(This is a design guideline spec. It's the responsibility of the Design/Installation team to develop project specific specifications to meet the project requirements.)

SECTION 270528 - INTERIOR PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SECTIONS INCLUDE

A. This section includes specifications for the installation of interior communications pathways.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to the work of this Section.

C. Interior Communication Pathways are defined to include, but are not limited to inner duct, conduit, pull boxes, cable hooks, cable trays, supports, accessories, associated hardware and fire stopping materials.

1.2 REFERENCES

A. Section 270000 in its entirety shall be included as part of this specification.

B. Related Sections:

1. Div 01
2. Section 270526 Grounding and Bonding for Communications Systems
3. Section 270543 Exterior Pathway for Communications Systems
4. Section 270553 Identification for Communications Systems
5. Section 271100 Communications Equipment Room Fittings
6. Section 271300 Communications Backbone Cabling
7. Section 271500 Communications Horizontal Cabling
8. Section 272100 Data Communication Network Equipment
9. Section 274116 Integrated Audio-Video Systems and Equipment
10. Section 274133 Master Antenna Television Systems
11. Section 275113 Paging System
12. Section 275319 Emergency Responder Radio Communications System

C. Conflicts:

1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between reference requirements and contract documents: Comply with the one establishing the more stringent requirements.

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1.3 QUALITY ASSURANCE

A. Verify conduit, raceway, cable tray, and cable hook runs do not interfere with existing or new systems within each facility.

B. Fire stopping: Manufacturer trained and approved installer to perform fire stopping work who has specialized in the installation of work similar to that required for this project.

C. Communication Pathway minimum Clearances:

1. Motors or transformers: 4 feet
2. Power cables and conduits: 12 inches parallel, 3 inches crossover
3. Fluorescent lights: 5 inches
4. Above ceiling tiles: 3 inches
5. Access above cable tray: 12 inches
6. Hot Flues, Steam pipes, Hot water pipes and other hot surfaces: at least 6”

D. Furnish products of latest proven design, new and in current production. Do not use obsolete components or out-of-production products.

E. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

F. All installed materials and accessories shall be new from the manufacturer. No used components will be accepted by the COH.

G. All Documentation submittals shall be reviewed by the supervising RCDD and stamped prior to submittal.

H. Contractor Qualifications:

1. The Contractor shall submit references and other related evidence of installation experience for a period of three years prior to the issue date of this Specification.
2. ALL work shall be supervised on-site by a BICSI RCDD. Must demonstrate knowledge and compliance with all BICSI, ANSI/TIA, UL, and NEC standards and codes. Contractor shall submit proof of RCDD designation.

I. COH retains the right to have access and inspect all work during the entire duration of the project and any items that do not adhere to the standards, reference, contract, bid, or project documents will be corrected immediately at NO cost to COH.

PART 2 PRODUCTS

2.1 GENERAL

A. Where conduit, pull boxes, cable tray and other raceway sizes are not specifically shown on contract drawings. All communication pathways shall be sized in accordance with the requirements of BICSI and the NEC.

B. All raceways, if used, shall be metal conduit. Raceways installed in stud walls or above suspended hard ceilings shall be Electrical Metallic Tubing.

2.2 INTERIOR COMMUNICATIONS CONDUIT

A. MANUFACTURES:

1. Allied
2. Triangle
3. Wheatland

4. COH approved equal

B. Rigid Steel Conduit shall pass all bending, ductility, and thickness of zinc coating in ANSI C80.1 and UL 6. Conduit shall be galvanized have threaded end with 1” minimum size and 4” maximum size. Fittings shall be cast iron or alloy steel, threaded and galvanized.

C. Intermediate Metal Conduit (IMC) shall be manufactured in accordance with UL 1242. Conduit shall be low carbon, hot-dipped galvanized inside and out, with threaded ends, 1” minimum size, and 4-inch maximum size. Fittings shall be cast iron or alloy steel, threaded and galvanized.

D. Electrical Metallic Tubing (EMT) shall be manufactured in accordance with UL 797 and ANSI C80.3. EMT shall be high-strength, zinc-coated, 1-inch minimum size. EMT may be used for sizes greater than 2" where physically protected. EMT shall not be utilized for service entrance conductors. Fittings shall be of same finish and material as tubing. Fittings shall be compression type with insulated throat.

E. Expansion Joint Fittings: OZ type AX or Appleton type XJB, watertight, permitting two-way movement up to 4 inches, equipped with bonding jumpers around or through each fitting.

F. Thruwall Sealing Fittings: Type WSK by O-Z Gedney Company.

G. Fire-Seal Fittings: Type CFSI by O-Z Gedney Company.

H. Sealing Material for Sealing Fittings: Chico X Fiberdam, and Chico A sealing compound, or Chico A-P interpak by Crouse-Hinds or Apelco sealing cement and fiber filler by Appleton.

I. Insulated Bushings: Type B or SBT, as applicable, by O-Z Gedney or series B1900, series BU500 or series TC700, as applicable, by Steel City.

J. Provide a measured pull tape in each empty conduit, empty innerduct for backbone and riser pathways.

K. Provide a pull string for all horizontal conduits with a minimum pulling tension of 200 pounds.

L. Thread lubricant/sealant shall be Crouse-Hinds type STL or T & B Kopr-Shield except, when required on joints for heat producing elements such as lighting fixtures; it shall be Crouse-Hinds type HTL.

M. PVC Conduit shall not be used as interior communication pathways. Except when encased in concrete.

2.3 INNERDUCT

A. Manufacturers:

1. Carlon CF4X1C
2. Maxcell Premise
3. Or COH approved equivalent

B. Innerduct

1. All fiber cables not placed in conduits shall be installed in corrugated innerduct (Carlon or equal).
2. Fabric Innerducts (Maxcell, or equal) shall be provided in all conduits dedicated for communications backbone cabling.
3. Innerduct shall be UL Listed with Flame Propagation compliant with UL 2024.
4. Only manufacturer’s fittings, transition adapters, terminators, and fixed bends shall be used.
5. All empty innerducts will be populated with a measured pull tape.

6. Where more than one innerduct is routed in a conduit, each innerduct shall consist of a different color from end to end (ex. Orange, Blue, Black, and White). Do not couple innerducts of different colors without COH approval.

7. All interior innerduct shall be plenum rated, unless installed in conduit.

2.4 CABLE TRAYS

A. Manufacturers:

1. Cablofil CF105/300EZ (12”W x4”H)

2. Or approved equal

B. Cable Tray

1. Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

2. Materials and Finish: Material and finish specifications for each tray type are as follows:

a) Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

b) Pre-galvanized Steel: Straight sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties in accordance with ASTM A653 SS.

c) Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray.

d) Stainless Steel: Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.

C. Type of Tray Systems

1. All work area trays shall be basket type, UON.

2. Refer to section 271100 for ladder type trays used in Communications Rooms (MDF/IDF).

3. All tray sizes and types shall have a minimum of 2 inch usable load depth.

4. All straight sections shall be supplied in standard 10 foot length, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

5. Tray widths shall be 12, 18, 24, or 36 inches as indicated on the drawings.

6. All fittings must have a minimum radius of 12, 24, 36 or 48 inches as indicated on the drawings.

7. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.

8. Aluminum Tray - Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1.

9. Steel (including Pre-galvanized and Hot-dip galvanized) - Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.
10. Cable Tray Support shall be placed so that the support spans do not exceed maximum span indicated on drawings or by the manufacturer. Supports shall be Trapeze style support. Cable trays installed adjacent to walls shall be supported on wall mounted brackets as specified by the manufacturer.
11. Trapeze hangers shall be supported by 3/8 inch (minimum) diameter all thread rods. No center hung method is allowed.
12. Accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.
13. All cable tray components and accessories will be from the same manufacturer. Parts from different manufacturer will not be intermixed.

2.5 CABLE HOOK SYSTEMS

A. Manufacturers:

1. Nvent CAT32HP4Z34
2. Or approved equal

B. Cable hooks shall have a flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.

C. Cable hooks shall have 90-degree radiused edges to prevent damage while installing cables.

D. Cable hooks shall be designed so the mounting hardware is recessed to prevent cable damage.

E. Cable hooks shall have a cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.

F. Cable hooks shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

G. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

H. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.

I. All Cable Hook shall be supported with minimum ¼” all thread with the appropriate fasteners.

2.6 FIRESTOPPING MATERIALS

A. Manufacturers:

1. Johns Manyille
2. Hilti
3. 3M

B. Description:

1. Performance requirements: Provide firestopping systems that are produced and installed to resist spread of fire according to requirement indicated, resist passage of smoke and other gases, and maintain fire resistance rating of assembly.
   a) F- Rated Systems: in accordance with ASTM E 814
   b) T- Rated Systems: in accordance with ASTM E 814

2. Fire stopping flame spread performance requirements: Provide products with flame-spread ratings of less than 25 and smoke development ratings of less than 50 as determined in accordance with ASTM E 84.

3. Fire Stopping UL performance requirements: Provide products with UL ratings specified for assembly indicated as determined in accordance with UL listings.

2.7 JUNCTION BOXES/PULL BOXES

A. All pull boxes shall be constructed with a minimum of 14-gauge galvanized steel with an ANSI 61 grey polyester powder finish inside and out over phosphatized surfaces or galvanizes steel unless otherwise specified.

B. All pull boxes shall have flat, removable covers fastened with plated steel screws with unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.

1. All removable box covers shall be connected to box with a safety strap or chain.

C. All pull boxes shall provide the appropriate provisioning for grounding.

D. All pull boxes shall be NEMA Type 1 and sized according to the table below unless otherwise specified.

Maximum Trade Size of Conduit (inches)	Minimum Box Size (inches)			For Each Additional Conduit Increase Width (Inches)
	Width	Length	Depth	
1	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2	8	36	4	5
2.5	10	42	5	6
3	12	48	5	6
3.5	12	54	6	6
4	15	60	8	8

2.8 CONDUIT PULL LINE

A. Description

1. Minimum pulling tension greater than 200 lb (900 N).

2. Ready-to-use cable pull line,

3. Use directly from the container.

4. Resists tangling when dispensing.

5. Rot and mildew resistant.

6. Handy reusable plastic dispenser pail with handle keeps the line dry.

7. Greenlee 430 or approved equivalent.

PART 3 EXECUTION

3.1 GENERAL

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.

C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

D. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.

E. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or any other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

F. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.

G. Do NOT route communication pathways under HVAC condensing units.

H. Expansion Fittings:

1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.

2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit funs where necessary. Provide bonding jumpers across fittings in metal raceways systems

3.2 CONDUIT INSTALLATION

A. Conduit shall be installed with threaded fittings and couplings**. Conduit pathway shall be provided for all communications cables routed in walls, surface mounted on walls/floors/ceiling, or over inaccessible drop ceiling.**

B. All metallic couplings, connectors and fittings shall be malleable iron or steel and finished with zinc plating or by galvanizing.

C. All conduits shall be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits shall be swabbed and cleaned before wires are pulled.

D. All open conduits must be provided with a pull rope with a minimum pull tension of 200+ pounds.

E. Expansion fittings shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type permitting a movement of up to four inches and shall be provided with approved bonding jumpers around or through the fitting.

F. Connection of Conduit to pull / junction Boxes and Enclosures:

1. Connection to NEMA 1 type boxes and enclosures:

a) Rigid conduit: Install insulated bushings and double locknuts.

b) EMT: Install compression box connectors with insulated throats.

2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.

3. When conduits enter floor-mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the given circuit.

4. Install sealing bushing within all conduits that have entered a building from outside, whether from above or below grade.

G. Each Conduit route shall be installed with the least amount bends as possible. No section of conduit shall be longer than 30m (100 ft) or contain more than two 90 degrees bends (offset is considered to be a 90 degree bend) between pull points, pull boxes or reverse bends.

H. The inside radius of bends in conduit shall be:

1. 6 times the internal diameter for 2-inches or less.

2. 10 times the internal diameter for greater than 2-inches.

I. A measured pull tape shall be placed in all installed conduit.

J. All communications conduits shall be identified with color coded orange tape marked “Communications” every 50 feet. Tag conduit termination points (to include J-box locations) with the origination and destination location.

K. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.

L. Conduit protruding through the floor shall be terminated at a minimum of 3 inches above the floor surface.

M. All stubbed conduit ends shall be provided with a ground bushing.

N. All conduit penetrations shall be provided with the proper conduit sleeves.

1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.

2. Sleeves shall be installed in the communications room floor or ceiling a minimum of two to four inches on center from the wall.

3. Conduit floor sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.

4. Shall be installed in a single tier or row from left to right horizontally. If two tiers or rows are required the conduits shall be staggered minimum of 2 inches between tiers.

5. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

O. All cable (horizontal, riser or backbone) wall or ceiling penetrations shall be provided with the proper conduit sleeves.

1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.

2. Sleeves shall be installed in the floor or ceiling a minimum of two to four inches on center from the wall.

3. Sleeves shall be installed in the walls at a minimum of two inches extended on each side of the wall.

4. Cable floor, ceiling and wall sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.

5. Shall be installed in a single tier or row from left to right horizontally.

6. If two tiers or rows are required the conduits shall be staggered minimum of 2 inches between tiers.

7. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

P. All conduit and cabinet entrances shall be sealed with an approved, re-enter able sealant material to prevent ingress of water, dust or other foreign materials.

Q. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.

R. Conduit Sizing and supports:

1. Support conduit 2 inches and larger at 10 feet on center maximum, and conduit 1½ inch and smaller at eight feet on center maximum.
2. Fasten 1½ inch and smaller conduit to concrete, masonry or steel with either one-hole malleable iron conduit straps, or "Korn" clamps, or U-bolts; for larger diameters, use two-hole straps. Use "clamp backs" for strapping conduits to planar surfaces.
3. Multiple runs shall be supported on channel adequately secured to walls or hung from structure above with conduits fastened to channel with clamps designed for the purpose.
4. Cable fill rates shall not exceed 40 percent of the cross-sectional area of the installed conduit unless greater fill is approved by Engineer. Contractor shall submit request for approval for installing cables with greater than 40 percent conduit fill. Request will be approved on a case-by-case basis.

S. Horizontal Conduit Routes:

1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, terminating equipment or cable tray, as indicated in Drawings.
3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30m (100 ft) or contain more than two 90 degrees bends (offset is considered to be a 90 degree bend).
4. Each dual horizontal conduit run shall be provided with a junction or pull box every 30m (100 ft) or contain more than two 90 degrees bends (offset is considered to be a 90 degree bend). The quantity of conduits entering the junction or pull box shall equal the number of conduits exiting the junction or pull box.
5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.

T. Horizontal conduit entrance in communications rooms – wall entry

1. Horizontal conduits shall enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.
2. Conduit wall stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
3. All conduit wall stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

U. Horizontal conduit entrance in communications rooms – ceiling entry

1. Horizontal conduits shall enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.
2. Ceiling conduit stubs shall be spaced in increments equal to the conduit OD from each other.
3. All ceiling conduit stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

V. Horizontal conduit entrance in communications rooms – floor entry

1. Horizontal conduits shall enter the communications room floor two inches to four inches on center from the wall and shall be stubbed 4 inches AFF.
2. Conduit floor stubs shall be spaced in increments equal to the conduit OD from each other.
3. Conduit crossovers are not permitted.
4. Provide vertical ladder rack or d-hooks properly secured to wall to transverse cable to cable tray over-head.

W. Horizontal conduit to cable tray

1. Non-communications conduit shall NOT be attached to the cable tray in any fashion.
2. Conduit terminating end shall be attached to cable tray side rail with “conduit-to-cable tray” clamps. No other form of attachment shall be permitted.
3. Top or bottom cable tray conduit feeds and attachments are not permitted.

X. Horizontal Junction/Outlet Boxes

1. Each horizontal conduit shall be terminated into an outlet box.
2. Each outlet box shall be a deep four-inch square junction box with a minimum of two one-inch knockouts on each of the sides.

Y. Riser conduit entrance in communications rooms – wall entry

1. Riser conduits shall enter the communications room wall a minimum of 24 inches above the top of the cable tray.
2. Conduit wall stubs shall be spaced in increments to equal the conduit OD from each other.
3. Riser conduits shall be installed in a single tier or row from left to right horizontally.

a) If two tiers or rows are required, the conduits shall be staggered between tiers.

b) No more than two tiers or rows are permitted.

4. All conduit wall stubs shall be extended to and over the cable tray to access cable tray pathway.

5. All riser conduit stubs shall be provided with the proper universal drop-out/ waterfall cable exit runway, which shall be supported by and mounted to channel strut.

6. Conduit crossovers are not permitted.

Z. Riser conduit entrance in communications rooms – floor entry

1. Riser conduits shall enter the communications room floor two inches to four inches on center from the wall and shall stub up six inches AFF.

2. Conduit floor stubs shall be spaced in increments to equal the conduit OD from each other.

3. Riser conduits shall be installed in a single tier or row from left to right horizontally.

a) If two tiers or rows are required, the conduits shall be staggered between tiers.

b) No more than two tiers or rows are permitted.

4. Exiting cable shall be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.

5. Conduit floor stubs shall be extended 2 to 4 inches from wall on center and 4 inches above AFF.

6. The riser cable shall be extended in the cable tray to the terminating equipment, as noted in the Drawings.

7. Conduit crossovers are not permitted.

AA. Cable Tray Installation

1. Cable tray shall be supported as follows:

a) Where tray is suspended above equipment cabinets it shall be supported by a Trapeze type hanger and per manufacture instructions. In all other applications, the tray shall be supported by uni-strut trapeze type hangers affixed to the structure above via minimum 3/8-inch threaded rod.

b) Threaded rod shall be fitted with a 6-inch long tube where it resides in cable tray to protect cables.

c) Minimum of 12 inches of vertical clearance above all cable tray.

2. Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA-VE2 for general cable tray installation guidelines.

3. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

4. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.

5. A support must be place within 24 inches on each side of a connection or fitting.

6. Maintain a minimum of 12 inches of clearance above cable tray for cable installation. Maintain a minimum of 3 inches between ceiling tile and cable tray support.

7. Cable tray installation will be completed in one continuous run with no separations between sections.
8. Vertical cable or ladder racks shall be used to route cable up and down the wall.
9. Dropout/Water Fall of the same make and size of the cable tray shall be used to route cables in or out of the tray.
10. Matted “T” and elbows shall be used of the same make and size for all interchanges and directional changes

BB. Junction Box/Pull Box Installation

1. Pull boxes shall be installed in sections of conduit every 100 feet in length, that contain more than two 90-degree bends, or that contain bends that are 180 degrees or more in the aggregate.
2. A pull box shall NOT be used in lieu of a conduit bends.
3. All pull boxes shall be installed in an easily accessible location with unobstructed entry to the pull box access panel.
4. Pull boxes shall be supported on all four corners in such a manner that the pull box is not supported by the cable running through or conduit attached to the pull box.
5. Horizontal Junction/Outlet Boxes
   a) Each horizontal conduit shall be terminated into an outlet box.
   b) Each outlet box shall be a deep four-inch square junction box with a minimum of two one-inch knockouts on bottom and each of the sides.
   c) Each conduit home run shall be provided with a deep 4-inch square junction box (w/cover) at 100-foot intervals and six inches above each ceiling and wall intersection.

3.3 CABLE HOOK INSTALLATION

A. Installation and configuration shall conform to the requirements of the ANSI/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

B. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

C. Cable Hook spacing maximum 5 feet on center.

D. Maintain maximum cable sag between cable hooks of 12 inches.

E. Cable shall not touch ceiling tile or light fixtures. Provide minimum 3” vertical separation above ceiling tiles.

F. Do not fill cable hook greater than manufactures recommended guidelines, maximum 40% fill.

3.4 FIRESTOPPING MATERIAL INSTALLATION

A. Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.

B. Verify substrate conditions are acceptable for product installation in accordance with manufacturer’s instructions.

C. Install fire stopping to comply with performance requirements specified herein.

1. Install fire stopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements
2. Installer shall be trained and approved by the manufacturer

D. Protect installed products from damage during construction operations until final completion.

E. Inspection: Code official or building inspectors to review proper installation using manufacturer guidelines.

3.5 LABELING

A. All communication pathway components shall be properly labeled per CoH IT standards.

B. Refer to section 270553

3.6 GROUNDING AND BONDING

A. Refer to Section 270526.

3.7 ACCEPTANCE

A. Refer to Section 270000.

END OF SECTION 270528