SAN DIEGO INTERNATIONAL AIRPORT

INFORMATION TECHNOLOGY INFRASTRUCTURE STANDARDS CONSTRUCTION MANUAL

SAN DIEGO COUNTY REGIONAL AIRPORT AUTHORITY

February, 14, 2011

This manual was developed for the

Information Technology Department

under the Terminal Development Program

to establish an airport-wide standard for IT

Communications Infrastructure

DISCLAIMER

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INTRODUCTION

SCOPE

This Standards Document provides design guidelines and requirements for designing infrastructure for Information Technology and Security Systems for San Diego County Regional Airport Authority (SDCRAA). It is not the intent for this document to replace existing technical specification, more so, to allow technical specification to be written by utilizing these guidelines as a base.

Architects, engineers, planners, consultants, installers, tenants, and staff are among the intended audience. The result of adhering to this specification is to provide infrastructure that:

1. Is secure
2. Provides for growth (Scalability)
3. Conforms to industry standards
4. Implements best practices
5. Improves reliability
6. Increases serviceability
7. Provides physical redundancy
8. Provides ease of maintenance

27 00 00 BASIC COMMUNICATIONS REQUIREMENTS

CONSTRUCTION APPROVALS

Before the construction or installation of any infrastructure, construction approvals shall be obtained from the San Diego Country Regional Airport Authority's Aviation Security and Public Safety Department, IT Department, Facilities Development Department, and Real Estate Department. Direct all correspondence to:

1) Title: Engineer
Attention: Facilities Development Department
Address: P.O. Box 82776, 92138-2776
Or
2320 Stillwater Road
City: San Diego, CA 92101-1022
Phone: (619)400-2400 Fax: (619) 400-2596

2) Title: Director
Attention: Aviation Security and Public Safety Department
Address: P.O. Box 82776, 92138-2776
Or
2320 Stillwater Road
City: San Diego, CA 92101-1022
Phone: (619)400-2400 Fax: (619) 400-2596

3) Title: Director
Attention: IT Department
Address: P.O. Box 82776, 92138-2776
Or
2320 Stillwater Road
City: San Diego, CA 92101-1022
Phone: (619)400-2400 Fax: (619) 400-2596

4) Title: Director
Attention: Real Estate Department
Address: P.O. Box 82776, 92138-2776
Or
2320 Stillwater Road
City: San Diego, CA 92101-1022
Phone: (619)400-2400 Fax: (619) 400-2596

5) Title: Program Manager
Name: Peter Aarons
Attention: Terminal Development Program
Address: P.O. Box 82776

City: San Diego, CA 92138-2776
Phone: (619) 400-2955 Fax: (619) 758-9650

Subsurface utilities shall be located by calling the California Underground Service Alert South at (800) 227-2600, or One Call Referral Systems International at (888) 258-0808. Orange is the uniform color code for utility flagging, painting, and identifying communications, alarms, signals, and CATV.

Additionally, it is highly encouraged to utilize the services of a private locating service to ensure all utilities are located.

ADMINISTRATION AND EQUIPMENT MANAGEMENT

Records

The following work activities should be documented and recorded:

a. Statement of work to be performed
b. Project schedules
c. Minutes of meetings
d. Emergency contact lists
e. Miscellaneous notes and photos

Labeling

1. General
    a. All labels shall be computer or label maker generated.
    b. It is recommended that cable labeling be conform to Telecommunications Industry Association TIA/EIA-606A, Administrative Standard for Telecommunication Infrastructure.
    c. Labeling scheme will be provided by the SDCRAA IT Department prior to installation. Examples listed below may not be the current approved scheme, and is the contractor's responsibility to ensure adherence to the current approved labeling scheme is achieved.

2. Conduit
    a. All conduit runs shall be labeled on origin and destination ends.

3. Innerduct/Fabric Multi-Celled Ducting in Pull Boxes, Maintenance Holes, and Manholes
    a. Every innerduct and/or fabric multi-celled duct installed, shall have a brass or plastic tag that contains the origin, destination, and the owner. These tags shall be placed at both ends and in every pull box, handhole, or manhole along the pathway. These tags shall be securely fastened so that they cannot be accidentally removed.

        i. *Examples*
            1. SDCRAA IT
            2. COM CTR TO ADMIN BSMT
            3. SDCRAA IT
            4. TR4 TO SR, MPOE

4. Cables
    a. All cables shall be labeled, and that labeling schedule provided on all as-built drawings and printouts.

5. Fiber Optic Jumpers
    a. All fiber patch jumpers will be labeled by the Contractor.

    b. All fibers in a jumper shall be identified with white heat shrink labels, or wrap around label 5/8 inch to 3/4 inch wide by 1 to 1 ½ inch long, with lettering clearly visible and shall be placed near the boot of the connector. The heat shrink label shall not be shrunk.

    c. Some examples of the labeling format for jumpers in the TR and the Cable Management System are as follows:
        i. Line 1 is the near port of the jumper. The format is: AAA-RXX-Y-ZZ where AAA is the two or three letter building code, RXX is the rack number, Y is the shelf number, and ZZ is the port number.
        ii. Line 2 is the far port of the jumper. The format is: AAA-RXX-Y-ZZ where AAA is the two or three letter building code, RXX is the rack number, Y is the shelf number, and ZZ is the port number.
        iii. Line 3 is the circuit number. The format is #XXXX where XXXX is the circuit identification number as assigned by ITs.
            1. 1 - CC-R59-3-25
            2. 2 - CC-R53-1-10
            3. 3 - CKT #3007

d. Some examples of the labeling format for all other jumpers is on three lines and is as follows:
    i. Line 1 is the near port. The format is: XXX-YY-ZZ where XX is the two or three letter building code, YY is the patch panel number in that building, and ZZ is the port number in that panel.

    ii. Line 2 is the far port. The format is XXX-YY-ZZ where XX is the two or three letter building code, YY is the patch panel number in that building, and ZZ is the port number in that panel. Line 3 is the circuit number. The format is #XXXX where XXXX is the circuit identification number as assigned by Its.

    iii. Line 3 is the circuit number. The format is #XXXX where XXXX is the circuit identification number as assigned by ITD.
        1. 1 - AD-3-14
        2. 2 - AD-4-22
        3. 3 - CKT #2557

6. Work Areas
    a. Work area outlet cabling shall be labeled at each end.
    b. Work area outlets shall be labeled on the front of the wall plate.
    c. Patch panel labels to be clearly labeled on the front of the patch panel.

7. Tenant Areas
    a. If TRs are shared with tenants, provide clear separation and identification of the equipment and terminations. Refer to Figure 1 in the Appendix.

Documentation

1. Upon completion of installation and after the final acceptance of all systems, the Installer shall supply a complete set of as-built documentation as follows:
    a. Site plan
    b. System block diagram
    c. Interconnection diagram
    d. Dig Alert tickets and Utility Locate documentation
    e. As-built drawings and prints of the conduit installation with routing
    f. Butterfly diagrams of manhole and handhole conduit configurations and cable routing, to include conduit sizes and cable counts
    g. Electronic drawings incorporated into BIM (Building Information Modeling) format
    h. Final acceptance test data sheet
    i. Updated Material List with quantities, model numbers and serial numbers

j. Manufacturer manuals/data sheets on all equipment
k. Manufacturer representatives and telephone numbers
l. Operation manuals
m. QA/QC manuals
n. Quality Management Plan (QMP)
o. Commissioning test forms
p. Warranty letter and time frame of warranty

2. The above documentation shall illustrate in detail the interconnection of every component and its correct functional relationship showing the positional and geographical location. The above documentation shall also include the following information:
    a. All testing parameters and resulting outputs
    b. All cable numbers
    c. All grounding points
    d. All conduit and/or cable tray pathways

3. Two (2) size “B” hard copies of the System block diagrams and Multi-wire Line diagrams must be submitted, along with one electronic copy in AutoCAD (AutoCAD 2010 minimum) .dwg format on CD ROM. In addition, two (2) hard copies of all other documents shall be provided, along with electronic one electronic copy of all other documentation listed above.

4. All information including, but not limited to, the definition of symbols, terms, and acronyms shall be included to assist in a clear understanding of the documentation.

STANDARDS, CODES AND REFERENCES

All installations shall comply with the latest National Electric Code, City, State and Federal codes, regulations, permits and inspections. Except as specified, standards and practices that prevail and which are generally accepted within the industry shall be used to assure the highest quality materials, equipment and workmanship.

If there is an apparent conflict between this specification and any code or standard, then the more stringent shall prevail.

Design energy efficient systems to comply with California Building Energy Efficiency Standards Title 24.

REFERENCES

List of codes and standards governing infrastructure installations:

ANSI C80-1	Rigid Steel Conduit, Zinc-Coated
ANSI C80-3	Electrical Metallic Tubing, Zinc-Coated
ANSI/CEA	Publication S-80-576
ANSI/ICEA S-83-596	Fiber Optic Premises Distribution Cable Technical Requirements
ANSI/NEMA FS 1	Fittings and Supports for Conduit & Cable Assemblies
ANSI/TIA/EIA 107	Return Loss for Fiber Optic Components
ANSI/TIA/EIA 455-A	Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components (FOTPs) Standard Test Procedures for Optical Fibers & Cables
ANSI/TIA/EIA 455-13	Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies (R2002)
ANSI/TIA/EIA 455-57A	Optical Fiber End Preparation and Examination

ANSI/TIA/EIA 455-59	Measurement of Fiber Point Defects Using An OTDR
ANSI/TIA/EIA 455-60	Measurement of Fiber or Cable Length Using An OTDR
ANSI/TIA/EIA 455-61	Measurement of Fiber or Cable Attenuation Using An OTDR
ANSI/TIA/EIA 455-95	Absolute Optical Power Test for Optical Fibers and Cables
ANSI/TIA/EIA 455-171	Attenuation by Substitution Measurement - for Short-Length Multi-mode Graded-Index and Single-mode Optical Fiber Cable Assemblies
ANSI/TIA/EIA 526-7	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
ANSI/TIA/EIA 526-14	Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant
ANSI/TIA/EIA 568-A and Addenda	Commercial Building Telecommunications Cabling Standard, October 1995
ANSI/TIA/EIA 568-B.1 and Addenda	Commercial Building Telecommunications Cabling Standard - Part 1 general requirements.
ANSI/TIA/EIA 568-B.2 and Addenda	Commercial Building Telecommunications Cabling Standard - Part 2 balanced twisted pair.
ANSI/TIA/EIA 569-B	Commercial Building Standard for Telecom Pathways and Spaces, February 2003
ANSI/TIA/EIA 598-B	Optical Fiber Cable Color Coding, 2001
ANSI/TIA/EIA 604.2	Fiber Optic Connector Intermateability Standard, 1997
ANSI/TIA/EIA 606-A	Administration Standard for Commercial Telecommunications Infrastructure, 2002
ANSI/TIA/EIA 607	Commercial Building Grounding and Bonding Requirements for Telecommunications, August 1994
ANSI/TIA/EIA 758	Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999

ANSI/TIA/EIA 862	Building Automation Systems Cabling Standard for Commercial Buildings, 2002
ANSI/TIA/EIA 942	Telecommunications Infrastructure Standard for Data Centers
ANSI/TIA/EIA 1005	Telecommunications Industrial Cabling Standards
ANSI/TIA/EIA 4750000B	Generic Specifications for Fiber Optic Connectors
ANSI Z136.1	National Standard for the Safe Use of Lasers
ANSI Z136.2	National Standard for the Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources
ASTM E-814	Fire Tests of Through-Penetration Fire-Stop
BICSI	Telecommunications Distribution Methods Manual (Latest Edition) NTS, OSP, WD, ESSRDM, A/V
FCC 47 Part 68	Code of Federal Regulations, Title 47, Telecommunications
FCC Part 76	Cable Television Service
IEEE	National Electrical Safety Code (NESC); Latest
ISO/IEC IS 11801	Standards
NEMA 250	Enclosures for Electrical Equipment (1000 V Max)
NFPA 70	National Electric Code; 2002
OSHA, 29 CFR Part 1910	Safety Requirements
SCTE	Society for Cable Television Engineers, Publications and Industry Standards.
TSB-67	Field Testing of UTP Cabling Systems, October 1995
TSB-72	Centralized Cabling Guidelines, October 1995

TSB-75	Additional Horizontal Cabling Practices for Open Offices, August 1996
TSB-95	Additional Field Testing Requirements for Category 5, October 1999
UL 1459	Underwriters Laboratories Standard for Safety – Telephone Equipment
UL 1863	Underwriters Laboratories Standard for Safety – Communications Circuit Accessories

ABBREVIATIONS

ACAMS	Access Control and Monitoring System
ACR	Attenuation-to-Crosstalk Ratio
AFF	Above Finished Floor
AWG	American Wire Gage
ANSI	American National Standards Institute
BTU	British Thermal Unit
BHS	Baggage Handling System
BICSI	Building Industry Consulting Service International
BMS	Building Management System
CAT	Category e.g., CAT6
CATV	Common Access Television
CCTV	Closed-Circuit Television
CMP	Communications Plenum
CMR	Communications Riser
COAX	Coaxial Cable
EIA	Electronic Industries Alliance
ELFEXT	Equal Level Far End Crosstalk
EMT	Electrical Metal Tubing
EVIDS	Electronic Visual Information Display System
FA	Fire Alarm
FEXT	Far End Crosstalk
FR-S	Fire Retardant Stamp
ID	Inside Diameter
IDF	Intermediate Distribution Frame
IEEE	Institute of Electrical and Electronics Engineers, Inc.
INS	Immigration and Naturalization Service
ISO	International Organization for Standardization
IT	Information Technology
LAN	Local Area Network
MM	Multimode fiber optic cable
MDF	Main Distribution Frame
MPOE	Main Point Of Entry
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NEXT	Near End Crosstalk
NFPA	National Fire Protection Association, Inc.
nm	Nanometer
OD	Outside Diameter
OSHA	Occupations Safety and Health Administration
OSP	Outside Plant

OTDR	Optical Time Domain Reflectometer
PIDS	Perimeter Intrusion Detection System
PLC	Programmable Logic Controller
PMD	Project Management Division (Engineering)
PVC	Polyvinyl Chloride
RMS	Resource Management System
RR	Rack Room
SM	Single Mode fiber optic cable
SR	Server Room
STP	Shielded Twisted Pair
TC	Telephone Closet
TDR	Time Domain Reflectometry
TGB	Telecommunications Grounding Busbar
TIA	Telecommunications Industry Association
TMGB	Telecommunications Main Grounding Busbar
TR	Telecommunications Room
UL	Underwritters Laboratories Inc.
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WAO	Work Area Outlet
WLAN	Wireless Local Area Network

DEFINITIONS

1. Active Equipment: Electronic equipment used to develop various WAN and LAN services.

2. Backbone: Collective term sometimes used to describe the campus and vertical distribution subsystem facilities and media interconnecting service entrances, communications rooms, and communications cabinets.

3. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

4. Cabinet: Freestanding, floor-mounted modular enclosure designed to house and protects rack-mounted electronic equipment.

5. Cable Tray: Vertical or horizontal open supports usually made of aluminum or steel that is fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.

6. Campus: Grounds and buildings of a multi-building premises environment.

7. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connection to active equipment.

8. Cross-Connect: Equipment used to terminate and tie together communications circuits.

9. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.

10. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities.

11. Grounding: A conducting connection to earth, or to some conducting body that serves in place of earth.

12. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.

13. Horizontal: Pathway facilities and media connecting Intermediate Distribution Facility (IDF) to Station Outlets (SO).

14. Information Technology (IT): A department which manages computers, voice, video, data networks and other technical areas of the business.

15. Intermediate Distribution Facility (IDF): Distributes communications services to users within a serving zone and interconnects with the BDF. Typically, the IDF contains passive equipment used for cross connect and active network equipment used for LANs. IDF is sometimes referred to as the communications equipment room.

16. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.

17. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.

18. Local Area Network (LAN): Data transmission facility connecting a number of communicating devices, e.g., serial data, Ethernet, token ring, etc. Typically, the network is limited to a single site.

19. Media: Twisted-pair, coaxial, and fiber optic cable or cables used to provide signal transmission paths.

20. Mounting Frame: Rectangular steel framework which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.

21. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, fiber optic termination hardware, etc.

22. Patch Cords: A length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross-connect.

23. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate administration of cross-connect fields.

24. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wire way, cable tray, surface raceway, under floor systems, raised floor, ceiling support wires, etc.

25. Private Branch Exchange (PBX): Private communications switching system located on the user's premises. A PBX switches voice and data calls within a building or premises and between the premises and facilities provided by public common carrier networks.

26. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.

27. Raceway: An enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wire way, under floor raceway, and surface raceway; does not include cable tray.

28. Racks: An open, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

29. Station Outlets (SO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.

30. Wide Area Network (WAN): Active communications transmission facilities extending beyond the premises.

31. Wiring Block: Punch down terminating equipment used to develop twisted-pair cross connect facilities.

27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

1. Within the main point of entry (MPOE) there shall be installed a telecommunications main grounding bus bar (TMGB).

2. The TMGB shall be grounded to both the electrical grounding entrance facility and the building's steel exterior wall, or according to the local authority having jurisdiction. Use of gas or water pipes is not permitted. The TMGB shall also connect to a telecommunications grounding bus bar (TGB) within each IT room via a telecommunications bonding backbone (TBB). Grounding conductors shall be installed to building steel with clamps designed for the purpose. Connections to building steel should be made non-reversible means and any disturbance to the fire proofing must be restored.

3. The TMGB shall be a copper bus bar of a minimum 4 inches x 12 inches x ¼ inch with a minimum of twelve (12) 5/16 holes and six (6) 7/17 holes. The bus bar shall be insulated from its support.

4. The TGB shall be provided for each TR, and shall be connected to both the closest grounding point in the building's electrical service panel (or according to the local authority having jurisdiction), and the building's steel exterior wall. Any disturbance to the building steel fire proofing must be restored.

5. The TBB shall be installed to connect the TMGB to each TGB. Separate conductors shall run from the TMGB to every level within a building. TBB's can be extended from the TGB's in TRs on the same level.

6. TBB's shall be sized according to the resistance measurement at the TR TMGB of 5 Ohms or less. Measurements shall be taken from two points. Electrical designer must achieve this requirement via wire sizing for given distances versus resistance drop.

7. For TGB's, at a minimum a #6 AWG, stranded, copper, green, insulated, conductor shall be provided to connect equipment racks and cabinets and cable tray intersystem bonding. All equipment racks and cabinets shall be bonded to each other and to the telecommunications grounding bus bar.

8. All grounding conductors shall be protected by installing within ½ inch conduit. This does not apply for cable tray top cable tray connection points, which can be installed without utilizing conduit.

9. Isolated grounds to reduce electrical noise shall be provided if specified. Isolated grounding receptacles shall be colored orange or marked with an orange triangle.

27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS

The Installer shall not interfere with the owner and/or tenants' operations without SDCRAA's prior written notice and in line with current tenant advisory timelines/constraints.

Traffic Control

1. The Installer shall comply with Department of Transportation standards and the requirements of the SDCRAA. Prior to performing work in any roadway, the Installer shall review and adhere to the standards and specification set forth by the Facilities Development Division (FDD) and the Airport Traffic Officers.

Storage and Handling

1. Handle materials and equipment in accordance with the manufacturer's written instructions.

2. Follow the manufacturer's written instructions for storing all items.

27 05 28.29 HANGERS AND SUPPORT FOR COMMUNICATIONS SYSTEMS

Copper

1. Most SDCRAA cabling is required to be installed within conduit from work area outlets to a cable tray system. See section 27 05 28.36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS for specifications on cable tray systems at SDCRAA.

2. There are some installations where "J" hooks are allowed if pre-approved by the Engineer and the SDCRAA.

3. Above ceilings, copper cables shall be suspended either by prefabricated "J" hooks, a trapeze suspended from the ceiling with continuous rod, or some other approved and industry accepted practice. Ties and bridle rings shall **NOT** be used to support cable in ceilings.

4. Approved “J” hooks may be fastened to beams, ceiling drop wires, pencil rod, or approved communications wiring hangers.

    a. Use of ceiling drop wires shall be independent and isolate from those supporting acoustical ceiling grid support wires.

    b. Independent wires utilized for cable hangers, must not attach to the ceiling grid.

5. Supports shall be space every 4 to 5 feet to minimize cable sag.

6. In ceilings, copper cables shall **NEVER** be pulled directly over suspended ceiling tiles or fluorescent light fixtures and shall **NEVER** be laid upon ceiling tiles or fluorescent light fixtures.

7. Cable ties within the ceiling are not permitted.

8. Velcro cable ties may be used to secure copper cables provided that they are **NOT** over-tightened and have the appropriate fire rating.

9. Screw-mounts, one inch square, can be used on backboards provided that they are secured with flat-head mounting screws.

Coaxial

1. Same as copper.

Rooftops

1. One junction box for each vertical cable riser with two 4 inch conduits for each junction box shall be provided on the building rooftop. Each TR junction box shall be connected to the closest TR via two 4 inch conduits. Conduits penetrating the roof shall be galvanized rigid steel conduit. Junction boxes located on the roof shall meet or exceed a rating of NEMA-3R.

Antennas

1. Antenna Support: Install structural members on the roof near the rooftop TR junction box for the mounting of satellite antennas for each TR junction box.

2. Antenna transmission lines should follow the manufacturer’s specifications on minimum bending radius, connector installation, and support requirements; wrap-lock or other smaller support equipment is **NOT** permitted.

27 05 28.33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

Conduits

1. No plastic or plastic based materials shall be used as conduits within buildings.

2. Rigid steel conduit and electrical metal tubing conduit shall be steel, hot dipped galvanized after fabrication.

    a. Flexible metal conduit is not permitted without prior approval by the Authority.

3. Unless and otherwise specified by SDCRAA, minimum size of interior conduit within SDCRAA infrastructure shall be 1 inch.

4. All TRs shall connect to the Main Distribution Frame (MDF) or Server Room (SR) with a minimum of two 4 inch conduits.

5. Adjacent TRs shall connect to each other with a minimum of two 4 inch conduits.

6. Within passenger terminals, the backbone pathway shall be individual, physically separate, redundant pathways feeding each TR from the MDF or SR utilizing cable tray or conduits as appropriate.

7. Every TR on the level immediately below the rooftop shall provide for connectivity to the rooftop or as permitted by the SDCRAA.

8. Power lines shall not run in communications conduits.

9. All communications conduit shall be connected with compression fittings, reamed and bushings installed, unless otherwise specified.

10. Conduit shall be sized for forty percent (40%) of perfect fill.

11. The maximum number of cables that can be installed with two 90-degree bends is 40 percent of perfect fill.

12. Conduits shall not extend more than 100 feet in any one continuous run without a pull-box. Communication conduits shall not exceed a total of 180-degrees bend radius without installation of a pull box. Pull box sizing shall be coordinated with SDCRAA IT and based on conduit sizes and fill ratios.

13. All 4 inch communication Service Entrance and backbone conduits shall have a 2500# pull rope installed and attached at each end. All 2-inch and below conduits shall have a 1200# pull string installed and attached a both ends. Each conduit shall have a pull string shall be marked with distance in feet marking at each end and be labeled on each end with the origin and destination, respectively.

14. One 4 inch conduit entering the TR and one 4 inch conduit leaving the TR shall have three (3) three-celled fabric ducting or four 1 inch orange-colored innerducts installed with pull strings with distance in feet markings on it inserted in each of the ducts and tied off at each end.

15. All communications 2 inches and smaller conduits shall require a minimum of 24 inch bend radius sweeps. All communications conduits 3 to 4 inches shall require a minimum of 48 inch bend radius sweeps. All conduits bend shall be factory manufactured radius sweeps for 4 inch conduits. Field radius sweeps are not permitted for 4 inch conduits.

16. The inside bend radius of conduits sized greater than 2 inches shall be a minimum of 10 times the internal diameter of the conduit.

17. All conduit connectors shall have plastic bushings. No thread ends may remain exposed.

18. All conduits shall be labeled on both origin and destination ends.

19. All conduits shall be painted and/or labeled to identify the type of communications pathway. Markings to occur every 10 feet.

    a. Color coding to be aligned with SDCRAA standard labeling scheme. (See Appendix Table-3)

20. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high and 2 1/2 inches deep.

21. Work area outlet conduits fed from a cable tray system, shall be grounded and bonded to the cable tray.

22. Empty conduits shall have approved caps installed after pull strings have been installed.

Exterior Conduit

1. Horizontal distribution conduits may only run exterior to the building in the following circumstances:
    a. It is not feasible to meet the recommended 250 feet cable length limitation by running within the facility.

    b. The runs are essential and are not exposed to direct elements (i.e. rain, sunlight). Note: Extremes of heat lowers the maximum length of the 250 foot cable by approximately one (1) yard for every ten (10) degrees.

2. Unless and otherwise specifically authorized, minimum – 1 inch conduit shall be used.

3. No Conduit shall be routed on the roof unless specifically approved by SDCRAA. If such routing is approved, then only rigid steel type conduit shall be used on the roof.

    a. Where roof installations must occur, the integrity of the roof must be taken into consideration during installations.

    b. Roof penetrations should only be performed by the warranting roofing company, to avoid voids in warranty.

    c. Where roof work is required for tenant needs, all costs will be absorbed by the tenant.

4. All conduits shall be painted and/or labeled to identify the type of communications pathway. Markings to occur every 10 feet.

    a. Color coding to be aligned with SDCRAA standard labeling scheme. (See Appendix Table-3)

Pull Boxes

1. Sized according to the NEC, unless exact sizes are specified.

2. The minimum size pull box for 1 ¼ inch conduit is 12 inches long x 4 inches wide x 3 inches deep. (12” x 4” x 3”).

3. The minimum size pull box for 4 inch conduit is 36 inches long x 12 inches wide x 8 inches deep. (36” x 12” x 8”).

4. Conduits shall not run more than 100 feet or have more than two 90 degree bends without pull boxes.

5. Conduit entry and exit points shall be placed at opposite ends of the pull box if possible.

6. Exterior exposed pull boxes shall meet or exceed a NEMA-3R rating.

7. In all cases, pull box sizing must meet industry standards and installed to meet building code requirements.

Fabric Multi-celled Duct and Innerduct

1. Innerduct or fabric multi-celled ducting (preferred) shall be installed in all conduit systems where fiber optic cable is placed.

2. For new multiple conduit installations, four 1 inch innerducts or three 3-cell fabric ducts (preferred) shall be pulled and shall include a pull string with distance in feet markings at each end in each innerduct.

3. SDCRAA IT only uses orange-colored innerduct so as not to be confused with other agencies.

4. Innerduct and/or fabric multi-celled ducting should extend 4”-6” inside pull boxes, hand-holes and manholes, and be secured in place using an approved duct plug.

5. Unused innerducts shall be plugged with an approved plug.

27 05 28.36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

Ladder Cable Tray

1. Ladder cable trays shall be used in all TRs at SDCRAA.

2. Ladder cable trays shall be a standard 18 inches wide and a rung spacing of 12 inches, mounted at least 8’ (feet) 6” (inches) above the finished floor. Ideally, ladder cable trays should be mounted at 12 inches above the cabinets being served.

3. Ladder cable trays installed within TRs shall be installed above the center-line of the cabinets from wall to wall and tee off at intervals not to exceed six feet. For a row of four cabinets or more, the cable tray shall tee off in at least two locations.

4. Ladder cable trays shall be supported by a threaded rod trapeze sized for the rated load.

5. Ladder cable tray parts shall be bonded to a number 6 AWG copper conductor and connected to the grounding busbar.

Cable Trays

1. Cable trays shall be metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.

2. Cable trays shall be a standard of at least 18 inches wide and mounted at least 8’ (feet) 6” (inches) above the finished floor.

3. In office areas, cable trays should be installed above the common corridor. In areas with diverse architecture pre-approval for cable trays must be obtained.

4. Cable trays shall be supported by a threaded rod trapeze sized for the rated load.

5. Cable trays shall not exceed a 50% fill ratio.

6. Cable trays parts shall be bonded to a number 6 AWG copper conductor and connected to the grounding busbar.

Power Poles

1. Power poles are not permitted.

Surface Mount

1. Surface-mount raceways shall be used *only* if there is no other alternative pathway for cables.

Fire-stopping

1. All penetrations made through fire-rated structures shall be sealed with approved fire-stopping materials.

2. Fire-stopping materials shall be of like materials and sufficient to restore the fire-rating of the penetrated structure.

3. Fire stopping pillows may be used for through penetrations for cable tray pathways.

Core Drilling

1. Core drilling concrete floors may be permitted with approval from the Engineer, provided that structural integrity is not compromised.

2. Ground penetrating radar systems can be used to detect rebar, and other embedded objects.

3. Prior to drilling, the concrete shall be X-rayed, and the X-ray given to the Engineer along with a request for core drilling whenever:
    a. Conduits are to pass through or interfere with a structural member.
    b. Notching, boring or cutting of the structure is necessary.
    c. Special openings are required through walls, floors, footings or other building elements to accommodate the work.

4. The concrete slurry from the drilling operation shall not be allowed to stain anything above or below it. Provisions shall be made to protect the environment and contain the slurry.

5. All spillage shall be cleaned up.

6. Damage to existing areas caused by spillage and/or splatter, shall be repaired at the expense of the contractor.

7. The core-drilled opening shall be properly fire stopped.

8. If coring is in a room with existing equipment, the Contractor is responsible for any damage to existing equipment caused by coring dust. Precautions shall be taken to minimize coring dust.

27 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

Underground

1. Minimum - 3 inches minimum gap when near power, light and other conduits.

2. Minimum - 6 inches minimum gap when crossing oil, gas, water and other pipes.

3. Minimum - 12 inches minimum gap when running parallel to oil, gas, water and other pipes.

4. Minimum - 12 inches minimum gap when below the top of railroad rails.

5. SDCRAA installation standards require underground communications ductbanks to be installed no less than 24 inches below finished grade. Top of the conduit ductbank shall have 24 inches of cover to the finished grade. Exceptions can be made for 18 inches of cover, with proper approval by the Authority prior to installation.

6. During backfill of trenches, install a continuous underground, surface detectable, warning tape at 6 to 8 inches below finished grade.

7. Printing on tape shall be permanent and not be damaged during installation or backfill.

8. Tape materials and ink shall be chemically inert and not be subject to damage to commonly found destructive substances found in soils.

9. Reinforced Orange colored; detectable, plastic warning tapes shall be installed 12 inches above conduit to prevent accidental dig-ups and interruption of service.

Codes/Standards Reference
NEC article 300.5

10. Conduits shall be spray painted with system color coding at 3-foot intervals throughout installation, when not encased in concrete. (See Appendix Table-3 for system color codes)

Ductbanks

1. Conduits shall be encased in concrete and shall have an orange electronic marker strip for future location purposes.

2. A minimum of one 4 inch conduit shall be filled with four 1 inch innerducts or three 3-cell fabric ducts (preferred) along the installed pathway.

3. All conduits and innerducts shall have ½ inch poly pull rope installed and secured at each end with feet distance noted at each end.

4. Furnish and install all requirements to effectively seal all utilized and unutilized conduits with an approved conduit sealing kit after installation, splicing, termination, testing and acceptance.

Manholes and Handholes

1. Shall be constructed for an H-20 or higher rating for deliberate heavy vehicular traffic for non-airfield installations.

2. Airfield installations shall have an aircraft rating. SDCRAA Facilities Management Department and Airside Operations Department will provide guidance on Airfield installation prior to any construction activities taking place on the airfield.

3. Handholes shall be sized a minimum 4 feet long x 5 feet wide x 4 feet deep (4’ x 5’ x 4’) to allow the coiling of a 25’ service loop per run.

4. Manholes shall be tested for explosive and oxygen-displacing gases, prior to entry.

5. Manholes shall be exhausted and ventilated as required.

6. Manholes having abnormal gas levels shall be reported to the Engineer for record-keeping.

7. All personnel entering manholes shall have successfully completed the OSHA confined space entry safety training, and have their confined space ID card in their possession.

8. New manhole dimensions shall not be less than 8 feet long x 6 feet wide x 8 feet 6 inches high (8’ x 6’ x 8'6”) to allow the coiling of a 50’ service loop per run.

9. Distances between manholes shall not exceed 400 feet, 600 feet is allowed in special cases if there are no bends.

10. Bend radii of conduit entering manholes shall be 9 feet minimum.

11. New manholes/handholes shall have factory manufactured cable rack supports along the inner walls, for maintenance of service loops, splice case support and routing of cables within the manholes/handholes in a neat and tidy manner.

12. Manholes shall have a metal ladder secured to the structure.

13. Manhole covers shall be numbered by welding the numbers on top of the manhole cover. (Refer to SDCRAA IT for numbering sequence.)

14. Manhole numbers shall also be painted on the inside collar of the manhole.

15. Manhole and Hand-hole covers shall be hinged.

Direct Burial

1. Direct burial shall not be used as a cable installation method on the SDCRAA campus.

Aerial Pathways

1. Poles shall not be set except for temporary projects and only then with approval from the Engineer and the SDCRAA.
2. Communications cable shall be mounted 40 inches below any power lines and 18 feet above streets and driveways.

3. Aerial cable spans shall not exceed 98 feet to the building.

4. Aerial cable entrances shall be limited to 100 pairs.

Codes/Standards Reference
NEC article 230
NEC article 830.10, 830.11

27 05 48 VIBRATION AND SEISMIC CONTROLS FOR COMMUNICATIONS SYSTEMS

1. SEISMIC (Zone 4) restraint of the conduit support system and all other equipment is required based upon the California Code of Regulations, Part 2, Title 24 and all other applicable codes.

27 08 00 COMMISSIONING FOR COMMUNICATIONS SYSTEMS

Commissioning and testing of communications systems shall comply with the ANSI/TIA/EIA - 568-C, Commercial Building Telecommunications Cabling Standard (2009).

Copper Testing Requirements

1. CAT3 cabling
    a. DC loop resistance
    b. Continuity
    c. Length
    d. Attenuation
    e. Crosstalk or Near End Crosstalk (NEXT)
    f. Noise
    g. TDR

2. CAT6 Cabling
    a. Wire Map
    b. Length
    c. Attenuation
    d. Near-End Crosstalk
    e. Propagation Delay/Delay Skew
    f. Power Sum Near End Crosstalk (NEXT)
    g. Attenuation to Crosstalk Ratio / Power Sum Attenuation to Crosstalk Ratio
    h. Equal Level Far End Crosstalk (ELFEXT)
    i. Alien Crosstalk (AXT)
    j. Return Loss

3. Coaxial
    a. DC loop resistance
    b. Length
    c. TDR
    d. Attenuation
    e. Noise

Fiber Optic Testing Requirements

1. SDCRAA has the right to observe and verify all fiber optic tests. The Installer shall notify the Engineer one week prior to testing so that testing can be observed. SDCRAA will require the Installer to retest at the Installer's own expense if the tests are conducted without properly notifying the Engineer.

2. Testing of all fiber optic cables shall occur on the reel with an OTDR prior to installations, to ensure there are no damages from the manufacturer. All strands shall be tested, and test results to be included in the overall documentation provided by the contractor.

3. The testing shall demonstrate that there are no errors, damaged or incorrectly installed components, that the installation is correctly labeled and that all of the installed components meet or exceed the criteria detailed in this document.

4. Any test that does not show that a component is satisfactorily installed, as per this document, shall be repeated at no additional expense to the SDCRAA. If a test procedure needs to be modified to satisfactorily test some components, the modifications shall be submitted to the Engineer for approval prior to the tests being conducted.

5. The Installer shall supply all test equipment required to carry out all of these tests. The Installer shall include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests detailed in this document, including labor costs, in the total bid lump sum. No extra or additional costs will be considered.

6. If on submittal of the test results there are any missing test results or incorrectly named files, the test shall be repeated at no additional cost to the Contract.

7. The Installer shall test every fiber optic strand in the installation in accordance with the field test specifications defined by the ANSI/TIA/EIA 568-C or by the appropriate network application standard(s), whichever is more demanding.

8. The Installer shall offset-null the power meter before starting a testing session to eliminate the detector dark currents. Offset nulling shall be performed before every test session or when environmental conditions change.

9. The Installer shall use “Two (2) Jumper Reference” when referenced specification is not directed by primary specification to create reference test levels. The reference connections resemble those used during the actual loss test, which means that the same detectors are matched to the same sources for both the reference and the test.

10. Before starting any new testing session or when a test jumper has been disconnected from the source port of either test set, the two jumper reference shall be repeated.

11. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

12. The link test limits attenuation are based on the use of the "Two (2) Jumper Reference" Method specified by ANSI/TIA/EIA 526-14A, Method A and ANSI/TIA/EIA 526-7, Method A.1; or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

13. The Installer shall test 100% of the installed cabling links; all cabling links must pass the requirements of the standards mentioned. The Installer shall diagnose and correct all failing links. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

14. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

    a. The manufacturer of the fiber optic cable and/or the fiber optic connectors

    b. The manufacturer of the test equipment used for the field certification

    c. Training organizations authorized by BICSI (Building Industry Consulting Services International with headquarters in Tampa, Florida) or by the ACP (Association of Cabling Professionals™) Cabling Business Institute located in Dallas, Texas

15. Test Jumpers shall have the core diameter and numerical aperture nominally equal to those of the cable plant being measured.

16. The fiber optic launch cables, test reference cables, test jumpers, test aids and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters. All test or reference optical patch cords shall be 3 meters in length, no more than 0.25 dB of total insertion loss, and 0.15 dB of repeatability over 10 mating cycles.

17. Any test reference cable, launch cable or test aid used in the acquisition of a performance measurement of a fiber optic link or component shall never be coiled in a diameter less than 12 inches during testing.

18. The “Pass or Fail” condition for the link-under-test is determined by the results of the required individual tests. A pass or fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

Fiber Optic Test Parameters

The following are current standards. Should these standards change in any way it is the responsibility of the Installer to adhere to the most current standards.

1. The maximum allowable splice loss = 0.3 dB

2. The maximum allowable connector loss = 0.50 dB

3. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA 568-B:
    a. Cable Attenuation (dB) = Attenuation Coefficient (dB/km) x Length (Km)
        i. Attenuation Coefficient for single-mode is:
            1. 1310nm = .05 (Depending on fiber)
            2. 1550 nm = 1.0 (Depending on fiber)
        ii. Attenuation Coefficient for multi-mode is:
            1. 850nm = 3.5 (Depending on fiber)
            2. 1300nm = 1.5 (Depending on fiber)
    b. Link Attenuation (dB) = Cable Attenuation + Connector Attenuation + Splice Attenuation
    c. Splice Attenuation (dB) = Number of Splices (S) x Splice Loss (dB)
    d. Connector Attenuation (dB) = Number of Connector Pairs x Connector Loss (dB)

Single-Mode Testing

1. The Installer shall perform the following tests on all single-mode fiber links.
    a. Bi-Directional Attenuation / Insertion Loss using an Optical Power Meter
    b. Bi-Directional Optical Return Loss (ORL)
    c. Bi-Directional Optical performance Trace using an Optical Time Domain Reflectometer (OTDR)
    d. Optical End Face visible inspection

2. Single-mode backbone links shall be tested at 1310nm and 1550nm in accordance with ANSI/TIA/EIA 526-7, Method A.1, “Two Reference Jumper” or the equivalent method. All single-mode links shall be certified with test tools using laser light sources at 1310nm and 1550nm.

3. Single-mode links shall be tested at 1310nm and 1550nm in accordance with

ANSI/TIA/EIA 526-7, Method A.1, Two Reference Jumper Cable Measurement.

4. All single-mode links shall be certified with test tools using laser light sources at 1310nm and 1550nm.

5. The Installer shall test attenuation/insertion loss bi-directionally, in accordance with ANSI/TIA/EIA 526-7, Method A –1.

6. The Installer shall test Optical Return Loss (ORL) bi-directionally in accordance with ANSI/TIA/EIA 107, Return Loss for Fiber Optic Components

7. The Installer shall perform an optical performance trace using an OTDR, bi-directionally, in accordance with ANSI/TIA/EIA 455-59, “Measurement of Fiber Point Defects Using An OTDR”, ANSI/TIA/EIA 455-60, “Measurement of Fiber or Cable Length Using An OTDR”, ANSI/TIA/EIA 455-61, “Measurement of Fiber or Cable Attenuation Using An OTDR”.

Multi-Mode Testing

1. The Installer shall perform the following tests on all multi-mode fiber links.
    a. Bi-Directional Attenuation / Insertion Loss using an Optical Power Meter
    b. Bi-Directional Optical performance Trace using an Optical Time Domain Reflectometer (OTDR)
    c. Optical end face visible inspection
    d. Multi-mode backbone links shall be tested at 850nm and 1300nm. All multi-mode links shall be certified with test tools using laser light sources at 850nm and 1300nm.
    e. Multi-mode links shall be tested at 850nm and 1300nm in accordance with ANSI/TIA/EIA 526-14A, Method A.2, Two Reference Jumper Cable Measurement.
    f. All multi-mode links shall be certified with test tools using laser light sources at 850nm and 1300nm.
    g. Link segments less than 200 meters need only be tested at 850nm, because attenuation deltas due to wavelength are insignificant.

Optical Fiber Test Results and Documentation

1. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

2. The test result records saved by the tester shall be transferred into a Microsoft Windows™ based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test. The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable.

3. The database for the completed job shall be stored and delivered on CD-ROM; this CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

4. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
    a. The identification of the link in accordance with the naming convention defined in the overall system documentation.

    b. The overall Pass/Fail evaluation of the link-under-test including the attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value).

    c. The date and time the test results were saved in the memory of the tester.

5. General Information to be provided in the electronic data base containing the test result information for each link:
    a. The identification of the customer site as specified by the end-user.

    b. The overall Pass/Fail evaluation of the link-under-test.

    c. The name of the standard selected to execute the stored test results.

    d. The cable type and the value of the 'index of refraction' used for length calculations.

    e. The date and time the test results were saved in the memory of the tester.

    f. The brand name, model and serial number of the tester.

    g. The revision of the tester software and the revision of the test standards database in the tester.

6. The detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information:
    a. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

    b. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value).

    c. The link length shall be reported for each optical fiber for which the test limit was calculated.

7. Acceptance of the fiber cable installation is partially contingent on the review and approval of the fiber power meter/source test data submitted.

Performance Data

1. Submit all performance data in feet.

2. All tracings shall cover between 50% and 75% of the displayed scale on the tracing.

Submittals

1. Submit product data for the following:
    a. Optical Loss Test Set model and manufacturer
    b. OTDR model and manufacturer

2. Submit certification or calibration data for the following:
    a. Optical Loss Test Set
    b. OTDR

Sustainability

General

1. Technology sustainability shall be driven by the direct and indirect economics, operational efficiency, social responsibility, natural resource conservation, and reduction of side-effects and no direct impacts to the environment.

2. Every system and infrastructure installation that is planned to be deployed within SDCRAA ownership should be accompanied by supporting documentation such as Return on Investment, Life Cycle Costs Analysis, and Total cost of Ownership analysis data.

3. All Tenant systems and infrastructure shall maintain a clear itemized utilization /foot print log of their respective utilization of main power, standby/UPS power, HVAC capacity, redundant power need for system operation and cooling, and VOC/GHG footprint.

Cable Infrastructure Management

1. Cabling Management should include the process and standards by which cabling and cabling infrastructure systems are installed, maintained, assigned, labeled, and serviced, both initially and throughout the lifespan of the system.

2. Cable Management should store the type of cable, conduit plan with origination and destination, how and where cabling is routed (cable route map), its related infrastructure installed, label, color-coding, service code (security/IT/Tenant, etc) and other identification.

3. Cable infrastructure management system should be integrated with Security Systems and the Building Management System (BMS).

Radio Frequency (RF)

1. All RF infrastructures, active or passive, shall conform to Federal Communication Commission (FCC) regulations, FAA's Spectrum Assignment and Engineering Division (ASR-100), and be specifically approved by the SDCRAA before installation and commissioning of all devices.

2. All RF infrastructures, active or passive, require SDCRAA AVSEC/PS and ITD approval before installation and commission.

3. It is recommended to use Radio Frequency ID Devices for security initiatives in the 13.56MHz and 2.45 GHz range or as approved by SDCRAA.

4. Wireless LANs

    a. Wireless LANs are permitted to operate without FCC licenses in 2.4 and 5.8 GHz range.

        i. In exclusive lease areas, there is unrestricted use of 802.11b/g/n. Signals emanating from exclusive lease areas, are restricted to those areas. Signal/broadcast strengths must be adjusted to not propagate into airport common use areas.

b. The 802.11b/g band at 2.4 GHz may be used as approved by SDCRAA for case by case basis, with an understanding the de-installation of a system will be at no cost to the SDCRAA.

c. WLAN equipment should be Wi-Fi Forum certified, using the IEEE 802.11 standard.

d. Wireless LAN must be scalable, secure and highly available and support 99% uptime.

e. Site Surveys must be conducted to establish existing coverage areas within the SDIA.

    i. Additions or expansions to the existing topology will first be documented through a site survey and presented to the SDCRAA for approval to ensure its accuracy.

f. Support for laptop computers, PDAs, pads, tablets, scanners, phones, Radio Frequency Identification (RFID) sensing devices, sensors, medical devices, and other devices that can take advantage of a standards-based wireless network.

g. A wireless network system that supports highly granular, location specific outdoor coverage, applications and content for the unique requirements of convention and visitors' bureaus and event producers that host events at SDIA.

h. All outdoor equipment should be compliant with IP56/NEMA 4 dust and water ingress ratings.

i. The equipment must incorporate protection and resilience against power surges from the electrical grid or from lightning.

j. Equipment shall be designed and mounted in a manner which does not interfere with the operation of existing services

k. Ensure that equipment complies with Federal Communications Commission (FCC) regulations concerning radiation limits (OET Bulletins No. 56 and 65).

27 10 00 STRUCTURED CABLING

27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

General

1. SDCRAA passive infrastructure should be designed in accordance with communication industry codes and standards, including but not limited to Building Industry Consulting Service International (BICSI) Telecommunication Distribution Methods Manual (TDMM), Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA-568 B series, IEEE standards for wired and wireless communications, National Electrical Code (NEC), local building codes, and SDCRAA standards.

2. SDCRAA has two primary groups that are responsible for maintenance and operation of systems and infrastructure, which are:
    a. SDCRAA IT Department (ITD)
    b. SDCRAA Aviation Security and Public Safety Department (AVSEC/PS)

3. The SDCRAA IT Department is involved in the maintenance and operation of all airport special systems, business operational systems, and back office systems. Please refer to Table -1 at the Appendix for a list of systems that are managed by ITD.

4. The SDCRAA AVSEC/PS Department is involved in the maintenance and operation of all security systems. Please refer to Table -2 at the Appendix for a list of systems that are managed by AVSEC/PS.

5. SDCRAA ITD and AVSEC/PS may use SDCRAA Facilities Development Department (FDD) in facilitating and implementing some of the maintenance and construction work.

6. Important room types in the SDCRAA infrastructure:
    a. Main Cross-Connect (MC): MC is a structured cabling system connection point between entrance cables, equipment cables, inter-building backbone cables, and intra-building backbone cables of the core network. It is the centralized portion of the backbone cabling used to mechanically terminate and administer the backbone cabling, providing connectivity between equipment rooms entrance facilities, horizontal cross-connects, and intermediate cross-connects . MC is also referred as a Main Distribution Frame (MDF) or Server Room (SR). MC has one part of which the external trunk cables entering a facility terminate, and on another part

of which the internal user subscriber lines and trunk cabling to any Intermediate Distribution Frames (IDF) terminate. MC may be placed either in the IT segment or in the Security segment of the TR depending on the service area and the systems it support. SDCRAA's MC shall not be placed in the Common Area of the TR. Tenants' MCs shall be place in their respective leased space or any other place as approved by the SDCRAA.

b. Intermediate Distribution Frame (IDF): Intermediate distribution frame is a cable rack for managing and interconnecting the telecommunications cable between end user devices and a MC. Cables entering a building run through a centralized MC, then to each individual IDF and then on to specific active elements and workstations. IDF is also referred as a Telecommunication Room (TR). In addition to voice, data, and wireless systems, TRs can house equipment for life safety/fire systems, and building automation systems. IDF/TR may be placed either in the IT segment or in the Security segment of the TR depending on its service area and the systems it support. SDCRAA IDFs shall not be placed in the Common Area of the TR. Tenants' IDFs shall be place in their respective leased space or any other place as approved by the SDCRAA.

c. Telecommunications Room (TR): TR is a combined shell that houses Security, Information Technology/ Telecommunication, and Common Area systems and equipments in different compartments or segments within the shell. The compartments or segments are separated by a chain-link fence. Each compartment has an outward swing door that is controlled by Access Control System (ACS) for entry. IT/Telecommunication segment of a TR is managed by SDCRAA ITD and the Security segment of a TR is managed by SDCRAA AVSEC/PS. The Common Area segment of a TR is managed either by a tenant, FDD or any other SDCRAA department. A typical TR at SDCRAA is illustrated in the Figure 1 at the Appendix.\

Environment

1. The environment surrounding the location of the TR must be free from sources of electromagnetic interference. Wherever TRs are adjacent to electrical rooms with transformers on the opposite walls, install a 1/4-inch copper meshing within the wall to reflect electromagnetic interference / electromagnetic compatibility.

2. It is highly recommended that the immediate environment surrounding a TR should not contain HVAC equipment such as steam boilers, compressors, chilled/hot water pipes, elevator equipment, electrical co-generation equipment or waste processing.

3. If TR need to be located near dust or contaminant-producing activities then adequate filtering systems must be added and all necessary methods should be taken to make sure the exhaust, dust, or other source of contaminant does not enter the intakes of air handlers servicing the SDCRAA infrastructure. Maintenance schedule for the filtering system is recommended to commence every three months (quarterly), to include filter replacement.

4. It is highly recommended that the TRs need be located away from flying dirt and debris (i.e. airline equipment ramps). If that is not feasible, then the TRs shall have positive pressure in addition to the TRs main entrance equipped with weather proof and dust proof screening/apparatus.

5. It is highly recommended to minimize traffic through TR.

6. For high traffic TRs, it is recommended to have the main entry door area be most highly positive pressurized.

7. It is highly recommended to seal all penetrations between TRs and adjacent areas. Do not share subfloor or ceiling plenums with any other part of the building.

8. It is highly recommended that the location must be above any potential flood zones, including being located below rest rooms and restaurants. If this is not possible then assure all equipment is not located or mounted within the first few inches of the floor. Additionally, there shall be water and fluid sensors installed within such rooms and integrated with the Building Management System (BMS) for monitoring and alarm of possible flooding and water leaks.

9. Where TR's cannot be located away from potential flood zones, floor drains are recommended to be installed in adjacent plumbing chases, and concrete curbs should surround the TR, providing additional protection.

10. TRs need to be accessible from a corridor, stairwell, and/or a service elevator large enough for cabinet and equipment loading and servicing.

11. All TRs are to be designed according to Figure 1 – Typical TR found in the Appendix. This design allows for the separation of common areas, IT areas and security areas. If this separation is not feasible then combine IT and security areas but still keep common areas separate at all times. All SDCRAA UPS systems shall be housed only in the security area of the TR.

Location

1. The location and quantity of telecommunications (TR or IT) rooms shall be designed so that the maximum distance from these rooms to any network field device that the room supports shall not exceed 250 feet via the longest possible route (i.e. right angles) traveled by the cable from the room to the field device. This includes all work area outlets, ACS card readers, cameras, access points, displays, antennas, etc.

2. If the distance from the TR to the furthest network field device exceeds 250 feet via the longest possible route, then another TR shall be installed to accommodate the distant field devices to maintain the 250 foot limitiation.

3. Within a building, if there are two or more TRs per floor, then the distance from one TR to an adjacent TR shall not exceed 500 feet via the longest possible pathway route (i.e. right angles).

4. It is recommended that all the field devices shall be fed from a TR on the same floor where that field device is installed. That is, where feasible, field devices should not be fed from TRs on levels above or below.

5. Where feasible, to maximize coverage of a TR, TRs should be located near the center of the floors that they serve, and there shall be a minimum of at least one TR per floor.

6. If more than one TR is installed within a building, then an MDF shall be identified that shall be larger than the other TRs.

7. SDCRAA TRs or equipment rooms shall not be used by tenants for their equipment unless explicitly approved by the SDCRAA Authorities. In such cases, the Tenant shall perform a detail load survey and testing for power utilization from building main power supply, standby/UPS, and HVAC BTU impact. It is recommended that the Tenants install all their proprietary communications equipment within their leasehold.

8. In a multi-level building, TRs on different floors should stack on top of each other. Straight vertical cable risers should be established for the purpose of cable routing.
9. Buildings with special shapes and sizes shall be considered on an individual basis.

Dimensions

1. Actual TR size shall be determined by the number of racks/cabinets plus space needed to access racks/cabinets plus space needed for UPS, HVAC equipment, FM-200, or other mechanical or electrical equipments with at least minimum 3' working space around as per code, such as BICSI code.

2. The size of a TR that contains active equipments shall never be less that 10'x10' in size although 12'x12' is preferable. Active equipment shall not be installed in a TR that is less than 100 square feet. This minimum dimension allows sufficient space for two equipment cabinets and wall space for terminations.

3. The size of dedicated SDCRAA TRs shall be designed large enough to accommodate all of the planned equipment required for existing and new technology, plus a growth factor of 50 percent. Typically this means a room large enough for between 2 and 4 equipment cabinets that are 28" wide by 36" deep by 84" tall.

4. The size of TRs designed for common use or to share with Federal Agencies shall be designed large enough to accommodate all of the planned equipment required for existing and new technology, plus a growth factor of 100 percent. Typically this means a room large enough for between 4 and 8 equipment cabinets that are 28" wide by 40 " deep by 84" tall. Equipment rooms shall be designed on an individual basis.

5. Sizing TRs according to the number of equipment cabinets installed in a single row configuration is as follows, with 10 feet by 10 feet as the minimum size although 12 feet by 12 feet is preferred:
    i. 2 cabinets = 10' x 10' (100 square feet)
    ii. 3 cabinets = 11' x 10' (110 square feet)
    iii. 4 cabinets = 14' x 10' (140 square feet)
    iv. 5 cabinets = 16' x 10' (160 square feet)
    v. 6 cabinets = 18' x 10' (180 square feet)
    vi. 7 cabinets = 21' x 10' (210 square feet)
    vii. 8 cabinets = 23' x 10' (230 square feet)

6. Sizing TRs according to the number of equipment cabinets installed in a double row configuration is as follows, with 16 feet as the minimum width:
    i. 2 cabinets = 7' x 16' (112 square feet)
    ii. 4 cabinets = 9' x 16' (144 square feet)
    iii. 6 cabinets = 12' x 16' (192 square feet)
    iv. 8 cabinets = 14' x 16' (224 square feet)

7. Where shallow closets are required for passive equipment, the closet dimension shall not be less than 8’ long x 30” deep. (20 square feet)

8. Where small walk-in closets are required for passive equipment, the dimension shall not be less than either 4’ x 6’ (24 square feet) or 5’ x 5’ (25 square feet).

Construction

1. General TRs within buildings may be constructed with materials similar to the surrounding architecture.

2. TR’s located adjacent to large electrical rooms housing EMI emitting equipment, shall be lined with proper materials to prevent EMI interference in data transmissions

Ceiling

1. Drop or false ceilings are not permitted.

2. Minimum ceiling height is ten (10’) feet; preferred ceiling height is twelve (12’) feet.

Floor

1. Floor must meet Class Zero Electrostatic Discharge (ESD), ANSI/ESD S20.20-2007, and DoD 4145.26-M standards, and any newer ESD standards that may apply to flooring at the time of installation.

2. Floor must not contribute to static generation.

3. Floor must be groundable after it is installed.

4. Floor should be covered with static resistant materials and its static resistant properties should be permanent regardless of temperature, humidity, maintenance or traffic.

5. Floor loading for general TRs shall be designed to support a minimum dead load 100 lbf/ft^2
6. Floor loading for large TRs or SR’s, shall be designed to support a minimum dead load 250 lbf/ft^2

7. Raised access floors are not recommended.

Seismic Bracing (Required)

1. The Installer shall provide seismic (Zone 4) restraint of the conduit support system and all other equipment, based upon the California Code of Regulations, Part 2, Title 24 and all other applicable codes.

Walls

1. Exterior wall should not be one of the walls for TRs. If this is not feasible, then place barriers on the outside of the wall to slow down vehicles that might try to smash through. The barriers must be connected to SDCRAA's peripheral monitoring system.

2. Walls without plywood shall be painted white in a semi-gloss finish.

3. Walls with plywood shall be covered with 3/4 inch x 4 ft x 8 ft, AC-grade, fire-retardant treated plywood, with the Fire Retardant-Stamp on it.

4. The "C" side shall face the studs (attached on top of finished walls) so that the "fire retardant" stamp is visible on the "A" side.

5. Plywood shall be painted with two coats of white, fire-retardant, low VOC paint leaving the Fire Retardant-Stamp(s) exposed for inspectors.

6. Cutouts for electrical switches and outlets shall be provided.

7. Plywood shall be fastened with #12 flat-head sheet metal screws to metal studs, every 16 inches to 24 inches on center depending upon stud spacing.

8. Plywood shall not be fastened with a nail gun or explosive-charge device.

Doors

1. Minimum door size is 36 inches wide x 80 inches tall.

2. Door should swing outward if local building codes allow.

3. All doors shall utilize ACS card reader access.

4. Depending on the type of room, the door may also be connected to biometric reader for entry.

5. All TR doors shall be keyed to Schlage “FG” Keyway - ANSI 156., Grade 1, 7 pin type (to match existing airport system) or approved equal locks to allow opening from the outside, and shall have a mechanism to manually enable and disable the key lock.

6. The use of magnetic locks is the preferred standard at SCDRAA.

7. All doors shall have “request-to-exit” and “panic exit” apparatus attached.

8. Door signage will need to comply with the SCDRAA’s practices and shall be indicated by room number and access control code only.

9. All locked doors in the path of egress to be unlocked whenever an event, such as fire alarm pull station activation, has occurred per Uniform Building Code (UBC) and the International Building Code (IBC). Emergency egress should not be in the TR, except for space egress.

10. Proper mechanism, methods, and apparatus shall be used to avoid use of fire alarm activation as a diversion to gain access to restricted areas.

Windows

1. TRs shall not have any windows.

Power

1. All TRs serving active equipment shall have dedicated electrical panels located within the TRs. Must maintain a three foot clearance in front of electrical panels.

2. Electrical panels serving active equipment shall be separate from those serving lighting. Lighting panels should not be located within TR’s.

3. The panels shall be grounded with a proper mechanism such as independent isolated ground to avoid ground loop.

4. Power requirements for rooms shall be calculated on an individual basis.

5. At minimum, AVSEC/IP’s MDFs in TR shall have four (4) racks and six (6) wall-mount panels and IDFs shall have two (2) racks and four (4) wall-mount panels.

6. At minimum, ITD’s MDFs in TR shall have four (4) racks and six (6) wall-mount panels and IDFs shall have two (2) racks and four (4) wall-mount panels.

7. Except for special circuits, all panels shall be fully populated with 30 amp circuit breakers. It is recommended that power panels not be populated more than 80%.

8. Except for special power requirements, each individual equipment cabinet or equipment rack shall have two separate 120 VAC, 30 amp circuits feeding them. All outlets shall be isolated ground outlets double-duplex.

9. On walls with backboards, there shall be 120 VAC, 30 amp, non-switched, fourplex wall outlets installed every six (6) feet.

10. Systems such as chargers for electric ground service equipment and 400-hz aircraft ground power units should be isolated and fed from dedicated switchboards.

Standby Power

1. Standby power should support the availability and integrity of SDCRAA operations, security, communications, tenant operations, emergency egress systems, HVAC, and other systems as deemed necessary by SDCRAA.

2. Standby power should support low voltage devices, battery-driven remote and stand-alone devices, standard 110/220 voltage, and high amperage / high voltage systems such as explosive detection systems, and HVAC systems.

3. If feasible, all electrical panels, with the exception of lighting panels, in TR's shall be connected to a panel that is fed from a UPS system that is connected to the Emergency generator for the building. The panels that are connected to the UPS shall be labeled as being connected to emergency power. All UPS shall have the Standby Power Supply feed as fall-back feed.

4. Generator and UPS installations shall be sized for the load they are expected to serve, plus fifty (50) percent. Generator power must be sustainable for a minimum duration of four (4) hours. In the event of an outage lasting longer than four hours, additional fuel will be required.

5. Automatic Transfer System (ATS) shall be used to achieve automatic shift to the emergency/standby power source. It is recommended the flip over/uptime from main-2-UPS/standby to have zero down time to avoid potential critical operational failure or security breach.

6. If any system is operated or has backup power from battery then battery packs should be tested on a monthly basis. Design considerations should be made to allow for bypass to be installed, enabling battery testing to commence with no interruption in service.

7. UPS's shall have an RS-232 communications port and a 10/100 Base-T Ethernet NIC for LAN management to allow for remote monitoring.

Lighting

1. Lighting shall provide a minimum of 50 foot candles measured at three foot three inches (3' 3") above the finished floor. The Lighting shall be positioned at the center of the racks for adequate for front and back of the rack.

2. The required egress lighting level is one foot candle (fc) in the path of egress when exiting TR's.

3. An emergency light fixture shall be mounted over all TR exit doors.

4. Fluorescent fixtures shall use "cool white" lamps.

5. Dimmer switches shall not be used.

6. Light fixtures shall be centered in the aisles between racks or cabinets and mounted at a minimum of 8'6" above the finished floor.

7. It is recommended that the Light fixtures shall be installed at the minimum distance of twelve inches (12'') from upper most cable tray. The distance will be determined by cabinet height plus tray design height plus twelve inches (12'') clearance.

Air Conditioning

1. Shall be provisioned for 24 hour 365 day, continuous service.

2. For general TRs, 10,000 BTU's of heat dissipation per cabinet shall be used as a minimum for planning purposes with a set of redundant air conditioning units. HVAC designer shall coordinate actual HVAC requirements with SDCRAA ITD.

3. For large TRs or SR's, 20,000 BTU's of heat dissipation per cabinet shall be used as a minimum for planning purposes with a set of redundant air conditioning units. HVAC designer shall coordinate actual HVAC requirements with SDCRAA ITD.

4. All TRs that house active equipment shall avoid hot spots and have inlet air temperatures from 55°F to 62°F.

5. All TRs, if feasible, shall have the inlet air circulating from the top to the front of the racks to allow the hot air exhaust to leave equipment through the back side of the rack. Note: It is recommended that the racks in Security and IT area of TRs be front facing to each other to accommodate optimal cool air inlet circulation.

    a. Use of a cold isle / hot isle layout is recommended.

6. It is recommended that all high density rooms have a mechanism to capture hot air for the purpose of energy efficiency, sustainability, and carbon footprint.

7. Inside temperature shall be maintained between 68 °F to 72 °F, and between 30% - 55% relative humidity.

8. A thermostat shall be provided within the TR. Room over-temperature and cooling unit failure shall be alarmed at the Network Operations Center , Security Operations Center, Facilities Management Office, and the Central Utility Plant (CUP).

9. All TR doors shall be sealed for dust-proofing, have positive ventilation, and all ventilation ducts into the room shall be filtered for dust abatement purposes.

10. Air conditioning is not required in TR's that do not contain active equipment as long as the temperature can be maintained between 50°F and 95°F with properly sized exhaust fans.

Fire-Life Safety

1. Smoke detectors are required and shall be installed per NFPA and local code requirements.

2. At a minimum a FM200 Clean Agent Fire Suppression System shall be installed for all TRs.

3. It is recommended to have an early warning fire detection system that is integrated to the Building Automation System (BAS) to report alarms, pre-alarms, and discharges. The early warning fire detection system should have the following features:

    a. It should be a heat detection type

b. It should be installed and maintained in accordance with NEP 72E, Standard on Automatic Fire Detectors.

c. Each installation should be engineered for the specific area it will protect, allowing for air current patterns.

d. Systems are required to have special exhaust ventilation providing dispersion of clean agent. These exhaust vents should be designed to not allow any reentry of dust or loss of thermal energy.

4. Fire-Life Safety system and security system shall be integrated.

5. It is recommended to have a manual pull station to have a manual activation of the fire suppression system.

6. It is additionally recommended to have a push button manual override.

7. Means of communication such as intercom or telephone apparatus with direct-line connected to the Network Operations Center and Security Operations Center shall be provided. The communication apparatus shall be situated adjust to the door and marked for emergency use.

8. Provision for emergency exiting of room shall be made available and clearly marked as emergency exit pathway. Doors shall swing outward.

Plumbing

1. Except fire sprinklers required by code, no pipes intended to carry water or any other fluid shall be installed in or above the TR ceiling.

2. If avoiding water pipes, drains, or any pipes carrying liquids within a TR is not feasible, then some or all of precautions below must be followed:
   a. Troughs to channel water out of the TR should be installed underneath pipes. These troughs should have the same or greater flow rate as the pipes themselves.

   b. It is possible to have a pipe within a pipe. If the interior pipe develops a leak, the water would be contained in the outer pipe.

   c. Water detection sensors should be placed along the runs of the pipes and at plumbing joints where most leaks are likely to start.

Security

1. Entry ACS card readers shall be provided for all TR doors.

2. A “request-to-exit” and “panic exit” button shall be provided for doors using crash bar technology to shunt the alarm on exit.

3. All TRs shall have cameras mounted on the outside of the room unless waived (approved) by AVSEC and Public Safety Department.

4. TR doors may also be connected to biometric reader for entry and exit as approved and required by AVSEC/PS.

5. Some rooms may have intercoms that connect back to the network operations center and security operations center.

Clearances

1. Electrical panels require a clearance of 36 inches in front and 30 inches to the side or as required by code. Equipment cabinets, UPS, and HVAC systems require a 36 inch working space clearance, front and back.

2. Equipment racks and cabinets require a 36” aisle space in front and behind each cabinet.

UPS Locations

1. It is recommended that UPS’s servicing TR and SR’s not be located within the TR or SR, to alleviate foot traffic from maintenance personnel.

2. When locating the UPS’s outside of a TR or SR cannot be avoided, the UPS shall be located in Security area unless otherwise authorized by the SDCRAA ITD and AVSEC/PS.

3. Depending on the type of batteries used in a UPS, exhaust fans maybe a requirement. Compensation for exhaust volume must be included in the HVAC design to maintain the positive pressure for Foreign Object Debris (FOD) rejection to the room.

Connectivity

1. All GenSet, UPS, HVAC units should have proper conduits to support Ethernet connectivity for Building Management System (BMS) and security operations center for control and monitoring.

27 11 13 COMMUNICATIONS ENTRANCE PROTECTION

1. Where copper cable pairs are placed underground and between buildings, electrical protection from lightning for every pair with Solid State type protectors at both ends, is required.
2. Furnish and install the appropriate amount of Multipair Protector Panels with 110 Connector System and all related components.

3. Install all equipment in accordance with manufacturer's specifications.

4. Route and terminate the copper feed cables inside the telecommunication space in accordance with manufacturer's requirements.

5. All directional changes with these cables shall be made with gradual sweeps to maintain a proper bend radius. All such cables shall be uniformly bundled and secured every 9 inches, utilizing black Velcro cable ties.

6. Bundle voice feed cables independent of other cables.

27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

Frame

1. Provide freestanding equipment cabinets to store computer, data storage, networking and security equipment in the data centers, computer rooms and equipment rooms. Each cabinet enclosure shall have a rectangular frame and removable top panel, side panels and doors. Installed cabinets shall include thermal, power, and cable management accessories that control airflow through the cabinet and keep network and power cables separate and organized.

2. The cabinet frame shall be rectangular with four corner posts, manufactured from steel with welded and bolted frame construction. The front and are rear of the cabinet shall be welded rectangular frames. The sides of the cabinet shall have three steel supports located near the top, middle and bottom to allow attachment of equipment mounting rails and thermal, cable and power management accessories. The side supports shall be bolted to the front and rear frames.

3. The cabinet frame shall include leveling feet and casters. The cabinet frame shall support 3000 lb (1360 kg) of equipment when supported on leveling feet and secured to the structural floor. The cabinet frame shall support 2250 lb (1020 kg) of equipment when moved or supported on casters.

4. Each cabinet shall include two pairs of equipment mounting rails. Mounting rails shall clamp to the side supports located near the top, middle and bottom of the frame and shall be fully adjustable in depth to provide front and rear support for equipment. Equipment Mounting Rails shall be spaced horizontally to support 19" (482.6 mm) wide EIA/ECA-310-E compliant rack-mount equipment and shall provide up to 38" (965 mm) of rail-to-rail depth for equipment. Mounting rails shall be square-punched according to the EIA/ECA-310-E Universal hole pattern with equipment mounting holes on alternating 5/8" – 5/8" – 1/2" (15.9 mm – 15.9 mm – 12.7 mm) vertical hole centers. Square-punched holes shall accept cage nut hardware with various threads. Rack mount spaces or units (U) shall be 1-3/4" (44.45 mm) high and shall be marked and numbered on the mounting rails. Numbering shall start at the bottom of the rail. Mounting rails shall provide 42U for equipment.

5. The cabinet shall be 79.3" (2013 mm) high by 23.6" (600 mm) wide by 39.4" (1000 mm) deep when casters, doors and side panels are installed.

6. The cabinet shall include a solid top panel with four multi-sized cable knockouts/ports, one in each corner. Each multi-size knockout consists of one round 2.8" (71 mm) diameter grommet-protected cable access port and one round 2.8" (71 mm) diameter knockout captive within a larger 4.5"W x 9.0"D (114 mm x 228 mm) rectangular knockout. The top panel shall feature tool-less removal and will be pre-punched at the front and rear with attachment points for parallel (side-to-side) installation of 12"W (300 mm) cable runway. The manufacture will sell covers for the knockouts and attachment hardware for the cable runway as separate accessories.

7. The cabinet shall include a single curved perforated metal front door with quick-release hinge pins. The primary door panel shall be constructed using a single perforated sheet (63% open) with a solid outer perimeter. The primary door panel shall be embossed with a 4.6" (117 mm) diameter concave feature along the entire vertical height and include a protruding logo badge. The door assembly shall include upper and lower metal caps that follow the curved contour of the primary door panel. The door shall be removable and reversible to open from the right or left. The front door shall have a swing handle with a single-point cam latch and a keyed lock.

8. The cabinet shall include two half-height, solid side panels. Each side panel shall have a keyed latch located at the top center of the panel for easy installation and removal.

    a. Adjacent cabinets containing like equipment do not require separate side panels; only side panels on the ends.

    b. Adjacent cabinets containing unlike equipment (i.e. security and LAN), must be physically separated with side panels.

9. The cabinet shall include a double (vertically split) perforated metal rear door with quick-release hinge pins. Each door panel shall be constructed using a single perforated sheet (63% open) with a solid outer perimeter. The doors shall be removable. The double rear door shall have a swing handle with a two-point latch and a keyed lock.

10. The cabinet frame, top panel, side panels and doors shall be manufactured from steel. The front and rear of the cabinet shall be welded rectangular frames. The front and rear cabinet frames, mounting rail supports, mounting rails, doors and side panels shall assemble with hardware.

11. The mounting rails, top panel, side panels and doors shall be electrically bonded to the cabinet frame. The cabinet frame shall have a prepared location for attaching a grounding lug.

12. The mounting rails, top panel, side panels and doors shall be electrically bonded to the cabinet frame. The cabinet frame shall have a prepared location for attaching a grounding lug.

13. The cabinet shall include PDU mounting brackets. The brackets shall be L-shaped, shall attach to the rear right or left corner of the cabinet frame and shall include tool-less mounting points for two vertical rack-mount power distribution units (PDUs) or power strips. The brackets will orient the PDUs/power strips so that the outlets on the PDUs/power strips face the center of the cabinet frame.

    a. Each cabinet shall be powered by two 120 VAC, 30 amp, circuit breakers.

    b. Each cabinet shall have a full-length, 12 outlet, power strip installed.

14. The cabinet shall be UL Listed as an Information Technology and Communications Equipment Cabinet, Enclosure and Rack System to standard UL 60950 under category NWIN. UL Listing will be stated in the manufacturer's product literature.

15. The cabinet frame, top panel, side panels, mounting rails and doors shall be painted a light color with epoxy-polyester hybrid powder coat paint, to aid in obtaining additional points for LEED certification.

16. The cabinet shall include (4) casters, (4) leveling feet, (4) floor attachment brackets and a baying kit. The manufacturer of the cabinet shall sell compatible equipment mounting hardware as an accessory.

Cable Management

1. Each installed cabinet shall be equipped with a vertical cable manager to organize network cables. The vertical cable manager shall attach to the side of the equipment mounting rail in the cabinet. The vertical cable manager shall have cable openings along the side that align with each rack-mount unit (U) space on the mounting rail. The openings shall be sized to allow 24 patch cords to enter each rack-mount unit (U) space. The cable openings shall be separated by plastic T-shaped cable guides to route cables into each space.

2. Each installed cabinet shall be equipped with a rack-mount horizontal cable manager to organize cables in the rack-mount unit spaces above and below each patch panel or network switch within the cabinet. The horizontal cable manager shall be 19” EIA rack-mount and 1U, 2U or 3U high. The horizontal cable manager shall be a single-sided U-shaped trough with a front-facing snap on cover. Plastic T-shaped cable guides along the top and bottom edge of the cable manager shall divide cable openings that allow cables to exit or enter the top or bottom of the manager. The cable manager shall be made of plastic, at least 5.9” (150 mm) deep and shall be sized to hold 24 patch cords per rack-mount unit (U) space.

    a. Cables that are to be secured and neatly bundled shall use Velcro.

    b. Tie wraps are not permitted.

3. Each installed cabinet shall be equipped with plastic snap-in grommets to protect cables that pass through openings in the equipment mounting rails. The grommet shall be plastic, 5.5” (140 mm) high x 3.25” (83 mm) wide, and designed to snap into the large rectangular cable openings in the equipment mounting rails in 29.5” (700 mm) wide and 31.5” (800 mm) wide cabinets. The grommet will cover the exposed metal edge of the opening in the equipment mounting rail.

Power Distribution

1. Each installed cabinet shall be equipped with a vertical PDU and power cord manager to store PDUs and power cord slack. The vertical power manager shall be C-shaped, shall attach to the side of the cabinet frame and shall include tool-less mounting points for two vertical rack-mount power distribution units (PDUs) or power strips. Tool-less mounting points will be spaced vertically 64.75” (1645 mm) apart. The bracket will support two 2.4” (61 mm) wide or narrower PDUs side-by-side or one 4.9” (124 mm) wide PDU. The bracket shall orient PDUs so that the outlets on the PDUs/power strips face the center of the cabinet frame.

Thermal Management

1. Each installed cabinet shall be equipped with an internal airflow baffle to block airflow around the sides of equipment in the cabinet. The airflow baffle shall seal the space at the front of the cabinet between the equipment mounting rails and the sides of the cabinet enclosure.

2. Each installed cabinet shall be equipped with plastic snap-in grommets with covers to block airflow through the cable pass through openings in the equipment mounting rails. The grommet shall be plastic, 5.5” (140 mm) high x 3.25” (83 mm) wide with a removable cover, and designed to snap into the large rectangular cable openings in the equipment mounting rails in 29.5” (700 mm) wide and 31.5” (800 mm) cabinets.

3. Each installed cabinet shall be equipped with covers to seal any cable opening in the top panel. The top panel includes several pre-punched round and rectangular cable knockouts. If a knockout is removed, the opening must be sealed with a cover (grommet) that protects cables as they pass through the top panel and seals open spaces between cables. Use a solid 2.8” (71 mm) diameter round thermoplastic elastomeric grommet that can be cut to match cable requirements on round openings. Use a rectangular plastic cover that has a 3.9” (99 mm) wide x 8.8” (224 mm) deep brush sealed cable opening in the center for cables and a split design (two-halves) that allows the grommet to be removed after cables are passed through the grommet opening on rectangular openings.

4. Each installed cabinet shall be equipped with filler (blanking) panels that seal any open rack-mount unit space (spaces not occupied by other equipment). The filler (blanking) panels shall be made of plastic and shall be designed to attach to square-punched equipment mounting rails without hardware, at the rear of the cabinet to prevent exhaust air being re-introduced to the cabinet. The filler (blanking) panel design shall allow the panels to be installed and removed from the equipment mounting rails without tools. Panels shall be sized to fit 1U x 19”EIA and 2U x 19”EIA rack-mount panel spaces.

5. Each installed cabinet shall include a fan top panel kit to help remove hot air from the cabinet. The fan top panel kit shall include four 100 CFM (170 CMH) fans in two housings attached to a solid cabinet top panel with vented center section and cable knockouts in each corner. Fans will be rated for 115 VAC, 50-60 Hz. The fan kit shall include a single detachable 15' (5 m) long power cord with dual IEC 60320 C13 power connectors (1 per fan housing) and a NEMA L5-15P plug.

6. Each installed cabinet shall be equipped with a bottom panel to block airflow through the bottom of the cabinet. The panel will have 8.8" (228 mm) wide x 3.9" (99 mm) deep brush-sealed cable access port located near the rear edge of the panel.

Cabinet Mounting Hardware

1. Provide additional equipment mounting hardware to attach equipment to the equipment mounting rails in the cabinet.

2. Provide hardware for attaching ladder rack (cable runway) to the top of the cabinet. The hardware shall attach the ladder rack in parallel (side-to-side) orientation and will elevate the ladder rack a minimum of 2" (50 mm) above the cabinet.

3. Cabinets to be mounted using a minimum of (4) 3/8" or M10 anchors and associated hardware for securing the cabinet to the structural floor.

Racks

1. Equipment racks shall be 19 inches.

2. Each rack shall be powered by two 120 VAC, 30 amp, circuit breakers.

3. Each rack shall have a full-length, 12 outlet, power strip installed.

Rack Mounting Hardware

1. Provide additional equipment mounting hardware to attach equipment to the equipment mounting rails in the cabinet.

2. Provide hardware for attaching ladder rack (cable runway) to the top of the rack.

3. Racks to be mounted and secured to align with Zone 4 seismic bracing standards.

4. Racks to be mounted using a minimum of (4) 3/8" or M10 anchors and associated hardware for securing the rack to the structural floor.

Wall Mounting

1. If cabinets or racks are not provided, wall mounting is acceptable provided that the equipment is small and the installation can be done securely to the plywood backboard. This requires Engineer approval.

Hardware

1. All fastening hardware used outdoors shall be stainless steel grade 18-8 or better.

27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

Patch Panels

1. *Wall-mount*: All fibers shall be terminated with standard SC connectors in fiber patch panels. Terminations of all fiber optic cables shall conform to EIA/TIA-568SC standard.
2. *Rack-mount:* All fibers shall be terminated with standard SC connectors in fiber patch panels. Terminations of all fiber optic cables shall conform to EIA/TIA 568SC standards.

3. All CAT6 Data UTP cables shall be terminated on CAT6 RJ45 (or manufacturer specified) patch panels inside the equipment rack.

4. All UTP cable termination shall conform to EIA/TIA-568B standards. Wire-minders shall also be installed for cable management.

27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

1. The Installer shall install two (2) 72 inch, 12-receptacle, 110VAC, 30A, power strip with a 6 foot power cord on either side, at the rear of the cabinet.

2. Power strip shall be capable of being mounted within three inches of the rear of the cabinet.

27 13 13 COMMUNICATIONS COPPER BACKBONE CABLING

1. Voice Backbone
    a. If Voice Over Internet Protocol (VOIP) is specified then verify design criteria involving any copper cabling.

    b. Install sufficient pairs of UTP from the Main Cross Connect room (MC) or MDF, to all other TRs, to cover current and future needs of telephone wires and data circuits for the area served by that particular TR.

    c. Sufficient telephone wire-pairs from telecommunications service provider shall also be brought into the MPOE of the building to cover current and future needs of telephone wires and data circuits for the building.

    d. Pair count requirements per TR will be determined on a case-by-case basis.

2. Data Backbone
    a. Copper cable is **NOT** used as network backbone cable at SDCRAA

3. Speaker Cable
    a. Recommended to use 12 AWG, unshielded, twisted pair

4. Coaxial
    a. Cable TV (CATV) - The cable used depends upon the length of the run.

    b. Analog Closed Circuit TV (CCTV)

    c. The cable used depends upon the length of the run. If the total length of any coaxial run is less than 800 feet, then RG-6 or approved equal shall be installed.

    d. If the total length of any coaxial run is between 800 feet and 1500 feet, then RG-11/U or approved equal shall be installed.

    e. Video CCTV runs greater than 1500 feet must use fiber optics and need SDCRAA ITD authorization before deployment.

27 13 13.13 COMMUNICATIONS COPPER CABLING SPLICING AND TERMINATIONS

1. Backbone terminations shall be available in no less than100 pair increments and terminated on a minimum of one 300-pair tower.
    a. Use of horizontal cross-connect fields are recommended and encouraged.
    b. Horizontal cross-connects shall be placed between each 300-pair tower as applicable.

2. Terminations shall match the existing 110 termination blocks currently at SDIA.

3. Splice cases shall be water tight and re-enterable. Secure all cables in the splice case and end plates in accordance with manufacturer's specifications, ensuring a watertight seal.

4. Exercise special care when assembling the case as to not damage any conductors and/or splice modules. Splicing technicians must have a manufacturer’s installation certification for the splices and splice cases being installed.

5. Splice modules should contain encapsulate to prevent water damage in the event the case is damaged and water enters the case.

6. The splice enclosure must not be flooded with encapsulate.

7. Perform a pressure test each case for leaks at 12 psi, ensuring a watertight seal.

8. Bond the cable's metallic sheath/shield (if armored) to the metallic splice case with the bonding bar assembly provided with the splice case, and in accordance with manufacturers specifications.

9. Connect the splice case to the manhole/building grounding grid using a #6 AWG solid copper wire or bonding tape.

27 13 23 COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

1. Outdoor Backbone Cable
    a. A minimum of 72 strand single mode fiber, 48 strand multi-mode fiber cables are required for inter-building connections

    b. Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm.

c. Each buffer tube shall contain up to 12 fibers.

d. Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding."

e. The fibers shall not adhere to the inside of the buffer tube.

f. Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding."

g. For gel-filled constructions each buffer tube shall be filled with either a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents. For gel-free construction each buffer tube shall contain a water-swellable yarn for water blocking protection. The water-swellable yarn shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This yarn will preclude the need for other water blocking material; the buffer tube shall be gel-free.

h. The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrink back requirements of 7 CFR 1755.900.

i. A filler may be included in the cable core to lend symmetry to the cable cross-section where needed. The fillers shall be nominally 3.0 mm in outer diameter.

j. The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod. The purpose of the central member is to provide tensile strength and prevent buckling. The central member shall be over coated with a thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

k. The buffer tubes shall be stranded together with the dielectric central member and a water blocking yarn using the reverse oscillation, or "S-Z," stranding process.

l. Two polyester yarn binders shall be applied contrahelically and with sufficient tension to secure each buffer tube to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.

m. A water blocking tape shall be applied longitudinally around the outside of the cable core. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, and electrically non-conductive. It shall also be free from dirt and foreign matter.

n. Tensile strength shall be provided by the central member, and dielectric yarns. Dielectric strength yarns shall be applied around the outside of the cable core.

o. Cables shall contain at least one ripcord under the outer sheath to facilitate its removal.

p. Non-armored cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

q. The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C and Grades J4, E7 and E8.

r. Cable jackets shall be continuous, free from pinholes, splits, blisters, or other imperfections. They shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand the stresses expected during normal installation and service.

s. Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code (NESC), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white; with the exception that cable jackets containing one or more coextruded white stripes shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

t. The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

u. Non-armored cables shall be all-dielectric.

v. The storage temperature range for the cable on the original shipping reel shall be -40 °C to +70 °C. The installation temperature range for the cable shall be -30 °C to + 70 °C. The operating temperature range for the cable shall be -40 °C to + 70 °C.

w. Fibers Optic cables shall have a fifty foot service loop coiled at each end and in each manhole, as applicable. These cables shall be dressed neatly and secured to the inside walls of the manholes utilizing a cable management system within the vault (i.e. racking) or fastened neatly and securely to ladder racking within TR's.

x. 50 foot service loops to be provided within each manhole and 25 foot service loops to be provided in each handhole. Service loops to be coiled neatly and secured to racking within the manhole or handhole.

2. Indoor Backbone Cable
   a. 72 single-mode fibers and 48 multi-mode fibers are the minimum count permitted for backbone fibers between TRs within the passenger terminals.

   b. Fibers optic cables that are run indoors shall have twenty-five (25) feet of cable coiled up at each end of the run. These cables shall be dressed neatly and secured to the inside walls of junction boxes or atop cable raceway or cable runway systems with TR's or SR's.

27 13 23.13 COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS

1. Fiber Optic Connectors and Pigtails
    a. Pre-polished connectors (preferred) or connectorized pigtails are fusion spliced to the cable. Connectors shall not be installed and polished in the field.

    b. Single-mode, 2 meter length, ultra PC polish, SC connector, fusion spliced, heat shrink protected on the splice.

    c. Multi-mode, 2 meter length, regular polish, SC connector, fusion spliced, heat shrink protected on the splice.

2. Fiber Optic Adapters
    a. Fiber optic adapters shall be color coded to differentiate between single-mode and multi-mode fibers. Blue-colored adapters shall be used for single-mode angled-polished connections, and Beige-colored adapters for multi-mode connections.

3. Fusion-splice Protection Sleeves
    a. The Installer shall protect all fusion splices with rod-reinforced heat-shrink protective sleeves.

4. Splice Trays
    a. The Installer shall use metallic splice trays that contain 24 splices with foam combs and pads for fiber strain relief.

    b. Trays shall be stackable, contain a plastic polycarbonate protective cover, and have a hole in the center for vertical and horizontal mounting.

5. Splice cases shall be water tight and re-enterable. Secure all cables in the splice case and end plates in accordance with manufacturer's specifications, ensuring a watertight seal.

6. Exercise special care when assembling the case as to not damage any conductors and/or splice modules. Splicing technicians must have a manufacturer’s installation certification for the splices and splice cases being installed.

7. The splice enclosure shall not be flooded with encapsulate.

8. Perform a pressure test each case for leaks at 12 psi, ensuring a watertight seal.

9. Bond the cable's metallic sheath/shield (if armored) to the metallic splice case with the bonding bar assembly provided with the splice case, and in accordance with manufacturers specifications.
10. Connect the splice case to the manhole/building grounding grid using a #6 AWG solid copper wire or bonding tape.

27 15 13 COMMUNICATIONS COPPER HORIZONTAL CABLING

1. Sufficient CAT6, 4-pair 24 awg. UTP shall be installed as a universal structured cable for the structured cable plant at each building.

2. CAT6 cables shall be used as a universal cable for all TELECOMMUNICATIONS needs, including telephone, data, fax, video, audio, etc. CAT6, 4-pair, UTP cables shall be installed at all conceivable required locations and for future expansion needs.

3. Each location shall be installed with a minimum of two, CAT6, UTP cables.

4. Termination of the CAT6 UTP cables shall be on 8-position CAT6 RJ45 jacks on a six port single-gang faceplate. All terminations of CAT-6 UTP cables shall conform to ANSI/EIA/TIA 568B.

27 15 23 COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING

Installation Requirements

1. 6 (six) single-mode fibers and 2 (two) multi-mode fibers are the minimum count permitted for horizontal fibers between TRs and field devices such as work area outlets and surveillance cameras.

2. The Installer shall procure and install all new with **NO** refurbished materials.

3. SDCRAA has the right to observe and verify all tests. The Installer shall notify the Engineer one week prior to testing so that testing can be observed.

4. Before installation, while the fiber optic cable is still on the reel, the Installer shall test each individual fiber strand with an OTDR for transmission anomalies and length. Single-mode fiber shall be tested at 1310 nm, and multi-mode fiber shall be tested at 850 nm.

5. Pre-installation test results shall be recorded and given to the Engineer in electronic form with the software to view the test results if necessary. These results shall be given to the Engineer prior to installation. There shall be no deviation from these initial test procedures.

6. Failures detected during the testing shall be recorded. Rectification of all damaged cable(s) shall include replacing damaged cable(s) with new cables with no additional cost to the contract. All damaged cables shall be removed from the project site.

Installation

1. During installation, the minimum bending radius shall be 20 times the cable diameter. After installation the minimum bending radius shall be 10 times the cable diameter.

2. If fiber optic cable is damaged during installation, movement or storage, the Installer shall replace the cable at the Installer's expense.

3. There shall be **NO** repairs to damaged cable. Damaged cable shall be removed from the site and replaced with a new cable.

4. Except for fusion-spliced connectors or factory-connectorized, pre-terminated pigtails, the Installer shall not use fusion splicing or mechanical splicing to repair any damage to any part of the cable prior-to, during, or after installation.

5. Damage includes but is not limited to; breaks in the fiber opens, abrading the cable jacket to expose the fibers or conductors, bending the cable more than the manufacturer's specification for bend radius and exceeding the manufacturer's tensile load installation specification.

6. All installed lengths of fiber shall be brand new and continuous. The Installer shall not fusion splice two short pieces of cable to make a longer piece, unless providing distribution from a high count cable to lower count cables.

7. Fibers optic cables that are run underground shall have 50 (fifty) feet of cable coiled up in every other manhole along the run. These cables shall be dressed neatly and secured to the inside walls of the manhole.

8. Fibers optic cables that are run underground shall have three labels attached. One label shall be attached on the spare coiled-up fiber or in the center between the entrance and exit of the manhole. One label shall be attached within twelve inches of the entrance and one label within twelve inches of the exit of the conduits in the manhole.

Terminating

1. The Installer shall only fusion-splice connectors or pigtails that have been polished by the manufacturer. The Installer shall not install or polish fiber optic connectors, either in the field or in his shop.

2. Both Single Mode and Multimode connectors shall be SC type connectors.

3. Fiber optic cable used in the assembly of the pigtails shall have similar optical characteristics as the installed fiber optic backbone cable.

4. Mechanical splices are not permitted.

5. Splices shall be protected with reinforced sleeves and installed in a specified splice tray.

6. All fiber must be terminated and labeled.

Cleaning

1. All connectors installed or accessed for testing shall be cleaned and then examined under a microscope to assure no contamination. Cleaning of optical connectors shall be accomplished only with the highest grade optical tools and supplies.

2. All connectors shall have a smooth, polished, scratch free finish. Optical fiber end face shall not show any signs of cracks or pistoning on optical endface surface at 200X magnification.

3. Minor chipping of the glass around the outside of the cladding is acceptable, but not to exceed 15% (fifteen percent) of end face surface, and positioned at edge of optical end face to ceramic connector. No defects in optical transmission area (core) are acceptable.

Connector Replacement

1. Any connector damaged or improperly installed shall be removed and replaced with a new connector. Damaged conditions will be determined by the Engineer and the Engineer shall make final decisions on the replacement of questionably damaged connectors.

Testing

1. The Installer shall ensure that all employees and sub-installers testing optical fiber comply with safety standards because some light sources used in testing and operating fiber optic cable assemblies may cause permanent eye damage.

2. Protection from eye exposure to light sources shall be in accordance with the American National Standard for the Safe Use of Lasers; and the Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources.

   Codes/Standards Reference
   ANSI Z136.1, Z136.2

Installation Equipment Requirements

1. Tooling and equipment used in the termination of fiber optics shall not impart damage to the optical fiber or to any part of the termination.

2. Equipment shall be appropriately stored and adequately protected when not in use. Equipment shall be verified or recalibrated at established intervals to assure compliance and precision.

3. The Installer shall select tools and equipment used in fiber optic termination and cabling operations appropriate to their intended function, and shall clean and properly maintain equipment and tooling being used on installation.

4. Pulling lubricant shall be used on all fiber optic cable pulls.

5. All test equipment shall be calibrated by a certified laboratory, or the manufacturer, within one year of point of use, and such certification shall be submitted to the Engineer prior to testing.

6. Tools requiring calibration shall have records that contain as a minimum:
   a. Date of calibration
   b. Calibration due date
   c. Identification of the organization performing the calibration

7. Calibration shall be traceable to the National Institute of Standards and Technology (NIST). Calibration intervals shall be based on the type of tool and records of the tool calibration. Intervals may be lengthened or shortened on the basis of stability demonstrated over previous calibration periods.

8. If the Installer requests deviation from this equipment list, the burden of proof shall be upon the Installer to demonstrate that any proposed substitute equipment meets or exceeds the specified parameters.

9. All fiber must be terminated and labeled.

Safety

1. All necessary safety precautions shall be taken to protect personnel from injury while fabricating, inspecting or testing fiber optic cable assemblies. Protective equipment shall comply with the requirements of the Occupational Safety and Health Administration.

2. At a minimum, personnel who may come in contact with bare fibers shall wear ANSI approved eye protection.

3. Fiber waste is an individual and collective safety concern. The Installer shall not allow slivers of bare fibers to be disposed of on the floors of the TRs.

Codes/Standards Reference
OSHA, 29 CFR Part 1910

Fiber Optic Test Jumpers

1. Single-mode
   a. The Installer shall use single-mode test jumpers that meet the requirements of the Telecommunications Industry Association.

   b. Single-mode test jumpers shall be of the same fiber type as the optical fiber cabling.

2. Multi-mode
   a. The Installer shall use multi-mode test jumpers that meet the requirements of the Telecommunications Industry Association.

   b. The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

   c. Multi-mode test jumpers shall be of the same fiber type as the optical fiber cabling.

Codes/Standards Reference
ANSI/TIA/EIA 526-7
ANSI/TIA/EIA 526-14A, section 3.3

27 15 43 COMMUNICATIONS FACEPLATES AND CONNECTORS

Work Areas

1. Work area outlets shall be connected by zone distribution or consolidation transition points to the TR.

2. Work area outlets in office areas shall be located so that one outlet serves each 80 square feet of usable office space.

3. Work area outlets shall contain (6) 8-position RJ45 type modular jacks positions in single faceplate for used with snap-in jacks accommodating any combination of Unshielded Twisted Pair (UTP), optical fiber, and coaxial work area cords.

    a. All unused ports shall be blanked out for future use.

    b. Blanks shall be of the same manufacturer as the faceplates and match in color.

4. Work areas outlets shall use Category 6 modular jacks.

    a. Jacks to be 8-position, Category 6, IDC terminals, T568B wiring scheme

    b. Each jack must be stamped or have icons to identify it as Category 6.

5. It is recommended to color coordinate high impact plastic faceplate to surrounding area.

6. It is recommended that the top three jacks shall be for voice and the bottom three jacks shall be for data.

7. Work area outlet boxes shall be flush-mounted and located adjacent to a power receptacle.

8. Work area outlet boxes shall be fed with 1 inch conduit.

9. Work area outlets shall be mounted at the same height as the existing convenience outlets unless required to meet ADA requirements.
10. Work area outlets shall be neatly and professionally labeled at the outlet (machine printed using adhesive-tape label for cable), on the front of the wall plate and in the TR.

11. Faceplate shall have snap-in clear-label covers and machine-printed paper for inserts.

12. Work area outlets shall meet or exceed the performance criteria for the cable type used, i.e. CAT6.

27 16 00 COMMUNICATIONS CONNECTING CORDS, DEVICES, AND ADAPTERS

1. For clarification purposes, “Patch Cord” refers to cords installed on the patch panel end in the Server Room or TRs and at the Work Area Outlet.

2. These must be of the same grade and manufacturer as the horizontal/backbone cabling. i.e. CAT 6

27 16 13 COMMUNICATIONS CUSTOM CABLE ASSEMBLIES

1. Mode conditioning cords may be required to transition from 62.5 to 50 micron Multimode fiber.

27 16 16 COMMUNICATIONS MEDIA CONVERTERS, ADAPTERS, AND TRANCEIVERS

1. Fiber optic adapters are to be color coded to differentiate between Single mode and Multimode fibers.
    a. Single Mode – Yellow
    b. Multimode – Orange or Aqua

27 16 19 COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

Cross-Connect Facilities

1. All voice backbone and horizontal cables shall be terminated on 110 style, punch-blocks. All data backbone and horizontal cables shall be terminated in jack fields that are rack-mounted.

2. Cables of similar type shall be terminated next to each other.

3. Horizontal and vertical wire management for organization of patch cords shall be provided.

Cross-Connect Color Coding

1. SDCRAA IT may NOT follow Industry standards for color-coding backboards. Please refer to Appendix-ii for Color code for all electrical conduits at SDCRAA.

2. SDCRAA ITD Ethernet cable color code is green.

3. Backboards shall be painted white until further notice.

Patch Cords

1. Recommended to use 24 AWG, stranded wire, 100 ohm, UTP, CAT-6 for copper patch cords.

2. If installing a structured cabling system, to be Channel certified, the patch cords must comply with the requirements set forth by the manufacturer to maintain the manufacturer's warranty.

Fiber Optic Jumpers

1. The Installer shall not manufacture or field assemble fiber optic jumpers.

2. Single-mode and Multimode jumpers shall be SC type, unless otherwise required for equipment interface.

3. For single fiber circuits, use single strand jumpers. For duplex fiber circuits, use zipcord jumpers.

APPENDIX

FIGURE – 1: TELECOMMUNICATIONS ROOM (TR)

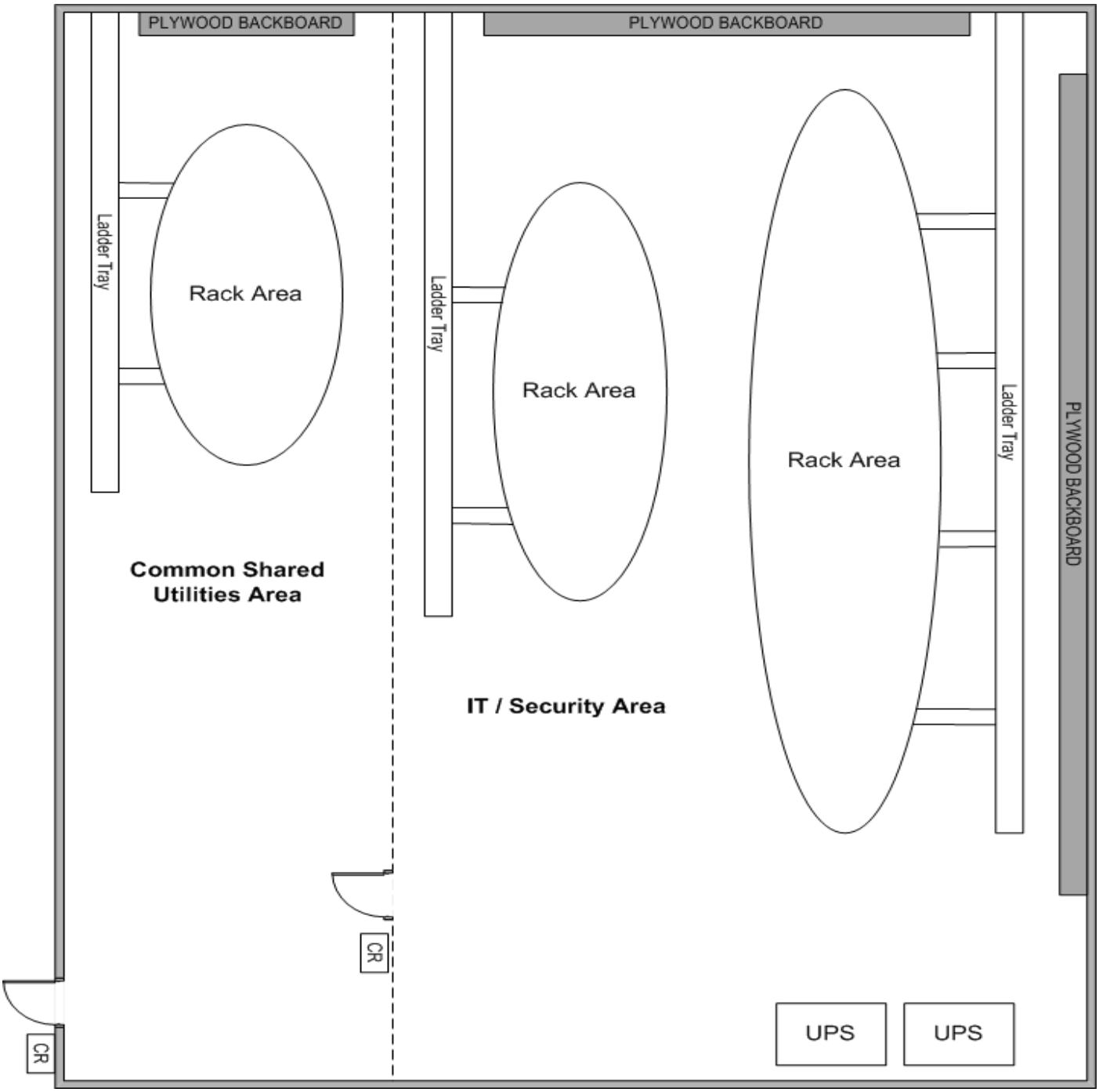

FIGURE – 2: SDCRAA TENANT IMPROVEMENT REQUEST FORM

CONCEPT APPROVAL

Tenant Legal Name and Address	Date

Tenancy Business (DBA) Name	Project Location: San Diego International Airport[1]

Signature – Owner/Officer	Printed Name – Owner/Officer	Telephone Number	E-Mail Address

PROJECT DESCRIPTION (ATTACH ADDITIONAL PAGES, IF REQUIRED)[1]:

☐ 2 – Bond Sets of Concept Plans Received (Floor Plan, Elevation, and Colored Renderings) and Electronic Copy (PDF/JPEG)	
☐ 2 – Material Sample Boards (depicting all materials, finishes, and locations) and Electronic Copy (PDF/JPEG)	
☐ Project Schedule/Timelines including Key Milestones	
☐ Project Cost Estimate (Attach Additional Pages, If Required)	$
☐ Other	

CONSTRUCTION DOCUMENTS APPROVAL

SUBMITTED:

☐ Permitted Construction Documents – Printed Copy and Electronic Copy (PDF & CAD)[2]	
☐ Specifications – Printed Copy and Electronic Copy[2]	
☐ Updated Material Sample Boards (depicting all materials, finishes, and locations) – 1 Board and Electronic Copy (PDF/JPEG)	
☐ Airport Terminal Map Highlighting Project Location	

Proposed Architect/Engineer	Telephone Number	License Number
Proposed Contractor	Telephone Number	License Number

Estimated Construction Commencement Date	Estimated Construction Completion Date

CONSTRUCTION/CLOSEOUT – AUTHORITY USE ONLY

☐ Punch List Corrections Completed	☐ Copy of Signed-Off Permit Card Received
☐ Copy of Record Drawing Received	☐ Bond/Deposit/Retention/Security Funds Released – Date:
☐ Other:	

FOOTNOTES:

1. *Please contact Real Estate Management if additional assistance is required.*
2. *Number of Printed Copies submitted for TI Project Plan Approval will be determined at Concept Approval.*

TABLE – 1: LIST OF SYSTEMS THAT ARE MANAGED BY SDCRAA ITD

Special Systems:

1) Baggage Handling Systems

2) Resource Management System

3) CUPPS/CUTE

4) CUSS

5) Building Management System

6) Flight Information Display Systems (FIDS, BIDS, RIDS, GIDS, SIDS)

7) Master Clock

8) Audio and Visual Paging

9) CATV

10) GIS

11) Roadway Dynamic Signage

12) Information Kiosks

13) Cable Management System

14) Local Departure Control System

15) Parking Access and Revenue Control System

IT/Telecom Systems:

1) Radio Communication System

2) Wireless Local Area Network

3) Wired Local Area Network

4) Telephones (VoIP, Public, Courtesy, Airport Authority)

5) Network and Telecommunications Backbone

6) Common Use Infrastructure

TABLE – 2: LIST OF SYSTEMS THAT ARE MANAGED BY SDCRAA AVSEC/PS

1) Access Control

2) CCTV

3) Alarm Monitoring

4) Screening

5) Breach Management

6) Perimeter Intrusion Detection

TABLE – 3: COLOR CODE** FOR ALL ELECTRICAL CONDUITS AT SDCRAA

Brown	HVAC
Yellow	Public Address/Intercom
Orange	Emergency
Pink	ACS/Security
Red	Fire Alarm
White	Telephone/Data
Yellow/Black	12KV
Blue	120/208V
Violet	Loading Bridge
Gray	Visual Display
Green	Ground

** **Color Codes for electrical conduits are provided by SDCRAA FDD. Please verify with SDCRAA FDD for any updates.**

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