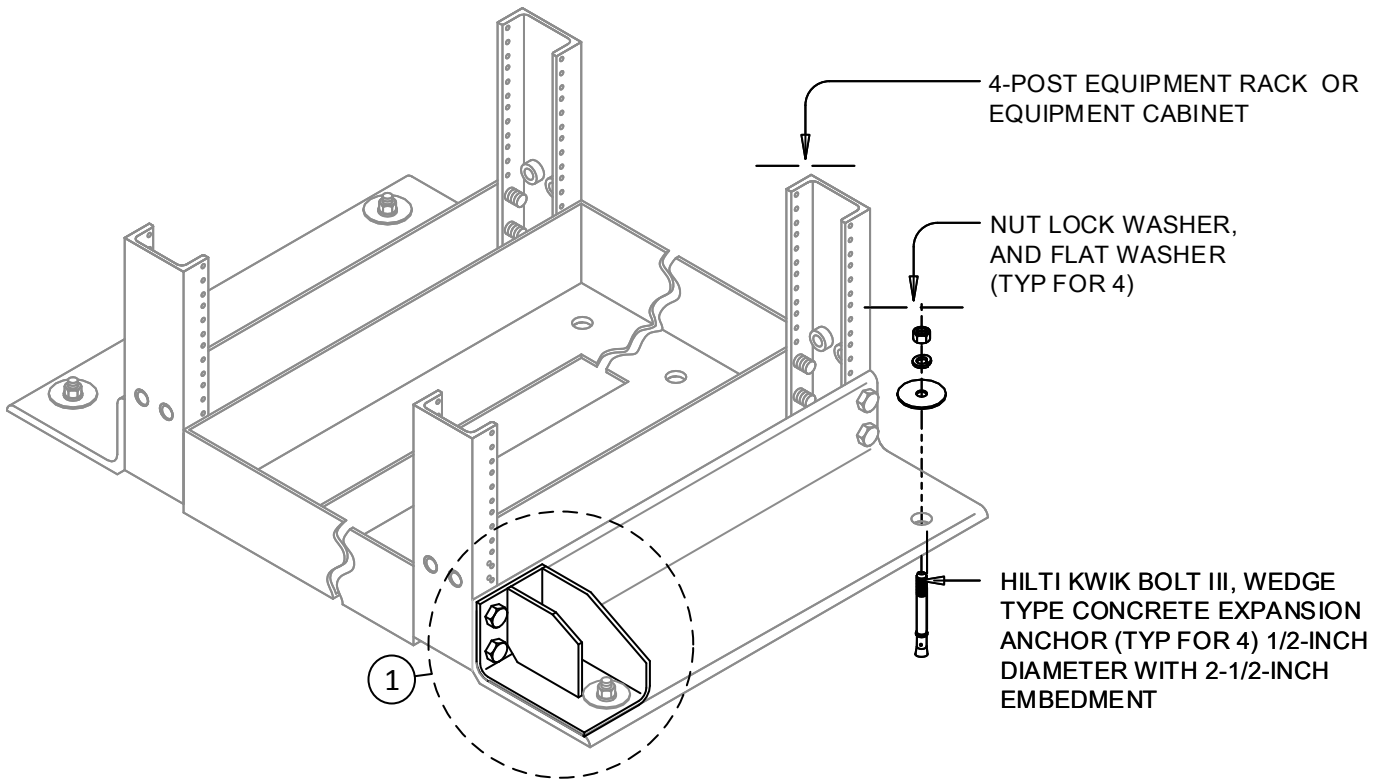
SKETCH No: **SK505A**

DATE: 6/15/14

REVISION: 3

SCALE: NONE





NOTE: REFER TO ROOM PLANS FOR EQUIPMENT RACK TYPE, SIZE, AND LOCATION(S).  
FOR GUSSET KIT, EXAMPLE TYPICAL OF FOUR.

① FOR GUSSET KIT, EXAMPLE TYPICAL OF FOUR.



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DESCRIPTION:

TELECOMMUNICATIONS  
EQUIPMENT RACK  
ANCHORING – 4-POST  
RACK

SKETCH No: **SK505B**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

REAR OF RACK BAY

19" EQUIPMENT RACK  
45 RACK UNITS, TYP

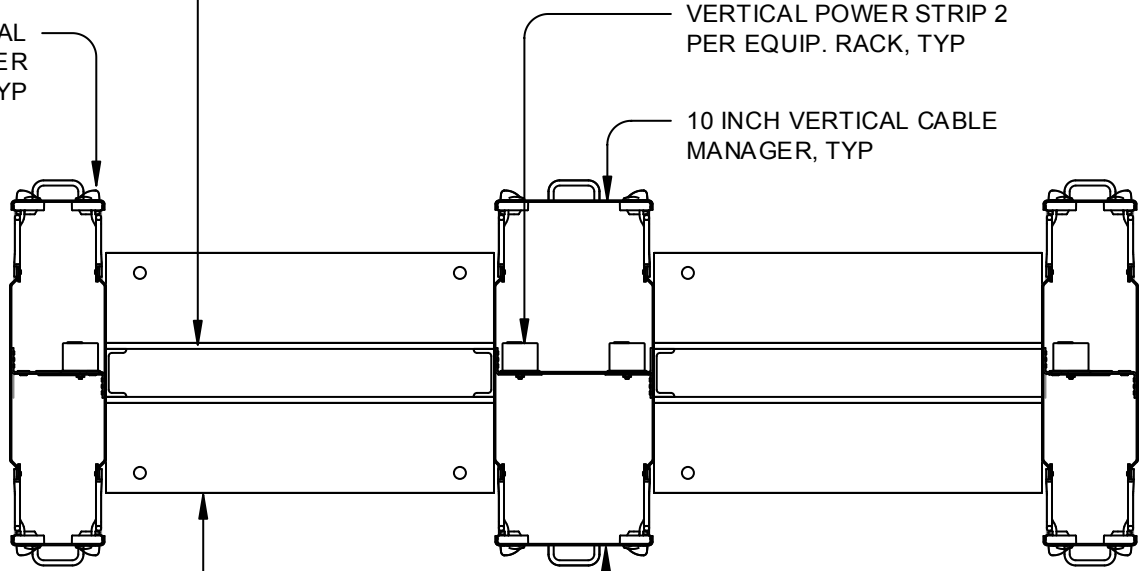
6 INCH VERTICAL  
CABLE MANAGER  
WITH COVER, TYP

VERTICAL POWER STRIP 2  
PER EQUIP. RACK, TYP

10 INCH VERTICAL CABLE  
MANAGER, TYP

BASE FOR 19"  
EQUIPMENT RACK  
UNIT, TYP

10 INCH VERTICAL CABLE  
MANAGER WITH COVER, TYP



FRONT OF RACK BAY



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Communications Standards

DESCRIPTION:

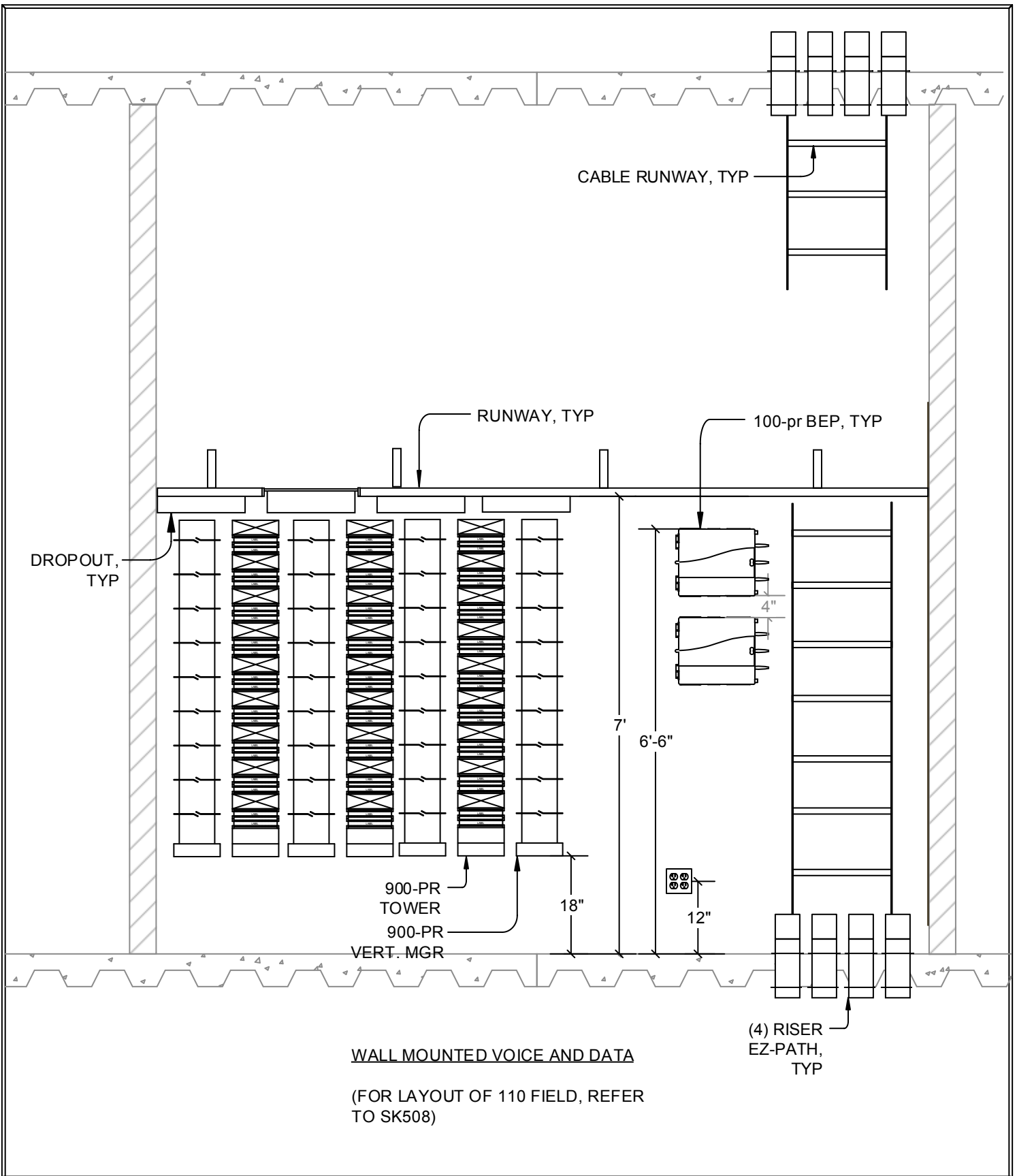
TELECOMMUNICATIONS  
POWER DISTRIBUTION UNIT  
MOUNTING WITHIN  
EQUIPMENT RACK  
VERTICAL CABLE MANAGER

SKETCH No: **SK506**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



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Communications Standards

DESCRIPTION:

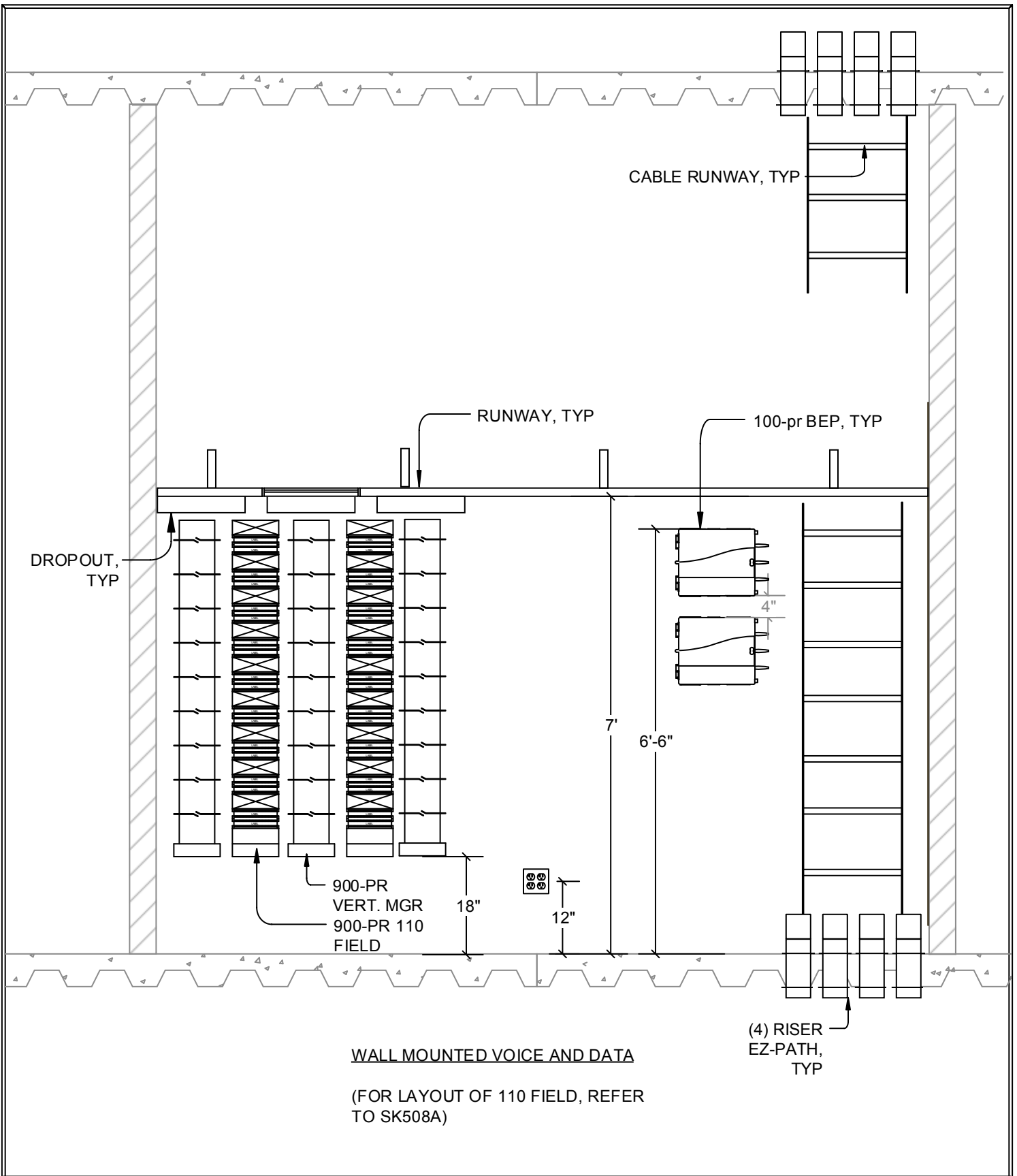
TELECOMMUNICATIONS  
WALL MOUNTED VOICE  
TERMINATION EQUIPMENT  
(EXISTING INSTALLATION  
PRIOR TO JAN. 2014)

SKETCH No: **SK507**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



UNIVERSITY OF CALIFORNIA  
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Information Services and Technology

Communications Standards

DESCRIPTION:

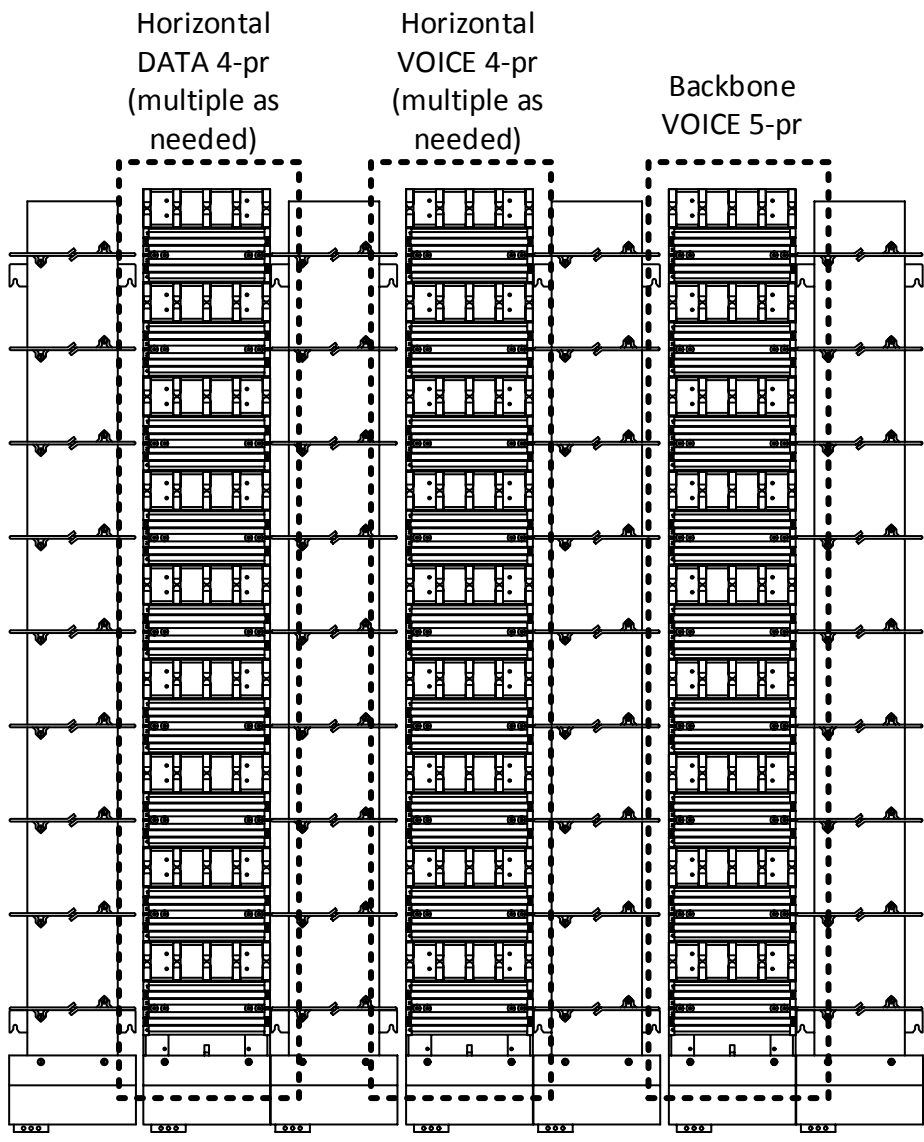
TELECOMMUNICATIONS  
WALL MOUNTED VOICE  
TERMINATION EQUIPMENT  
(NEW TR's OR BLDGS)

SKETCH No: **SK507A**


DATE: 6/15/14

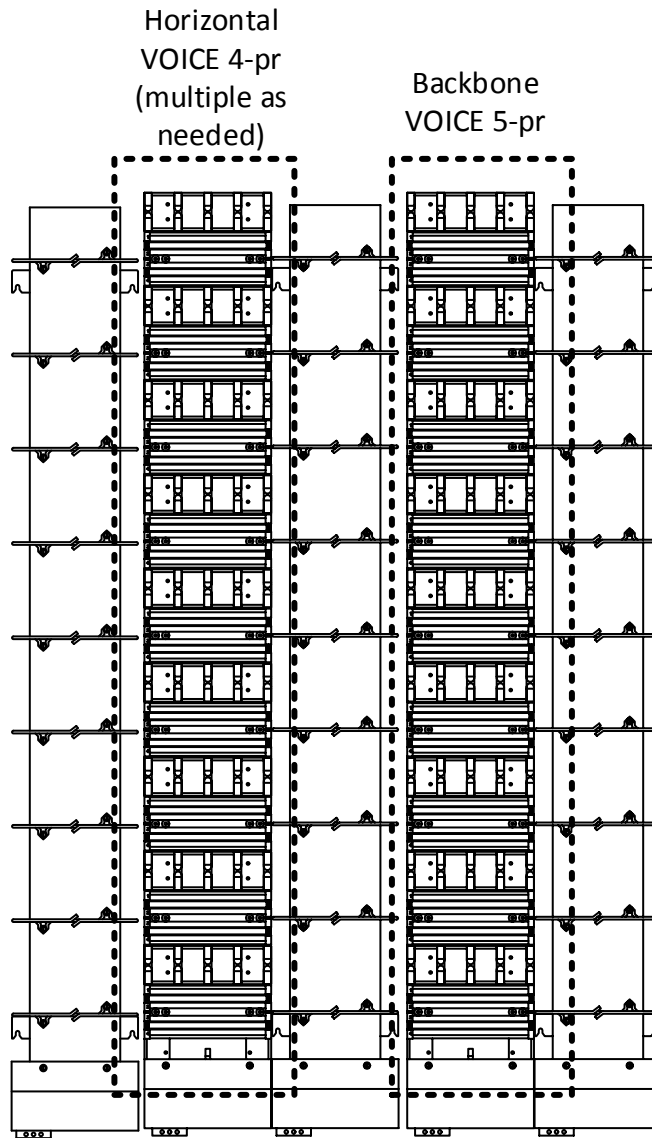
REVISION: 3

SCALE: NONE



**FOR ANY INSTALLATION OF 110 BLOCK IN EXISTING TELECOM ROOM WHERE HORIZONTAL DATA AND VOICE ARE TERMINATED ON THE WALL**

 <p><b>UNIVERSITY OF CALIFORNIA BERKELEY</b> Information Services and Technology  Communications Standards</p>	<p>DESCRIPTION:  TELECOMMUNICATIONS 900-pr 110 BLOCK ELEVATION AND ALLOCATION (PRE-2014)</p>	<p>SKETCH No: <b>SK508</b></p>
		<p>DATE: 6/15/14</p>
		<p>REVISION: 3</p>
		<p>SCALE: NONE</p>



**FOR ANY INSTALLATION OF 110 BLOCK IN NEW  
TELECOM ROOM WHERE ONLY HORIZONTAL VOICE  
ARE TERMINATED ON THE WALL**



**UNIVERSITY OF CALIFORNIA  
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Information Services and Technology

Communications Standards

DESCRIPTION:

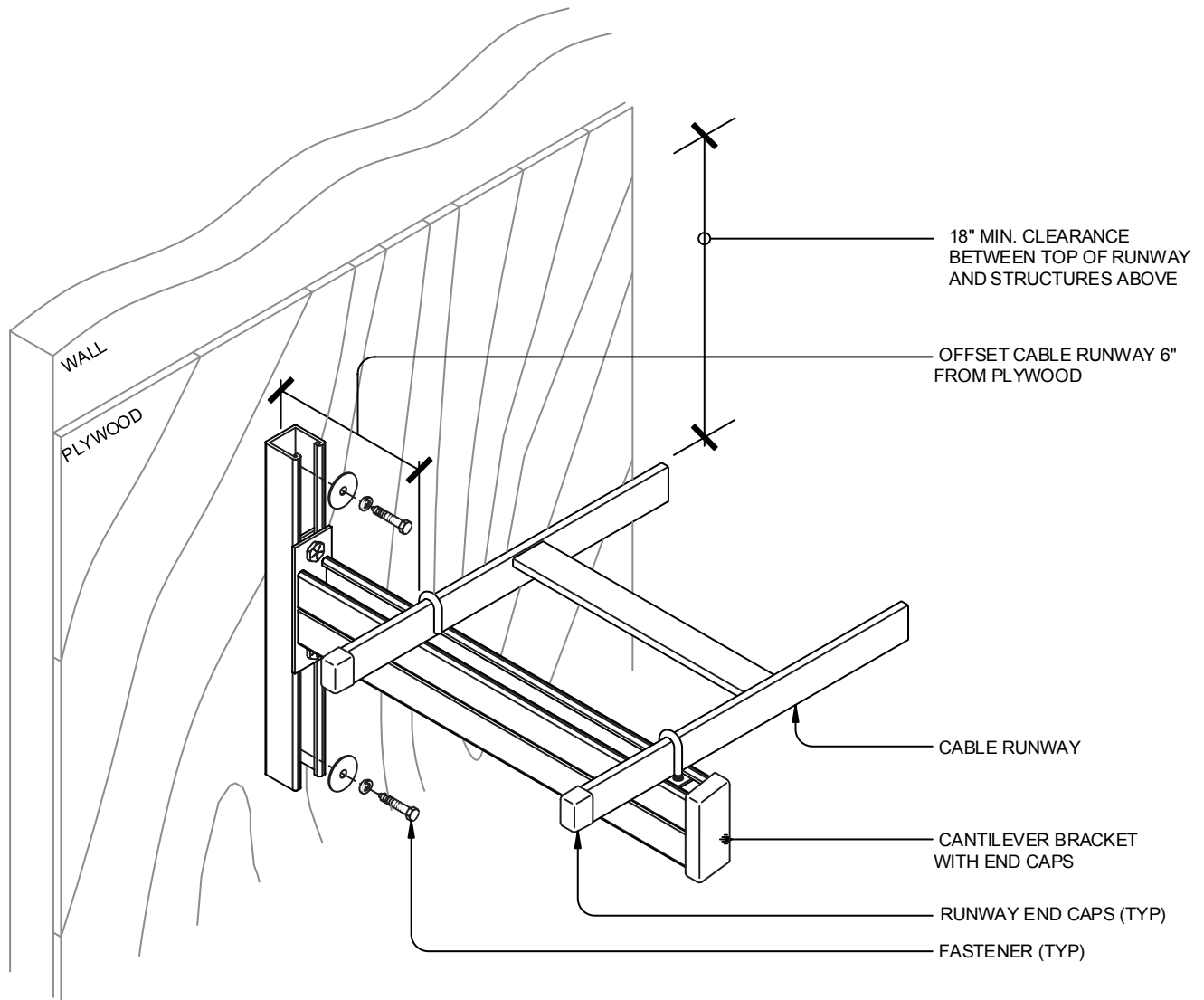
TELECOMMUNICATIONS  
900-pr 110 BLOCK  
ELEVATION AND  
ALLOCATION (NEW BLDG  
OR TR)

SKETCH No: **SK508A**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



NOTE:1. SECURE BRACKET TO PLYWOOD USING APPROPRIATE FASTENERS.



UNIVERSITY OF CALIFORNIA  
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Communications Standards

DESCRIPTION:

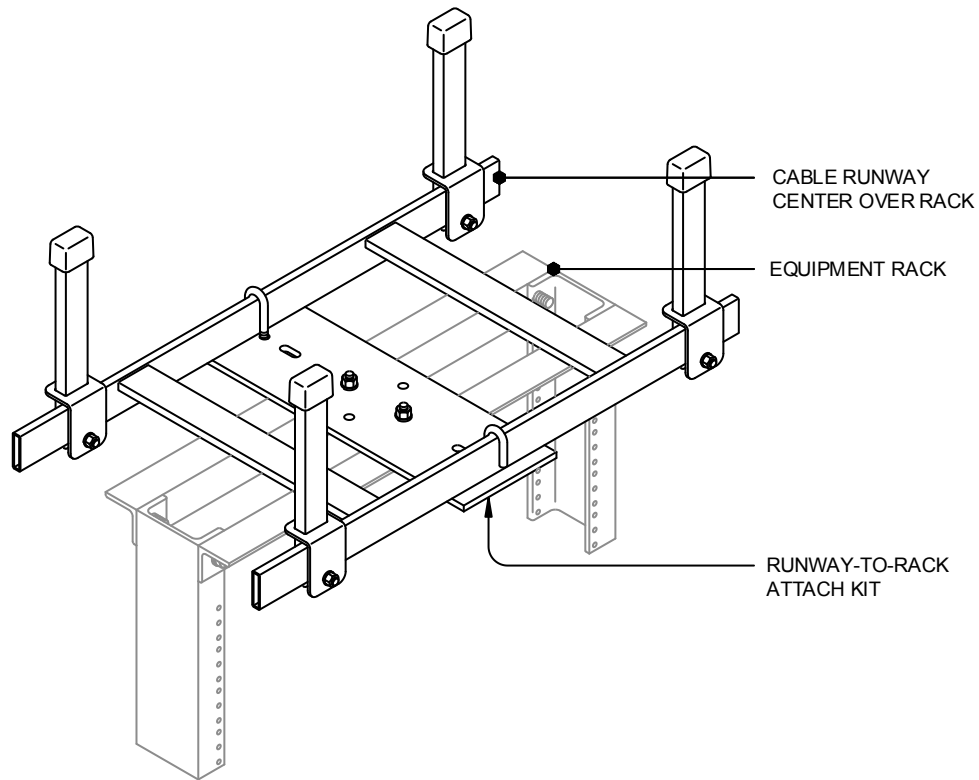
TELECOMMUNICATIONS  
CABLE RUNWAY TO WALL  
BRACING

SKETCH No: **SK509**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



NOTES: 1. UTILIZE FASTENERS INCLUDED WITH RACK-TO-RUNWAY-ATTACHMENT KIT



**UNIVERSITY OF CALIFORNIA  
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Information Services and Technology

Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
CABLE RUNWAY TO RACK  
BRACING

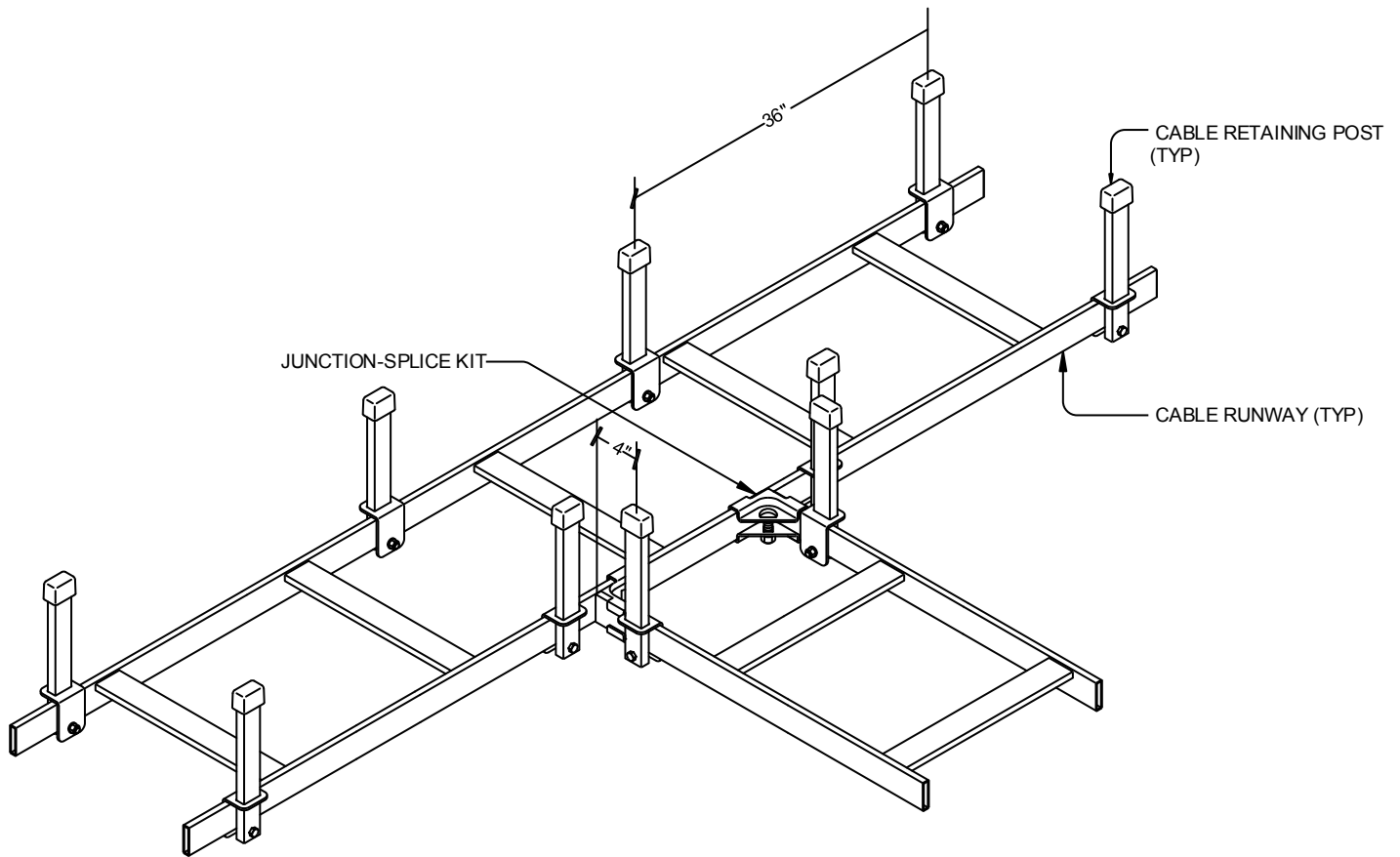
SKETCH No: **SK510**

DATE: 6/15/14

REVISION: 3

SCALE: NONE





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Information Services and Technology

Communications Standards

DESCRIPTION:

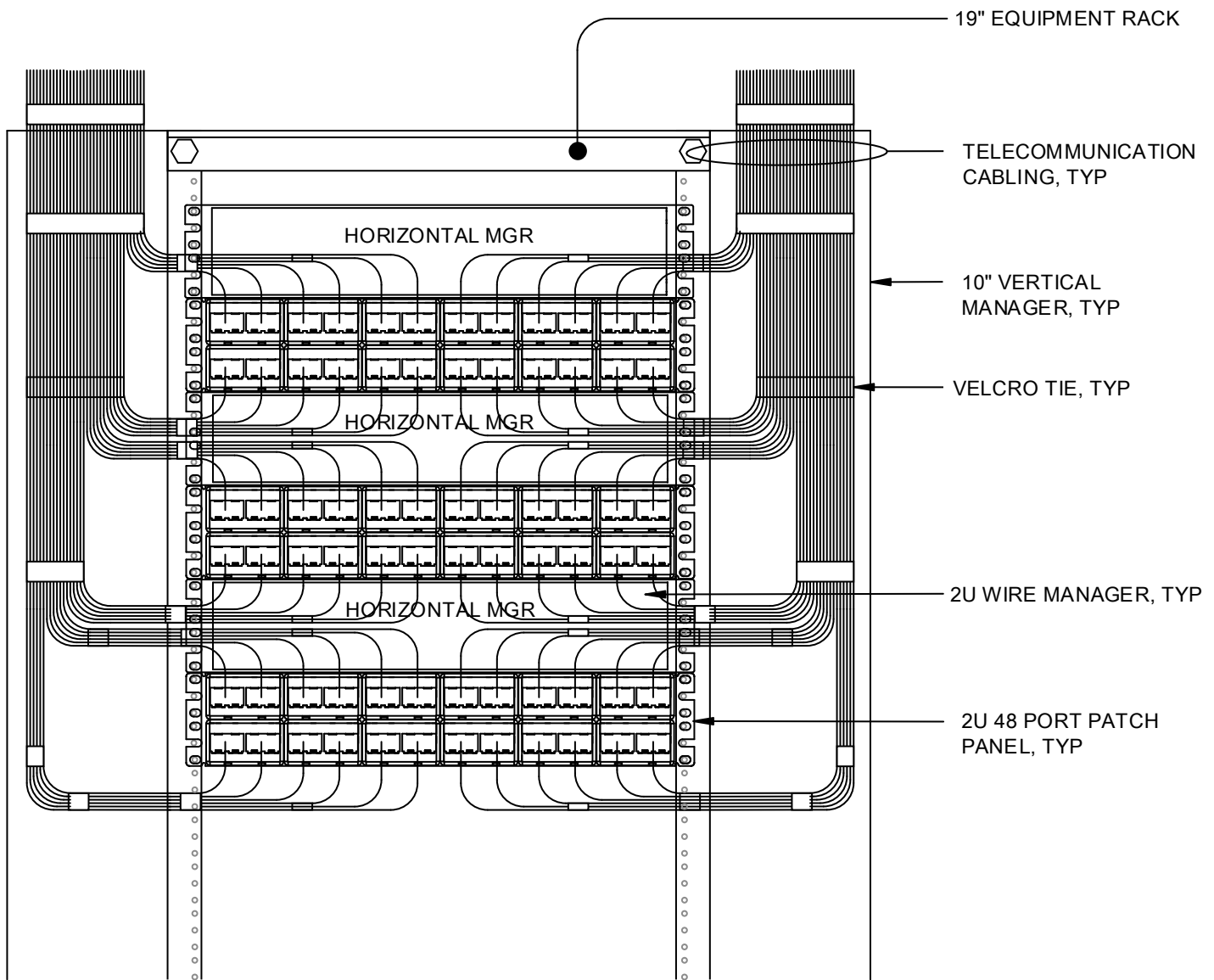
TELECOMMUNICATIONS  
CABLE RUNWAY RETAINER  
POST

SKETCH No: **SK511**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



**VIEW FROM BACK OF RACK**



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Information Services and Technology

Communications Standards

**DESCRIPTION:**

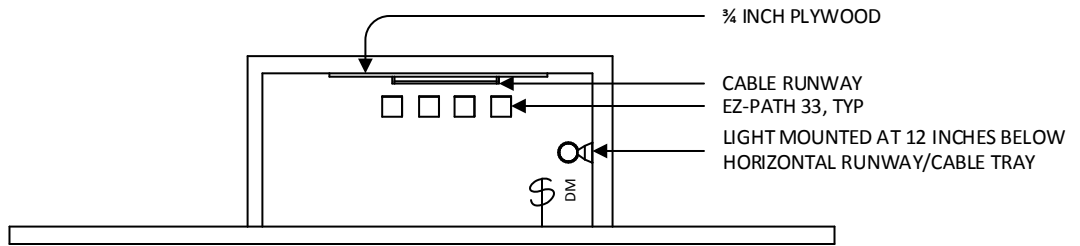
TELECOMMUNICATIONS  
HORIZONTAL CABLE  
ROUTING AT EQUIPMENT  
RACK BAY

SKETCH No: **SK512**

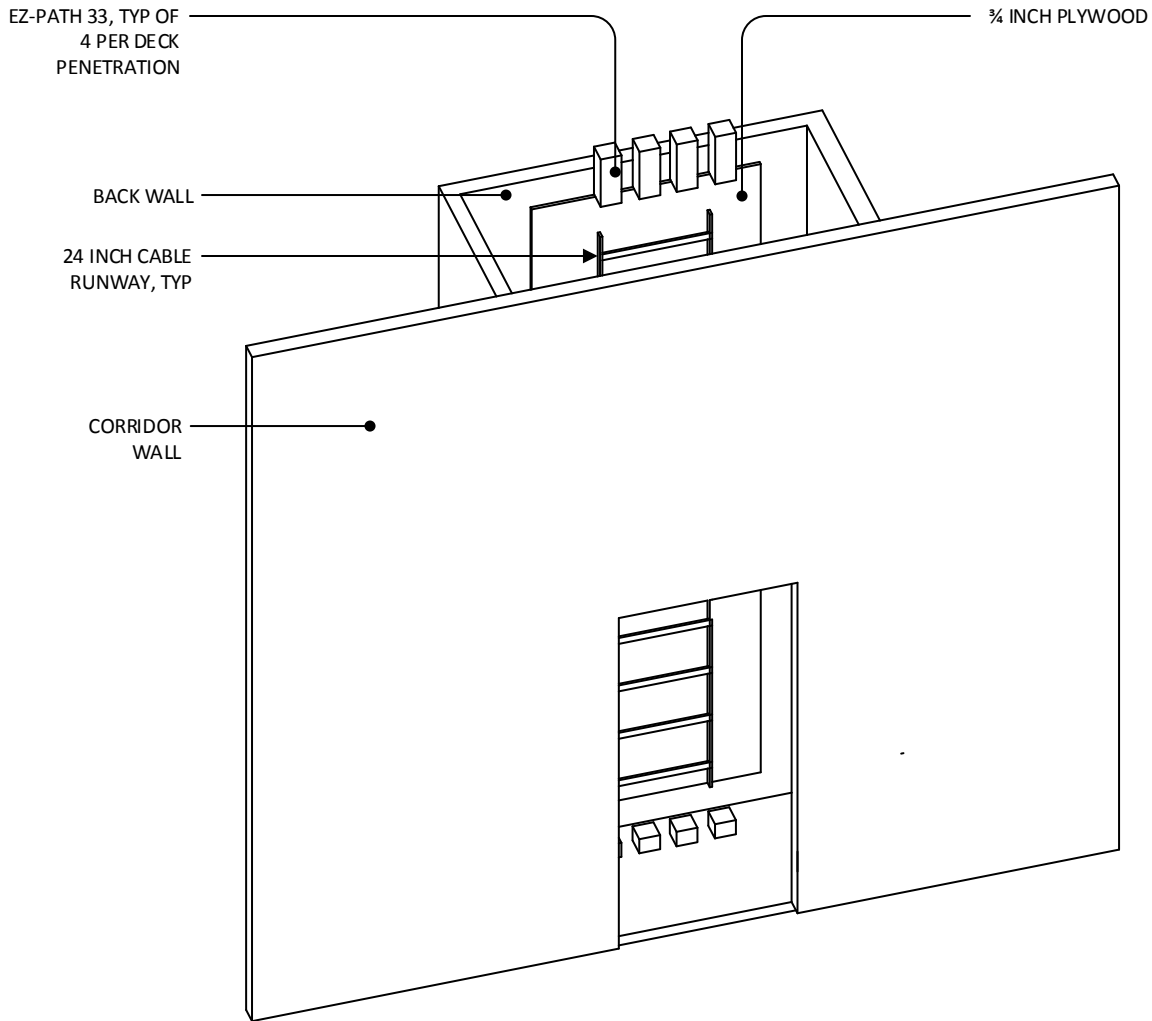
DATE: 6/15/14

REVISION: 3

SCALE: NONE



PLAN VIEW



ISO VIEW



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Communications Standards

DESCRIPTION:

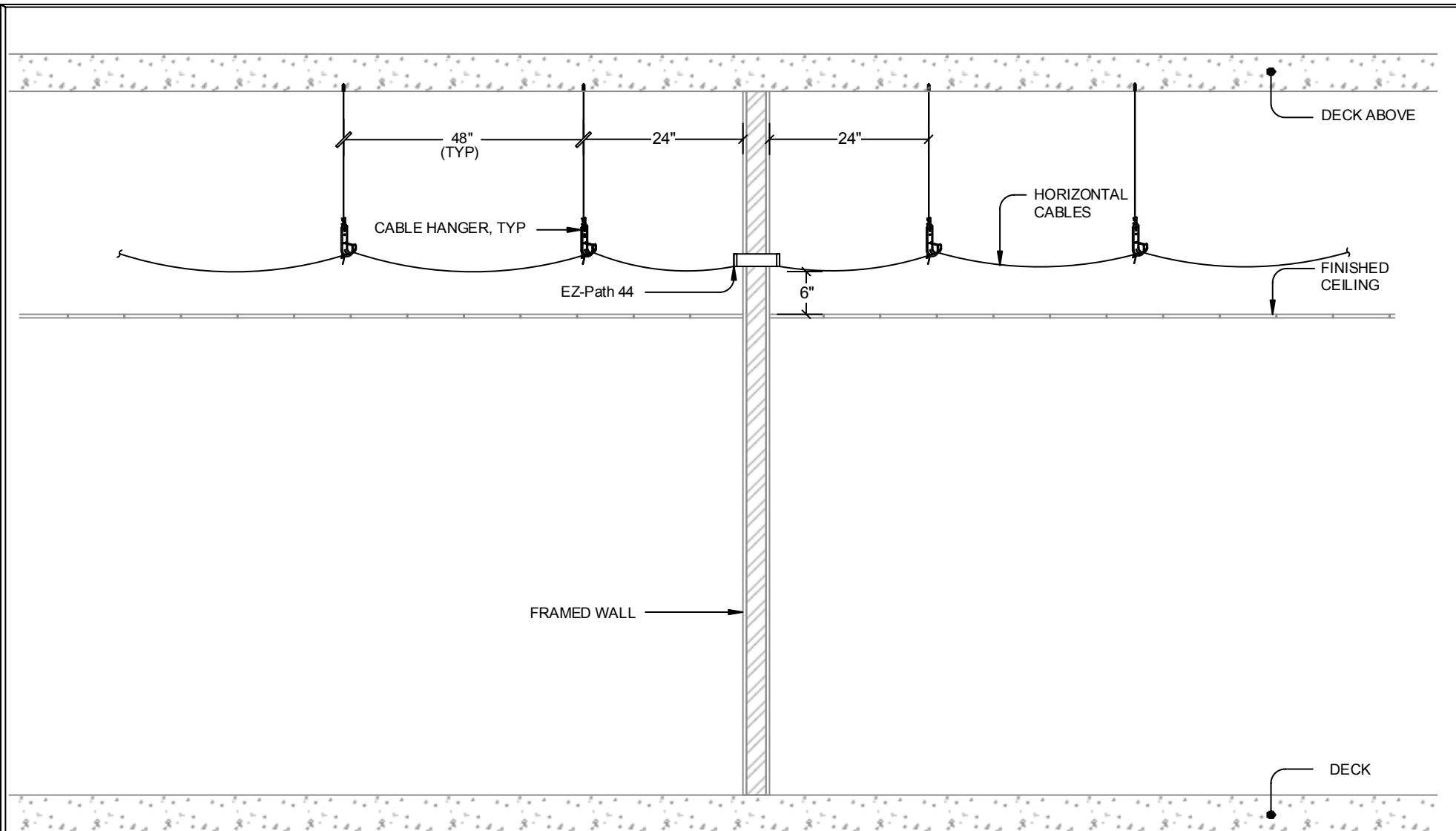
TELECOMMUNICATIONS  
RISER CLOSET

SKETCH No: **SK520**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



- NOTES:
1. DO NOT TIE CABLES TO BUILDING STRUCTURES.
  2. PROVIDE SLEEVES OR CONDUITS WHERE REQUIRED.
  3. SIZE BASED ON QUANTITY OF CABLES PLUS 40% SPARE CAPACITY.
  4. PROVIDE BUSHING ON SLEEVE AND CONDUIT ENDS.
  5. PROVIDE CABLE RETAINING CLIP ON CABLE HANGERS.



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DESCRIPTION:

TELECOMMUNICATIONS  
CABLE ROUTING DETAIL IN USER SPACE USING J-HANGER  
SUPPORT THROUGH FULL HEIGHT PARTITIONS.

SKETCH  
No:

SK600

DATE:

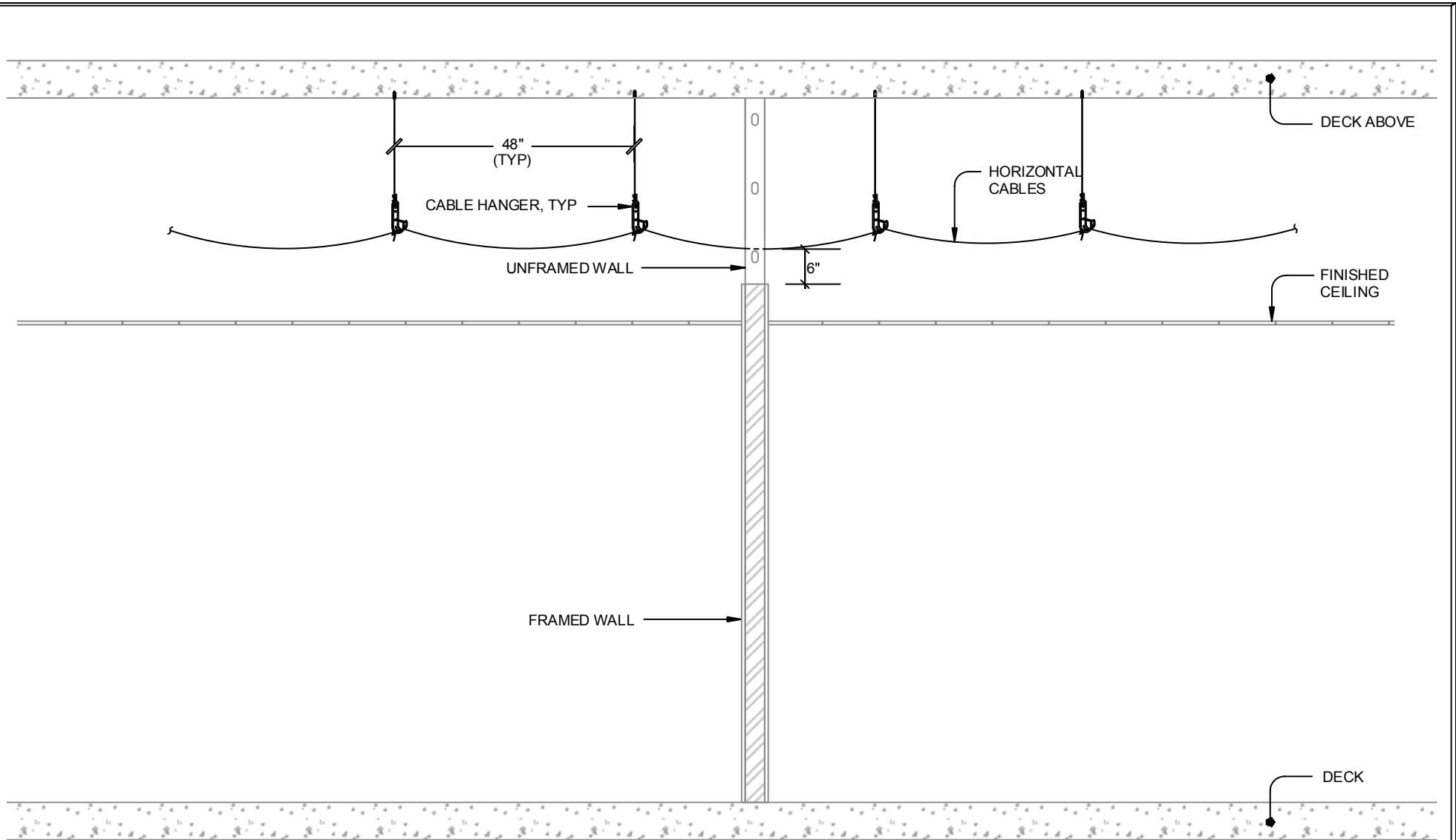
6/15/14

REVISION:

3

SCALE:

NONE



- NOTES: 1. DO NOT TIE CABLES TO STUDS.  
 2. DO NOT REST/SUPPORT CABLES ON TOP OF FRAMED WALL.  
 3. PROVIDE CABLE RETAINING CLIP ON CABLE HANGERS.



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 Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
 CABLE ROUTING DETAIL IN USER SPACE USING J-HANGER  
 SUPPORT FOR LOW PROFILE PARTITIONS

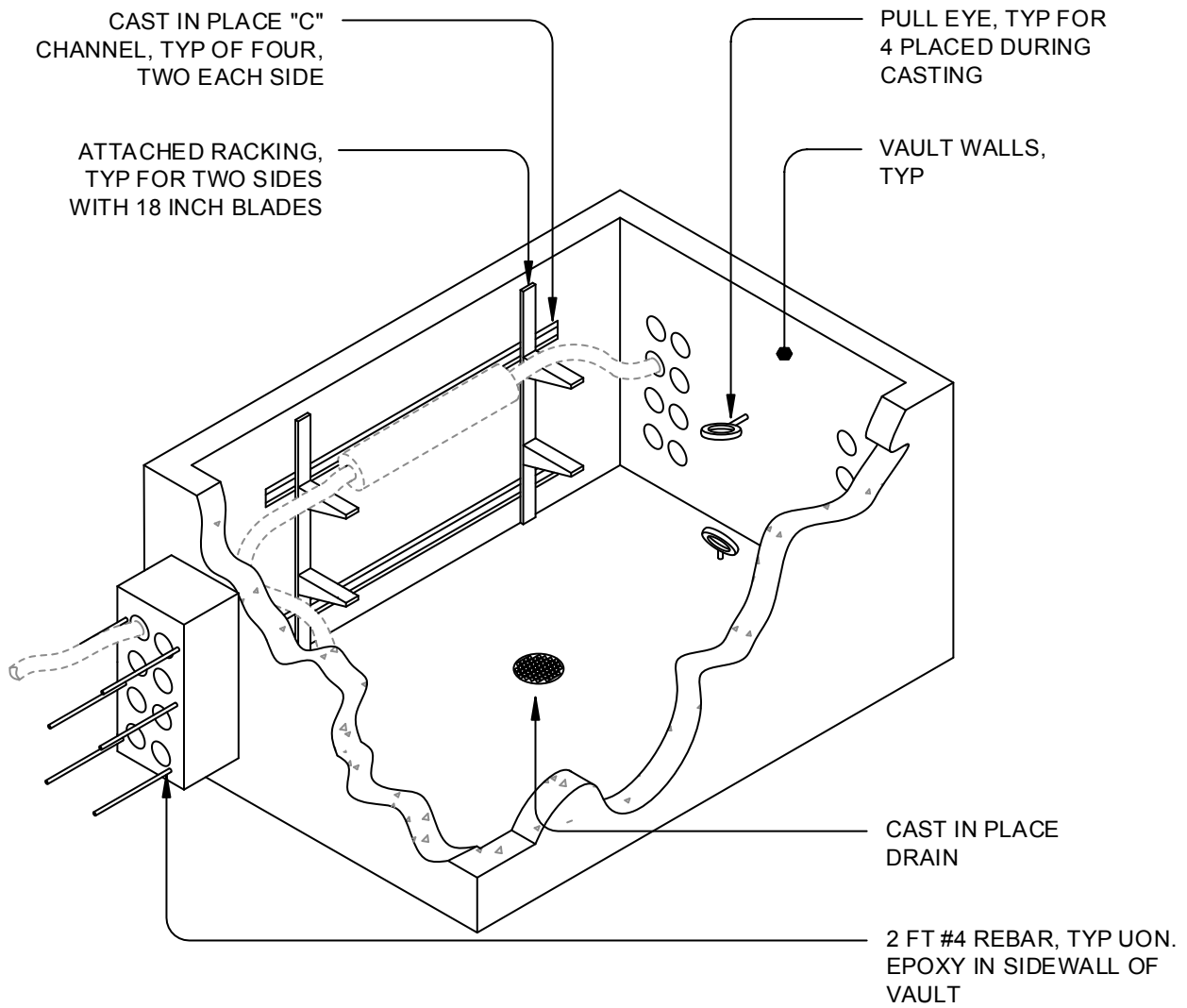
SKETCH No:	SK601
DATE:	6/15/14
REVISION:	3
SCALE:	NONE

CAST IN PLACE "C"  
CHANNEL, TYP OF FOUR,  
TWO EACH SIDE

ATTACHED RACKING,  
TYP FOR TWO SIDES  
WITH 18 INCH BLADES

PULL EYE, TYP FOR  
4 PLACED DURING  
CASTING

VAULT WALLS,  
TYP



CAST IN PLACE  
DRAIN

2 FT #4 REBAR, TYP UON.  
EPOXY IN SIDEWALL OF  
VAULT



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DESCRIPTION:

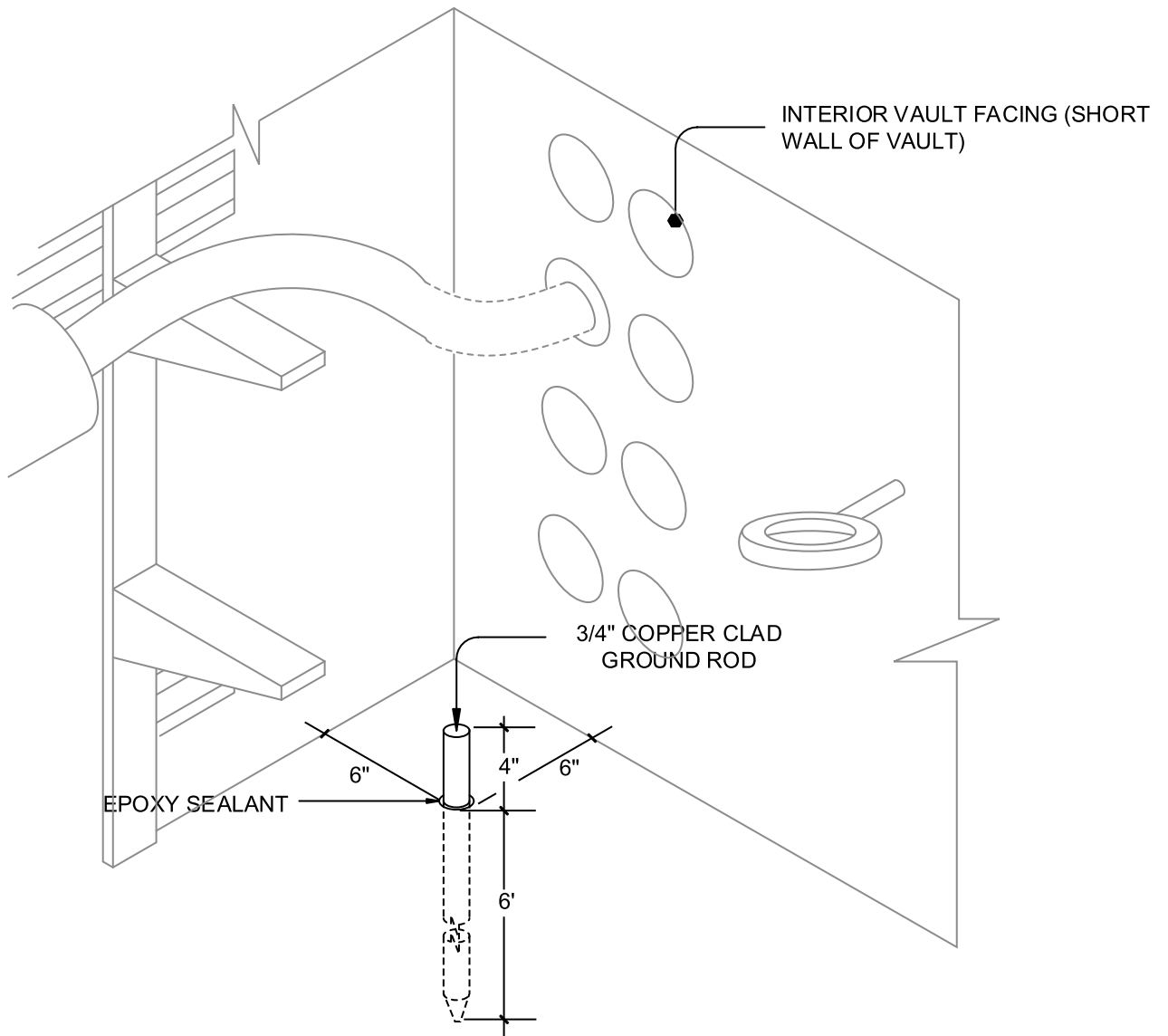
TELECOMMUNICATIONS  
VAULT DETAIL (EXAMPLE  
ONLY)

SKETCH No: **SK700**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



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Communications Standards

DESCRIPTION:

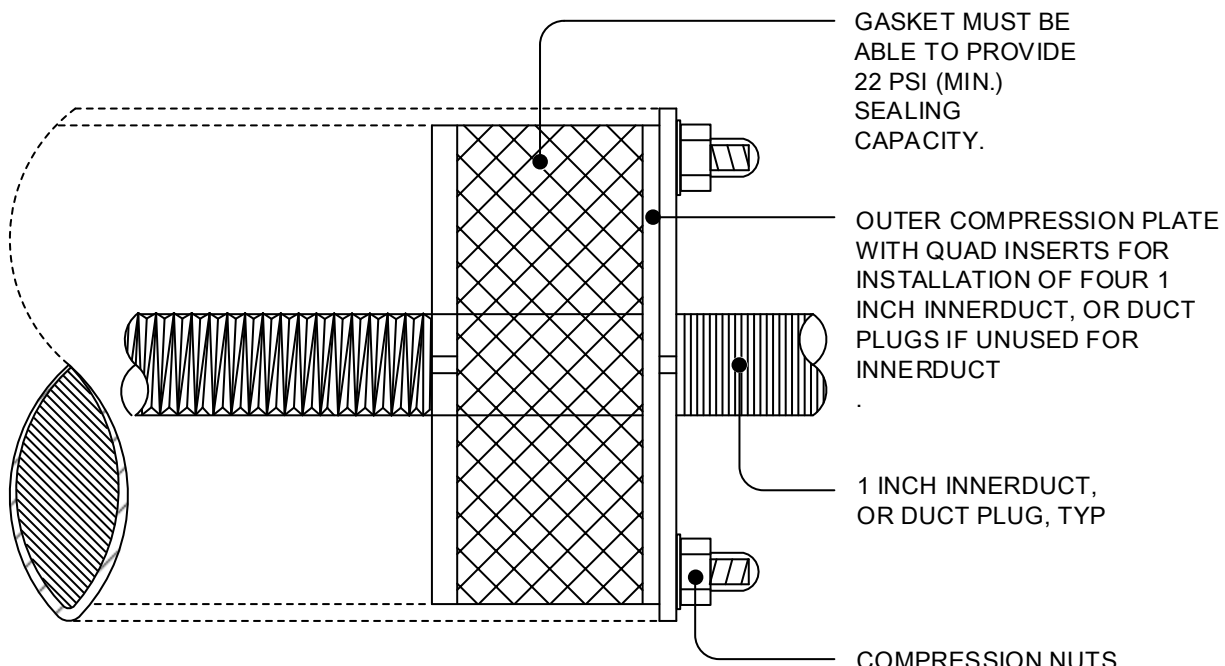
TELECOMMUNICATIONS  
VAULT GROUND ROD

SKETCH No: **SK701**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



GASKET MUST BE ABLE TO PROVIDE 22 PSI (MIN.) SEALING CAPACITY.

OUTER COMPRESSION PLATE WITH QUAD INSERTS FOR INSTALLATION OF FOUR 1 INCH INNERDUCT, OR DUCT PLUGS IF UNUSED FOR INNERDUCT

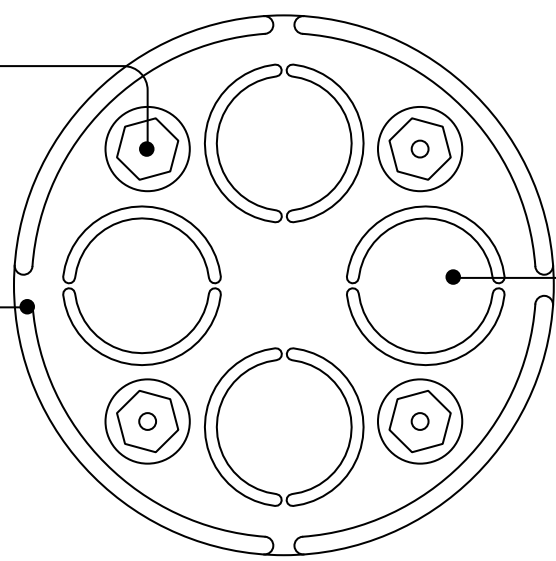
1 INCH INNERDUCT, OR DUCT PLUG, TYP


COMPRESSION NUTS AND WASHERS, TYP. COVER ALL NUTS AND WASHERS WITH PVC NUT CAP

COMPRESSION NUTS AND WASHER, TYP. COVER WITH PVC NUT CAP, TYP

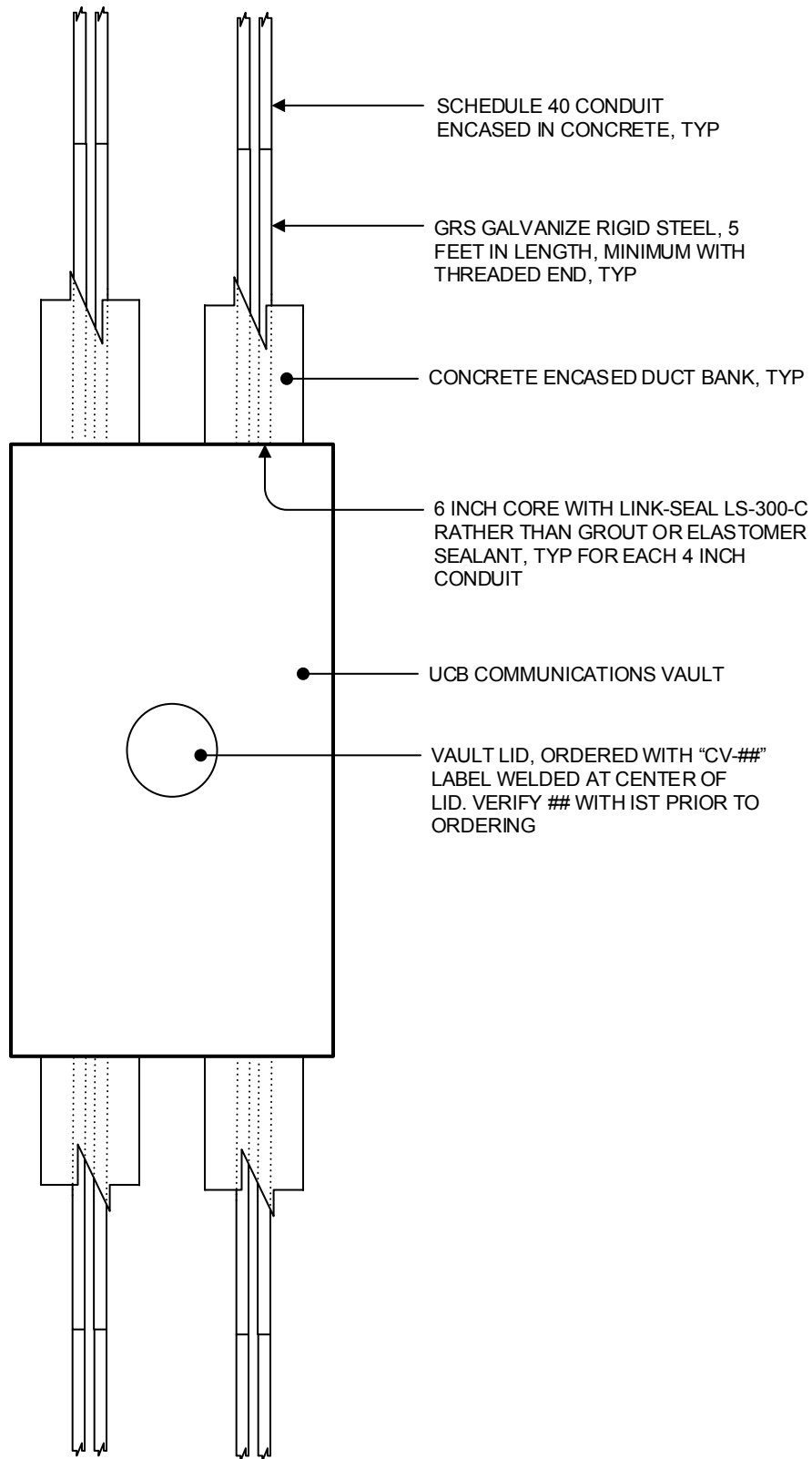
SPLIT COLLAR AND WASHER.

PASS-THROUGH FOR 1 INCH INNERDUCT. IF WIRING AND CONDUIT PLANS DO NOT CALL FOR THE PASS THROUGH TO BE USED, PROVIDE AN INNERDUCT PLUG FOR ANY UNUSED POSITIONS



 <p><b>UNIVERSITY OF CALIFORNIA BERKELEY</b> Information Services and Technology</p> <hr/> <p>Communications Standards</p>	<p>DESCRIPTION:</p> <p>TELECOMMUNICATIONS QUAD DUCT PLUG</p>	<p>SKETCH No: <b>SK702</b></p>
		<p>DATE: 6/15/14</p>
		<p>REVISION: 3</p>
		<p>SCALE: NONE</p>





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Information Services and Technology

Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
VAULT AND DUCT BANK  
CONNECTION DETAIL

SKETCH  
No: **SK703**

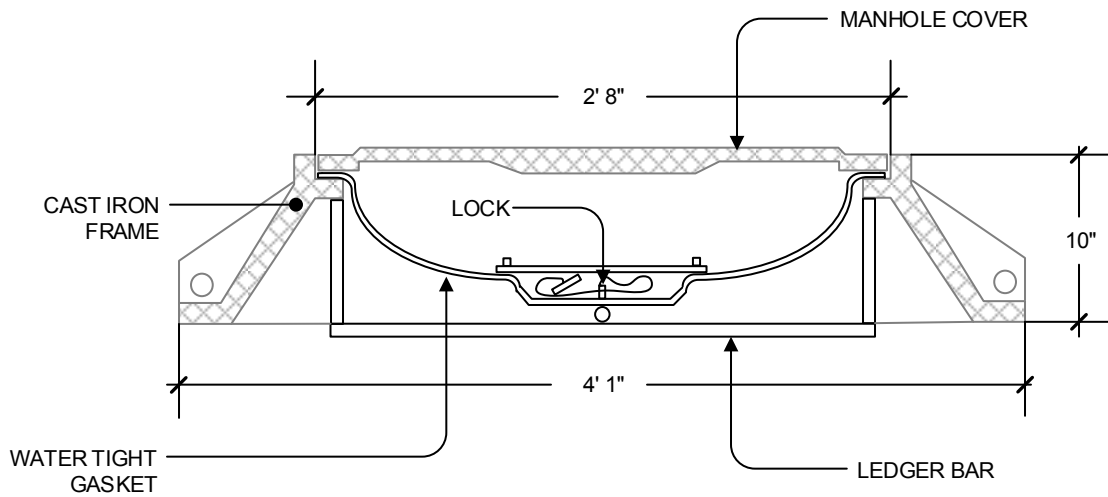
DATE: 6/15/14

REVISION: 3

SCALE: NONE

LOCATION OF ADDITIONAL (4)  
1-1/2" DIAMETER LIFTING HOLES  
REQUESTED BY UCB TO  
FACILITATE LIFTING

PLAN VIEW OF VAULT COVER  
PLATE (DESIGN IN PLATE  
OMITTED INTENTIONALLY)



NOTE: CONTRACTOR SHALL PROVIDE SHOP DRAWING  
FROM MANUFACTURER TO CONFIRM LOCATION  
OF LIFTING HOLES



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Information Services and Technology

Communications Standards

DESCRIPTION:

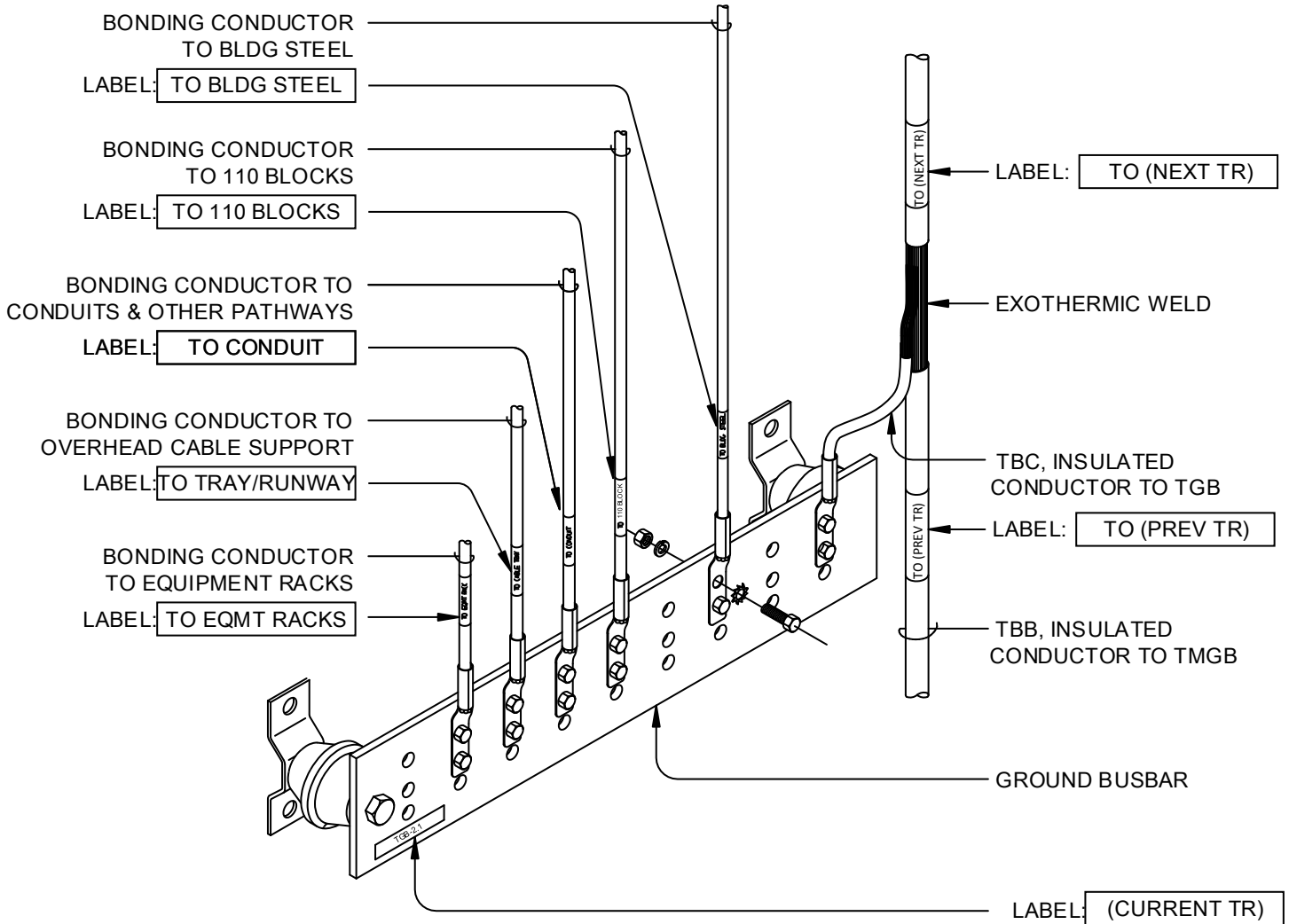
TELECOMMUNICATIONS  
VAULT LID LOCKDOWN  
DEVICE

SKETCH  
No: **SK704**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



NOTES: REFER TO ROOM PLANS FOR BUSBAR MOUNTING LOCATION.  
 REFER TO GROUNDING RISER DIAGRAM FOR LIST OF EQUIPMENT REQUIRING GROUNDING.  
 ITEMS SHOWN HERE ARE AN EXAMPLE.



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Communications Standards

DESCRIPTION:

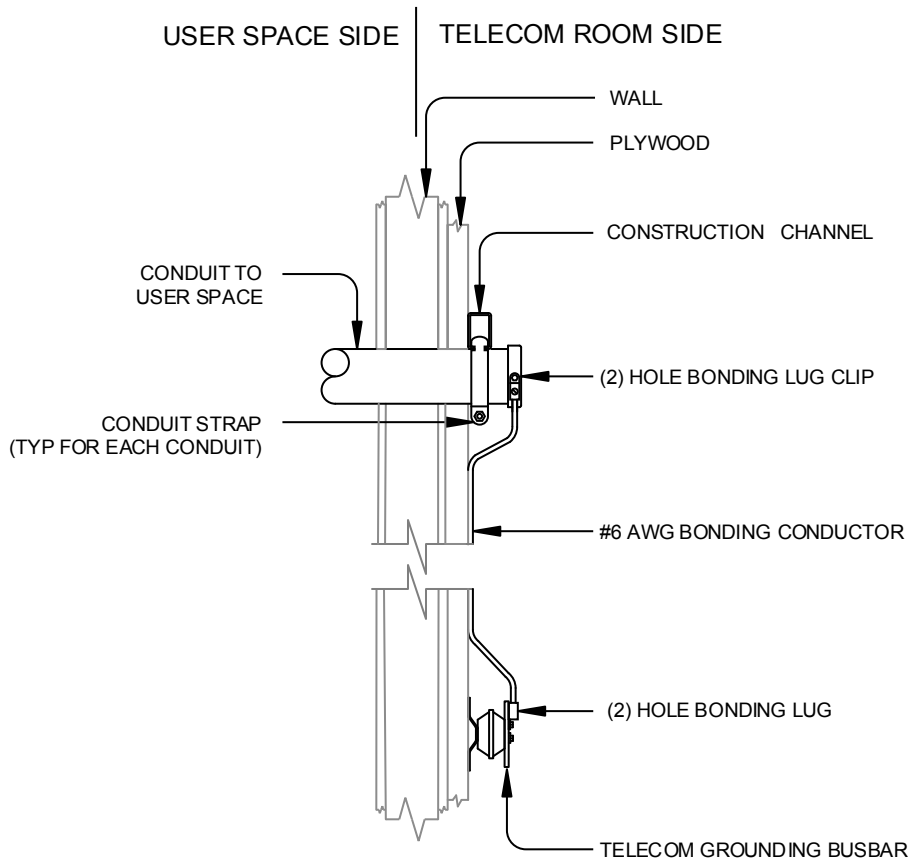
TELECOMMUNICATIONS  
 ROOM GROUNDING BUS  
 BAR (TWO-HOLE) AND  
 LABELING

SKETCH No: **SK800**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



NOTES: FOR FIRE RATED WALL CONSTRUCTION, PROVIDE FIRESTOPPING TO MATCH WALL RATING.



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Communications Standards

DESCRIPTION:

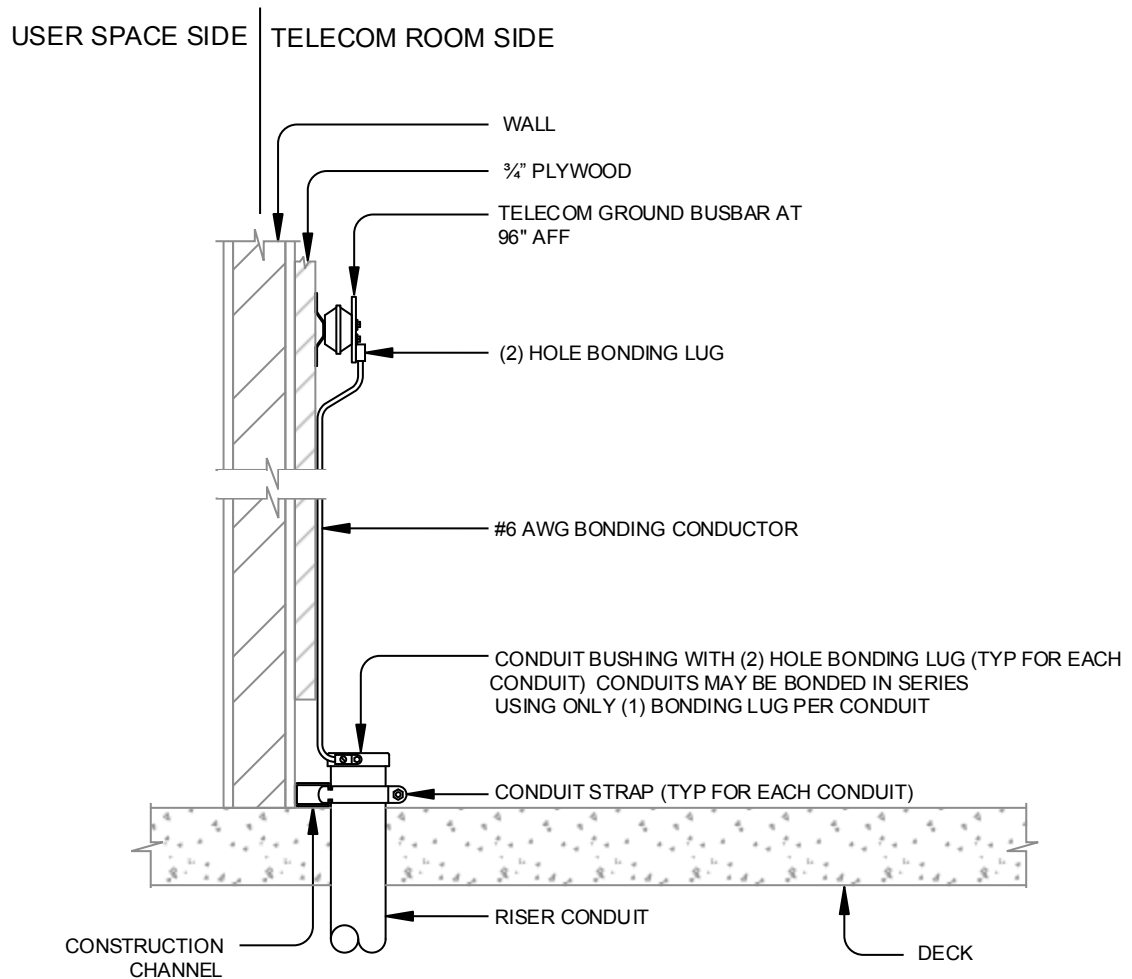
TELECOMMUNICATIONS  
CONDUIT BONDING

SKETCH No: **SK801**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



NOTES: FOR FIRE RATED FLOOR/DECK CONSTRUCTION, PROVIDE FIRESTOPPING TO MATCH FLOOR/DECK RATING.



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DESCRIPTION:

TELECOMMUNICATIONS  
RISER CONDUIT BONDING  
BETWEEN FLOORS

SKETCH No: **SK802**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

JUNCTION  
SPLICE KIT,  
TYP

BUTT  
SPLICE  
KIT, TYP

BONDING  
STRAP, TYP

INSTALL  
FASTENER  
(SCREW,  
EXTERNAL  
TEETH STAR  
WASHER, HEX  
NUT)  
THROUGH  
STRINGER

CABLE RUNWAY,  
TYP

RACK-ATTACH  
KIT, TYP

TBC

CONNECTOR,  
TYPE #2

STRAP, WITH  
FASTENER, TYP

CONNECTOR,  
TYPE #3

TBC TO TMGB/TBC  
ROUTING UNDER  
WALL BRACKET  
CONNECTOR,  
TYPE #1

WALL ANGLE  
SUPPORT

EQUIPMENT  
RACK

- NOTES:
1. PROVIDE BONDING STRAPS AT ALL RUNWAY SPLICES.
  2. PROVIDE BOND (CONNECTOR #2, TBC, & CONNECTOR #3) FOR EACH RACK.
  3. CONNECTOR, TYPE #1: TBC-TO-RUNWAY CONNECTOR, SINGLE BARREL LUG.
  4. CONNECTOR, TYPE #2: TBC TAP CONNECTOR, C-TYPE COMPRESSION TAP.
  5. CONNECTOR, TYPE #3: TBC-TO-RACK CONNECTOR, BARREL LUG, 1-BOLT/2- HOLE.
  6. FASTENER FOR STRAP SHALL CONSIST OF SELF-TAPPING SCREW WITH LOCK WASHER. FASTENER LENGTH SHALL NOT IMPEDE ON OPPOSITE SIDE OF STRINGER.



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DESCRIPTION:

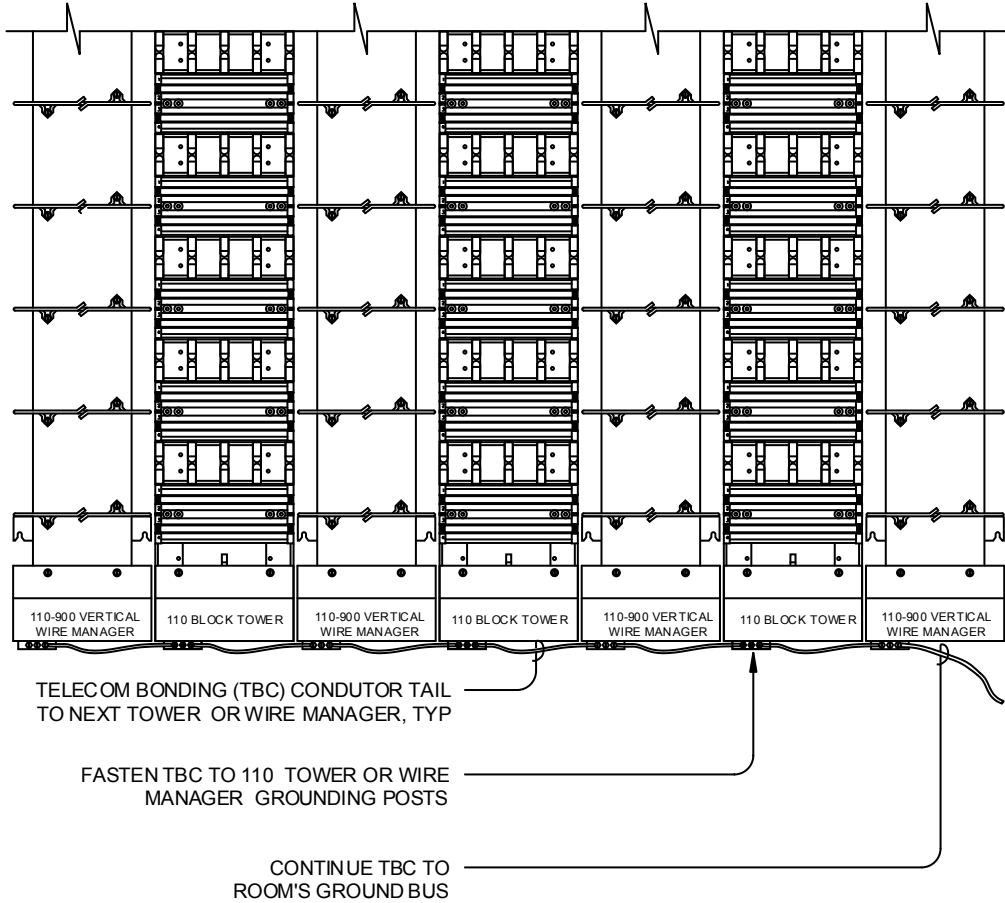
TELECOMMUNICATIONS  
CABLE RUNWAY BONDING

SKETCH  
No: **SK804**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



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Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
110 TOWER - BONDING

SKETCH No: **SK805**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

CONTINUE TBC (PER RACK) TO TGB/TMGB  
ROUTE ON THE INSIDE OF FLANGE AND  
UNDERSIDE OF RUNWAY STRINGERS, TYP

CABLE RUNWAY

PROVIDE TBC 'TAIL' PER BUSBAR

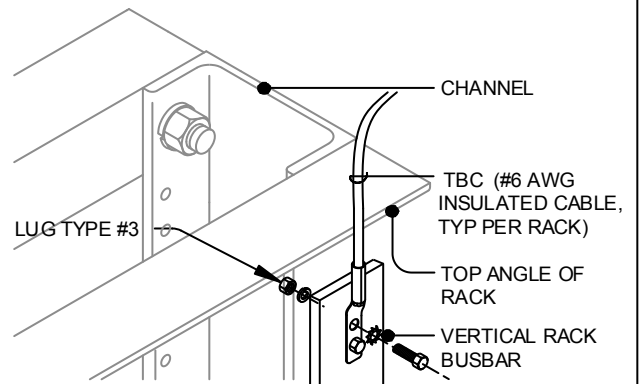
PATCH PANEL, TYP

CABLE MANAGER, TYP

PROVIDE TBC 'TAIL'  
PER PATCH PANEL

VERTICAL RACK  
BUSBAR, TYP

EQUIPMENT  
RACK, TYP



COMPONENTS:

TWO-HOLE COMPRESSION LUG, HARDWARE.

HARDWARE SET:

BOLT, TEETH STAR WASHER, LOCK WASHER,  
HEX NUT.

INSTALLATION:

MOUNT VERTICAL BUSBAR TO REAR OF RACK.

NOTE: DO NOT BOND EQUIPMENT BUSBARS OR PATCH PANELS IN SERIES

**FOR ANY INSTALLATION OF  
SIEMON'S CATEGORY 6A CABLING  
OR NEW TELECOM ROOM**



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DESCRIPTION:

TELECOMMUNICATIONS  
EQUIPMENT RACK  
BONDING

SKETCH No: **SK806**

DATE: 6/15/14

REVISION: 3

SCALE: NONE



CONTINUE TBC TO TGB/TMGB  
ROUTE ON THE INSIDE OF  
FLANGE AND UNDERSIDE OF  
RUNWAY STRINGERS

CABLE RUNWAY

"C" TAP

PROVIDE TBC 'TAIL' PER RACK

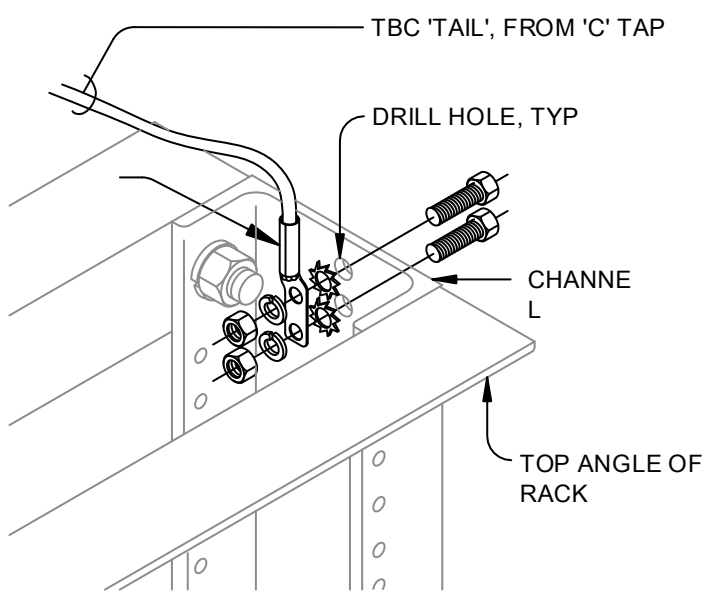


TBC 'TAIL', FROM 'C' TAP

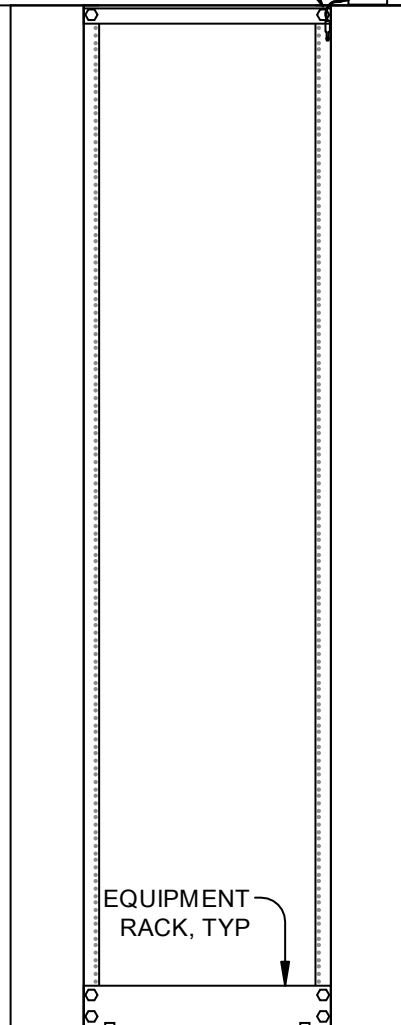
DRILL HOLE, TYP

CHANNE  
L

TOP ANGLE OF  
RACK



EQUIPMENT  
RACK, TYP



COMPONENTS:

TWO-HOLE COMPRESSION LUG, HARDWARE.

HARDWARE SET:

BOLT, TEETH STAR WASHER, LOCK WASHER,  
HEX NUT.

INSTALLATION:

DRILL HOLES THROUGH MOUNTING CHANNEL  
OF RACK AND VERTICAL MANAGER.  
INSTALL FASTENERS THROUGH CHANNEL AND  
VERTICAL MANAGER.

NOTE: DO NOT BOND EQUIPMENT RACK IN SERIES



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DESCRIPTION:

TELECOMMUNICATIONS  
EQUIPMENT RACK  
BONDING WHEN  
GROUNDING BUS BAR ISN'T  
PRESENT (ref: SK806)

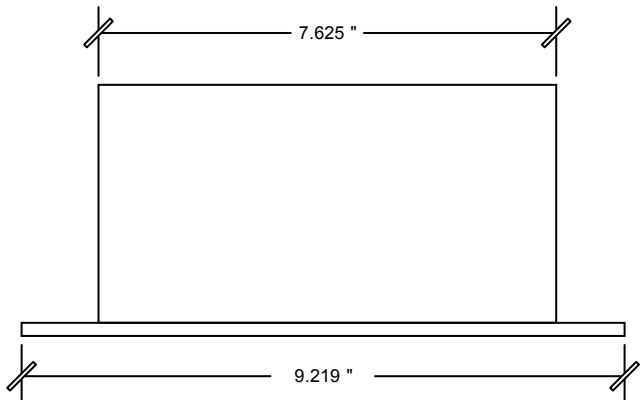
SKETCH No: **SK807**

DATE: 6/15/14

REVISION: 3

SCALE: NONE

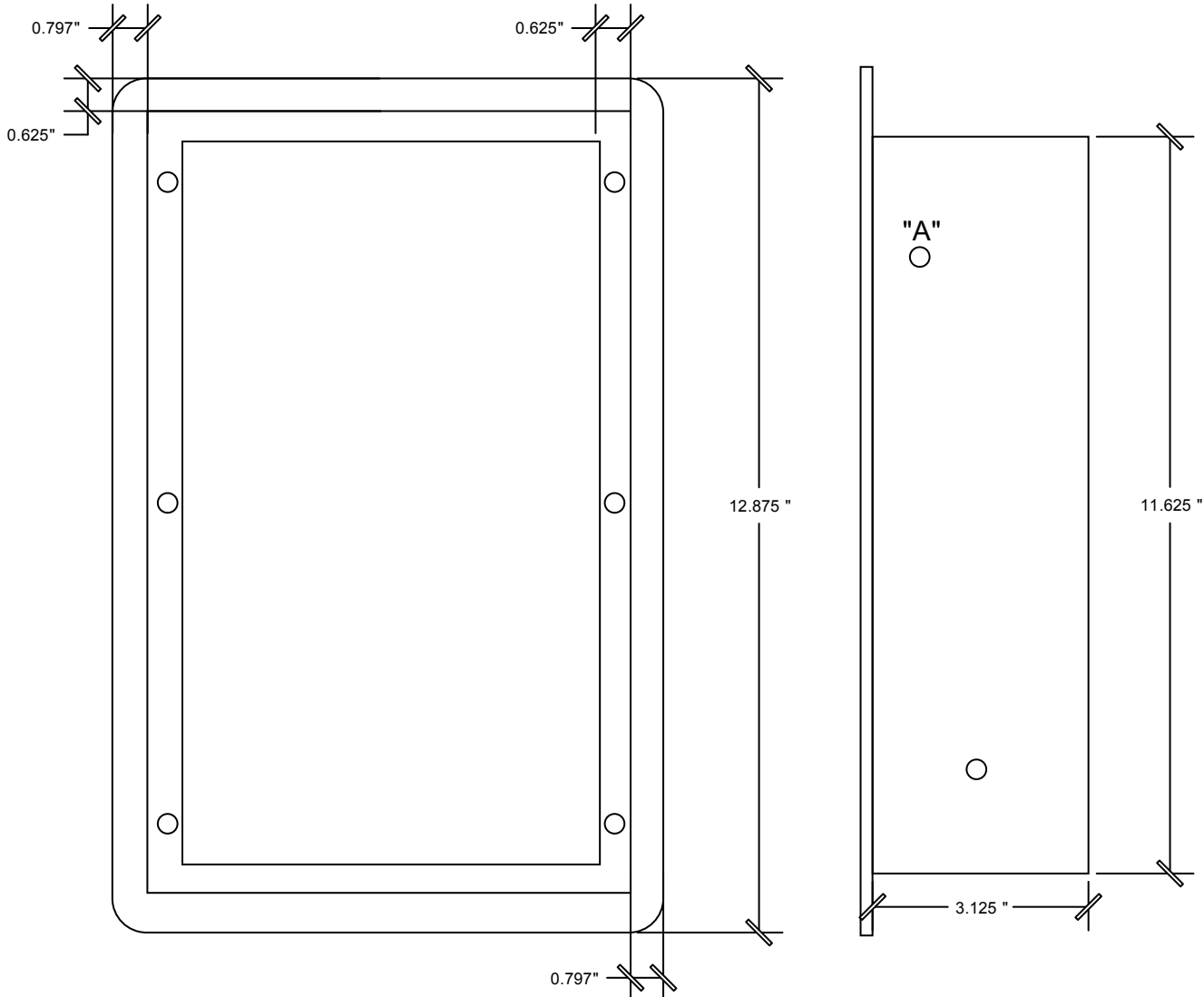
# 906 ENCLOSURE WITH BEZEL - FLUSH MOUNT



"A" HOLES 1/4 INCH (TWO EACH SIDE USED FOR MOUNTING.)

**ASSEMBLY:**

1. CUT OPENING TO FIT PHONE BOX 7-5/8"w X 11-5/8"h.
2. FOR WOOD MOUNTING, USE (4) 3/16" X 5/8"L LAG SCREWS WITH WASHERS
3. FOR CONCRETE, BRICK, MASONARY, USE PLASTIC FLANGED INSERTS FOR SIZED FOR 3/16 " SCREWS WITH WASHERS.



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Communications Standards

**DESCRIPTION:**

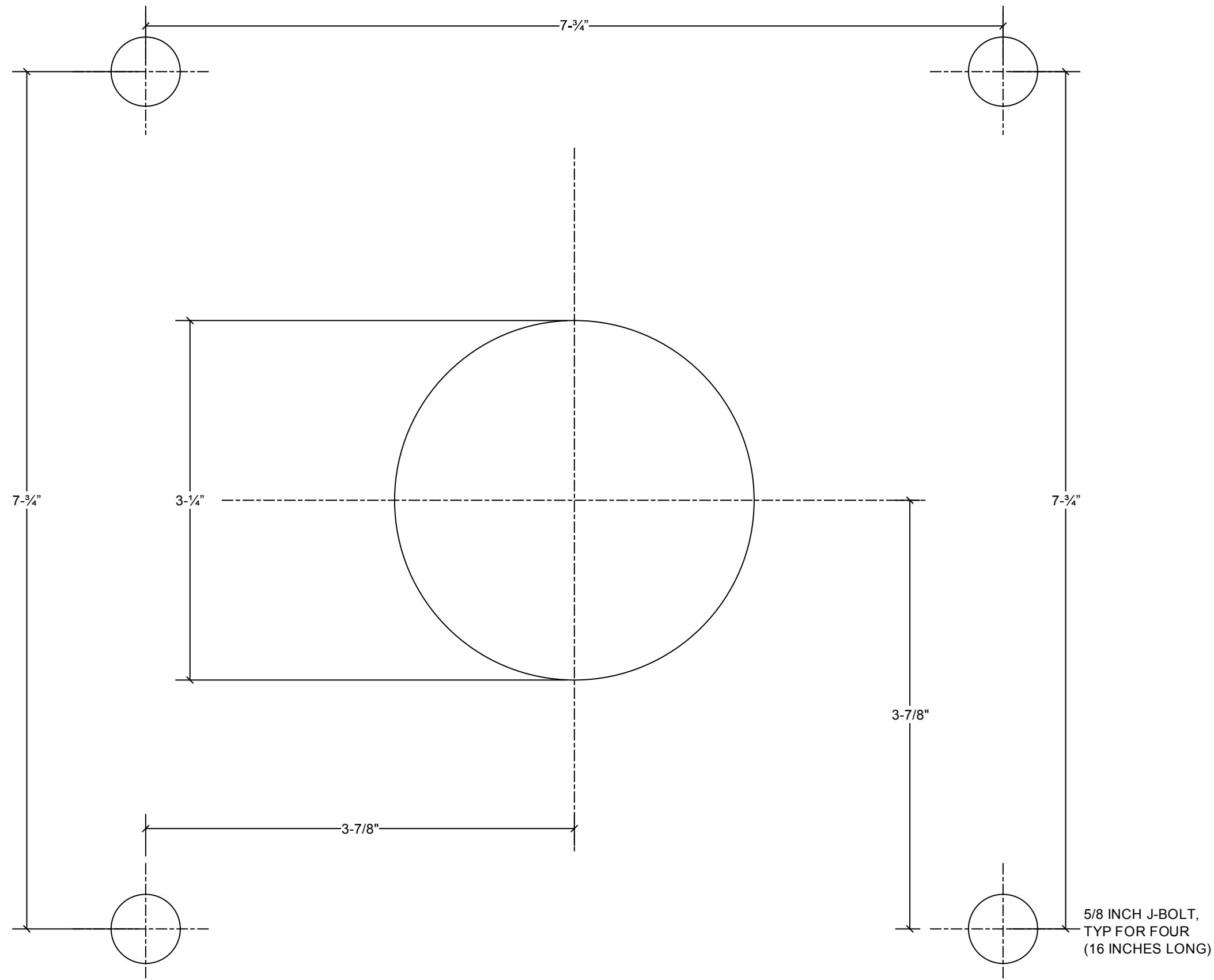
TELECOMMUNICATIONS  
WALL MOUNTED BLUE LIGHT  
PHONE INSTALLATION  
INFORMATION

SKETCH No: **SK900**

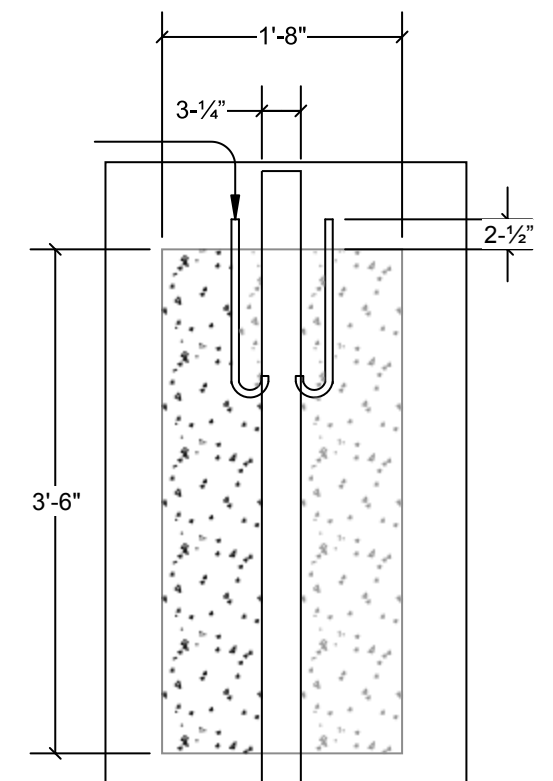
DATE: 6/15/14

REVISION: 3

SCALE: NONE



**BLUE LIGHT PHONE - PEDESTAL BASE**  
 SURROUNDED BY UNDISTURBED  
 EARTH, OR BACKFILL COMPRESSED AT  
 95% DENSITY,



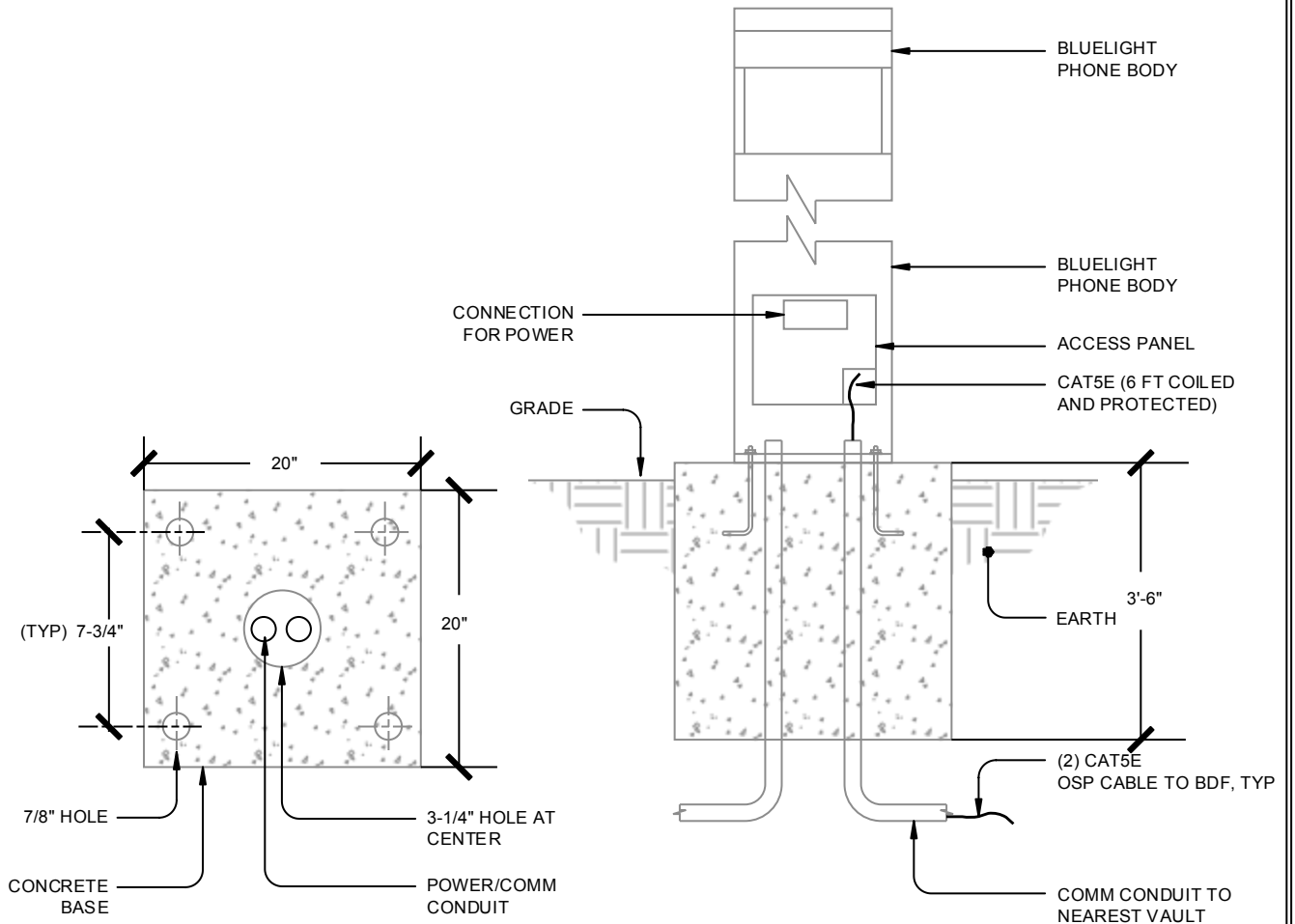
5/8 INCH J-BOLT,  
 TYP FOR FOUR  
 (16 INCHES LONG)



UNIVERSITY OF CALIFORNIA  
 BERKELEY  
 Information Services and Technology  
 Communications Standards

DESCRIPTION:  
 TELECOMMUNICATIONS  
 BLUE LIGHT PHONE - BOLT LAYOUT TEMPLATE AND OSP CONCRETE BASE.  
 TEMPLATE FOR BOLT PLACEMENT IS ACTUAL SCALE IF PRINTED AT 11/17

SKETCH No:	SK901
DATE:	
REVISION:	
SCALE:	NONE



**BASE - PLAN VIEW**

**BASE - ELEVATION VIEW**



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Communications Standards

**DESCRIPTION:**

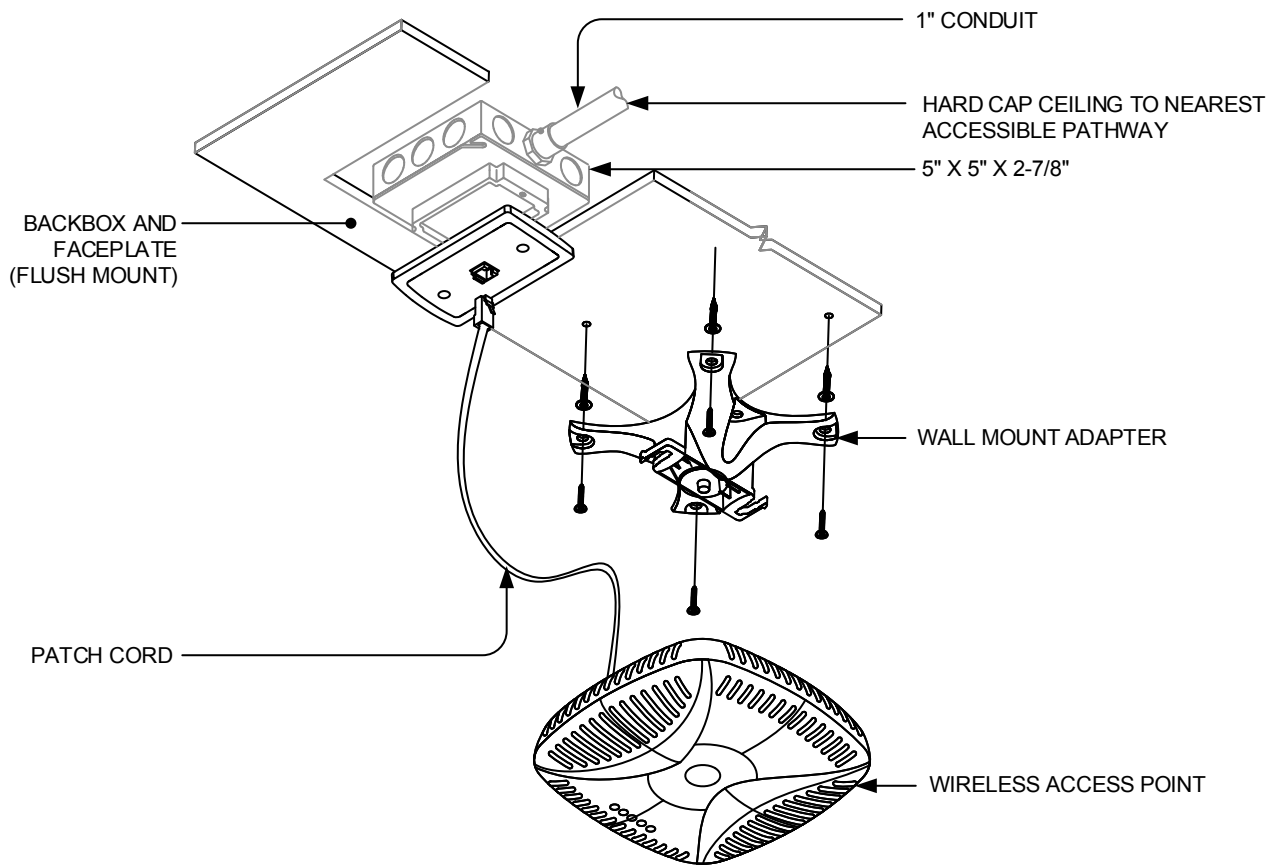
TELECOMMUNICATIONS  
BLUE LIGHT PHONE - OSP  
INSTALLATION  
INFORMATION

SKETCH No: **SK902**

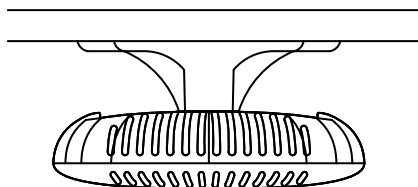
DATE: 6/15/14

REVISION: 3

SCALE: NONE



**ISOLATION VIEW**



**SECTION VIEW**



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Information Services and Technology

Communications Standards

DESCRIPTION:

TELECOMMUNICATIONS  
WIRELESS ACCESS POINT  
MOUNTED IN HARD CAP  
CEILING

SKETCH No: **SK903**

DATE: 11/25/14

REVISION: 4

SCALE: NONE