SECTION 270000-COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general design requirements, administration topics, and installation for communications systems.

1.2 SYSTEM DESCRIPTION

A. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to: communications backbone and riser cabling, communications horizontal cabling system, communications equipment room fittings, communications pathway and management systems, testing, labelling and other items/materials, as specified in drawings, these specifications, and contract documents.

B. Related Sections
1. Section 270526 Grounding and Bonding for Communications Systems
2. Section 270528 Interior Pathways 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

1.3 REFERENCES AND RELATED DOCUMENTS

A. Drawings and General provisions of the contract, including Uniform General Conditions, Supplementary General Conditions, Architectural plans and specifications, requirements of Division 1, Electrical, Mechanical, Plumbing, Audio-Visual, Security and Communications specifications and plans, and the publications listed below apply to the Communications section, are incorporated into this specification by reference, and shall be considered a part of this section.

B. Reference to codes, rules, regulations, standards, manufacturer’s instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.

C. The Contractor shall read all sections in their entirety and apply them as appropriate for work in this section.

D. Conflicts
1. Drawings and specifications are to be used in conjunction with one another and to supplement one another.
2. In general, the specifications determine the nature and quality of the materials and tests, and the drawings establish the quantities, details, and give

characteristics of performance that should be adhered to during the installation of the communications system components.

3. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quantity and/or quality shall be estimated and installed.

4. Clarification with COH and IT Consultant about these items shall be made in writing prior to procurement and installation.

E. Codes and Standards

1. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA)

   a) ANSI/TIA-568-C.0 "Generic Telecommunications Cabling for Customer Premises"
   b) ANSI/TIA-568-C.1 "Commercial Building Telecommunications Cabling Standard"
   c) ANSI/TIA-568-C.2 "Balanced Twisted-Pair Telecommunication Cabling and Components Standard"
   d) ANSI/TIA-568-C.3 "Optical Fiber Cabling Components Standard"
   e) ANSI/TIA-568-C.4 "Broadband Coaxial Cabling and Components Standard"
   f) ANSI/TIA-569-C "Telecommunications Pathways and Spaces"
   g) ANSI/TIA-606-B "Administration Standard for Commercial Telecommunications Infrastructure"
   h) ANSI/TIA-607-B "Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications"
   i) ANSI/TIA-758-B "Customer-Owned Outside Plant Telecommunications Infrastructure Standard"
   j) ANSI/TIA-862-A “Building Automation Systems Cabling Standard”
   k) ANSI/TIA-942-A: “Telecommunications Infrastructure Standard for Data Centers”
   l) ANSI/TIA-1152: “Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling”

2. American National Standards Institute (ANSI)

   a) ANSI C80.1 Electrical rigid steel conduit (ersc)

3. American Society for Testing Materials (ASTM)

   a) ASTM A123/A123M-13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   b) ASTM A510/A510M-13 Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
   c) ASTM A653/A653M-13 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   d) ASTM B3-13 Standard Specification for Soft or Annealed Copper Wire
   e) ASTM B8-11 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   f) ASTM B33-10 Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
   g) ASTM B633-13 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
   h) ASTM B653/B653M-11 Standard Specification for Seamless and Welded Zirconium and Zirconium Alloy Welding Fittings

4. BICSI

    a) BICSI Outside Plant Design Reference Manual
    b) BICSI Telecommunications Distribution Methods Manual (TDMM)
5. Federal Specifications (FS)

    a) FS W-C-58C Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron
    b) FS W-C-1094 Conduit and Conduit Fittings Plastic, Rigid
    c) FS WW-C-566C Flexible Metal Conduit
    d) FS WW-C-581D Coatings on Steel Conduit
6. Institute of Electrical and Electronic Engineers (IEEE)

    a) IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems
    b) IEEE 1100-2005 IEEE Recommended Practice for Powering and Grounding Electronic Equipment
7. National Electrical Code (NEC)

    a) NEC Article 250 - Grounding and Bonding
    b) NEC Chapter 8 - Communications Systems
8. National Electrical Manufacturers Association (NEMA)

    a) NEMA RN1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
    b) NEMA TC2 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
    c) NEMA TC3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
    d) NEMA VE 1 - Metal Cable Tray Systems
    e) NEMA VE 2 - Cable Tray Installation Guidelines
9. Underwriters' Laboratories (UL)

    a) UL Cable Certification and Follow-Up Program
    b) UL 6: Electrical Rigid Metal Conduit - Steel
    c) UL 83: Thermoplastic-Insulated Wires and Cables
    d) UL 467: Grounding and Bonding Equipment
    e) UL 514B: Conduit, Tubing, and Cable Fittings
    f) UL 651: Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
    g) UL 651A: Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit
    h) UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
10. Local, county, state and federal regulations and codes in effect as of date of installation.
11. Equipment of foreign manufacture must meet U.S. codes and standards.

    a) It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

1.4 ABBREVIATIONS, ACRONYMS AND DEFINITIONS

A. Abbreviations and Acronyms
1. ACD Automatic Call Distribution
2. AFF Above Finished Floor

3. ANSI American National Standards Institute
4. ATM Asynchronous Transfer Mode
5. AWG American Wire Gauge
6. BD Building Distributor
7. BICSI Building Industry Consulting Services International
8. CAT5 Category 5 Copper Cable
9. CAT5e Category 5e Copper Cable
10. CAT6 Category 6 Copper Cable
11. CAT6A Category 6A Copper Cable
12. CDDI Copper Distributed Data Interface
13. CMP Communications Multipurpose Plenum: cable rating
14. CMR Communications Multipurpose Riser: cable rating
15. COH City of Houston
16. ELFEXT Equal-Level Far-End Crosstalk
17. FD Floor Distributors
18. FEXT Far End Crosstalk
19. Gbps Gigabits per second
20. HITS Houston Information Technology Services
21. HVAC Heating, Ventilation, and Air Conditioning
22. IDF Intermediate Distribution Frame - Termination frames, relay racks, and cable management
23. IEEE The Institute of Electrical and Electronics Engineers
24. IM Information Management
25. ISDN Integrated Services Digital Network
26. ISO International Organization for Standardization
27. LAN Local Area Network
28. Mbps Megabits per second
29. MDF Main Distribution Frame, consisting of carrier entrance rooms and head-end
30. MMF Multi-mode fiber optics, 50 or 62.5 micron laser optimized core
31. MIMO Multiple-In and Multiple-Out
32. Multi-path The possible multiple routes of a single source of RF energy due to reflection, refraction, or diffraction.
33. MUTOA Multi-User Telecommunications Outlet Assembly
34. NEC National Electrical Code
35. NEMA National Electrical Manufacturing Association
36. NEXT Near End Cross Talk
37. NRTL Nationally Recognized Testing Laboratories
38. OSHA Occupational Safety and Health Act
39. PBB Primary Bonding Busbar (was called TMGB)

40. PBX Private Branch Exchange: telephone switch
41. PDS Premises Distribution Systems (See SCS.)
42. PoE Power over Ethernet (IEEE 802.3af)
43. POP Point of Presence
44. PSACR Power Sum Attenuation-to-Crosstalk Ratio
45. PSAFEXT Power Sum Alien Far-End Crosstalk
46. PSAELFEXT Power Sum Alien Equal Level Far-End Crosstalk
47. PSANEXT Power Sum Alien Near-End Crosstalk
48. PSELFEXT Power Sum Equal Level Far-End Crosstalk
49. PSNEXT Power Sum Near-End Crosstalk
50. RF Radio Frequency: Signal generated by a radio transmitter and sent out through an antenna. The frequency of the transmission is described in terms of the number of cycles per second or Hertz (Hz).
51. SBB Secondary Bonding Busbar (was called TGB)
52. SCC Security Command Center
53. SCS Structured Cabling System, or Structure Connectivity System; a complete cabling system
54. SFF Small Form Factor
55. SFP Small Form-Factor Pluggable – Hot-pluggable transceiver used for both telecommunication and data communication applications. Comes in both copper and fiber.
56. SMF Single-mode fiber optics, 8.3 micron core
57. SNMP Simple Network Management Protocol
58. TC Telecommunications Closet
59. TE Telecommunications Enclosure
60. TEF Telecommunications Entrance Facility
61. TIA Telecommunications Industry Association
62. TR Telecommunications Room
63. TO Telecommunications Outlet
64. TWC Time Warner Cable - Owner
65. UPS Uninterruptible Power Supply
66. UTP Unshielded Twisted Pair
67. VoIP Voice over Internet Protocol
68. WAO Work Area Outlet
69. WAN Wide Area Network
70. WAP Wireless Application Protocol
71. WPA/WPA2 WiFi Protected Access / WiFi Protected Access II – IEEE 802.11i-2004

B. Definitions
1. Access Floor - A floor system that has removable floor panels.

2. Building Backbone Cabling – Cabling used to connect Floor Distributors (FD) or other local collection points to the Building Distributor (BD). Building backbone cabling typically carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling may include either fiber optic or copper cabling or both.

3. Building Distributor (BD) – Termination point from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF in Americas, Main Comms Room in EMEA and Communication Room, IT Lab or IT Room in AsiaPac. Referred to as BD in international and European industry standards and Intermediate Cross-connect (IC) in American industry standards. There is one BD for each building and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet). All BD's are linked to the

4. Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

5. Campus Distributor (CD) – Termination point from which all campus backbone cabling emanates and highest-level interconnection point for the network backbone. Commonly referred to as NOC in Americas and Main Comms Room in EMEA. Referred to as CD in international and European industry standards and Main Cross-connect (MC) in American industry standards. On smaller campuses, there is one CD for the campus. On larger campuses there might be several CD's with each CD serving several buildings. Besides linking to each of the BD's it serves, the CD is also the network interconnection point for data center links and links to service providers.

6. Category 3 (Cat 3) – A category of transmission performance, defined in TIA standards, that specifies electrical properties up to 10 MHz. Cat 3 is the minimum performance grade permissible and is used typically for analog voice distribution.

7. Category 5e (Cat 5e) / Class D – A category/class of transmission performance that specifies electrical properties up to 155.5 MHz. Capable of supporting copper-based, four-pair Gigabit Ethernet (IEEE 802.3ab 1000BASE-T) applications. Category 5e is defined in TIA 568B.2 standard. Class D is defined in the ISO 11801 standard.

8. Category 6 (Cat 6) / Class E – A category/class of transmission performance that specifies electrical properties up to 250 MHz. Refer to the TIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements. Also refer to CENELEC EN50173.

9. Category 6A (Cat 6) / Class EA– A category/class of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to the TIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class EA requirements.

10. Certification – The testing and documentation of the transmission performance (e.g., Category 5e / Class D) of a permanent link or channel, based on sweep frequency (where applicable) testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of

installation. Channel certification is optional and is the responsibility of the group using the channel.

11. Channel – The entire physical pathway between active equipment ports, inclusive of all patch cords, patch panels, jacks and cabling segments.
12. Class C – A category of transmission performance, defined in ISO and EN standards, that specifies electrical properties up to 16 MHz
13. Conduit - A raceway of circular cross-section.
14. Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point (MPOE) and interconnection point to the network. Commonly referred to as Telco Room in Americas, POP Room in EMEA and Building Entrance in AsiaPac. Referred to as Building Entrance Facility in international and European industry standards and Entrance Facility (EF) in American industry standards. The EF is linked to the CD, where present, or to the BD.
15. Floor Distributor (FD) – Termination point for horizontal cabling and interconnection point for network access. Commonly referred to as IDF in Americas and AsiaPac and as Sub Comms Room in EMEA. Referred to as Floor Distributor (FD) in international and European industry standards and Horizontal Cross-connect (HC) - FD quantities and locations are determined by building size and geometry so that all points served are within 90 cable meters (295 cable feet) of an FD. The FD feeds all Telecommunications Outlets (TO's) in its service zone. All FD's in a building are linked to the building's Building Distributor (BD) via backbone cabling.
16. Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.
17. Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept is based on the assumption that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed, and the electrical characteristics of the permanent link will remain unaltered.
18. Plenum - A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.
19. Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.
20. Spine – also called a backbone, the main communications cables in an IDF.
21. Provide: Where the word "provide" is used, the word is understood to mean, "the Contractor shall furnish and install" the equipment, tests, inspections, etc. referenced.
22. Related Work: The sections referenced under the article RELATED SECTIONS are understood to include provisions that directly affect the work being specified in the section where the RELATED SECTIONS article occurs.

23. Concealed: Where the word "concealed" is used in conjunction with raceways, equipment and the like, the word is understood to mean hidden from sight as in chases, furred spaces or suspended ceilings.

24. Exposed: Where the word "exposed" is used, the word is understood to mean open to view.

1.5 QUALITY ASSURANCE

A. Communications Contractor shall have a complete working knowledge of low voltage communications cabling applications such as, but not limited to data, voice and video network systems.

B. Communications Contractor shall have installed similar-sized systems in at least ten (10) other projects in the last five (5) years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document.

C. Communications Contractor and individual installation crew members shall be experienced and qualified to perform the work specified herein at time of bid submission. All onsite supervision personnel that will be assigned to this project shall be listed in the Pre-Installation Submittal.

1. 80% shall have a minimum of three (3) years of experience in the installation of the types of systems, equipment, and cables specified in this document prior to this bid.

2. All installation team members must demonstrate knowledge and compliance with all applicable methods, standards, and codes.

3. All members of the installation team shall be certified by the Structured Cabling System Assurance Warranty provider as having completed the necessary training to complete their part of the installation and capable of an installation that falls under manufacturer’s guidelines necessary to obtain the Manufacturer’s System Assurance Warranty.

4. Any personnel substitutions shall be noted in writing to HITS.

D. A BICSI RCDD shall supervise and approve all on-site work as a recognized member of the Contractor’s installation team.

E. Refer also to General Conditions.

1.6 COMPLETENESS OF WORK

A. Complete and usable work: The contractor is responsible for providing complete and usable work according to contract documents. All materials and equipment shall be provided with all accessories and additional work required for field conditions, as well as additional work and accessories required for complete, usable, and fully functional construction and systems, even if not explicitly specified or indicated. Telecommunications system in this Contract shall be provided as complete and operable systems in full compliance with requirements on drawings and specification requirements. Drawings are diagrammatic and specifications are performance-based, and Contractor shall provide all work required to comply with drawings and specifications, even if not explicitly indicated or specified. Contractor shall be responsible for coordinating installation of electrical systems with all field conditions and work of other trades. Minimum clearances and work required for compliance with NFPA 70, *National Electrical Code*® (*NEC*®), and manufacturer’s instructions shall be provided. Comply with additional requirements indicated for access and clearances. Contractor shall verify all field conditions and dimensions that affect selection and provision of materials and equipment, and shall provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment. Contractor shall protect from damage

resulting from Contractor's operations existing facility, equipment, and wiring. Extra charges for completion and contract time extension will not be allowed because of field conditions or additional work required for complete and usable construction and systems. Comply with additional requirements indicated for access and clearances.

B. Drawings and specifications form complementary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Except where explicitly modified by a specific notation to contrary, it shall be understood that indication or description of any item, in drawings or specifications or both, carries with it instruction to furnish and install item, provided complete.

C. Terms: As used in this specification, provide means furnish and install. Furnish means "to purchase and deliver to project site complete with every necessary appurtenance and support," and install means "to unload at delivery point at site and perform every operation necessary to establish secure mounting and correct operation at proper location in project."

D. Authority approvals: Give notices, file plans, obtain permits and licenses, pay fees, and obtain necessary approvals from authorities that have jurisdiction as required to perform work according to all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

E. Supplementary items: Provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure and complete installation. Examine project drawings and other Sections of specifications for requirements that affect work of this section. Completely coordinate work of this section with work of other Sections and provide a complete and fully functional installation. Refer to all other drawings and other specifications sections that indicate types of construction in which work shall be installed and work of other sections with which work of this section must be coordinated

F. Quantities: Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

1.7 CONTRACTOR REQUIREMENTS

A. In order to accomplish the conditions of this agreement, the Contractor shall perform the specific duties listed herein.

B. Contractor shall provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services to provide and install a complete communications cabling infrastructure system. Pay all required sales, gross receipts, and other taxes.

C. Insurance
1. The Contractor shall procure, submit for review, and maintain for the duration of this agreement, insurance against claims for injuries to persons or damages to property which may arise from, or in connection with, the performance of work hereunder by the Contractor, his agents, representatives, employees or subcontractor. The Contractor shall pay the cost of such insurance.
2. COH, its directors, officers, representatives, agents and employees, respectively, shall have no responsibility to the Contractor with respect to any insurance in accordance with the provisions set forth herein.

D. Regulatory Requirements
1. Communications Contractor shall supply all city, county, and state telecommunication cabling permits required by Authority Having Jurisdiction (AHJ).
2. Communications Contractor shall be licensed and/or bonded as required for telecommunications/low voltage cabling systems.

E. Privacy and Confidentiality

1. The Contractor will respect and protect the privacy and confidentiality of COH, its employees, processes, products, and intellectual property to extent necessary, consistent with the legal responsibilities of COH policies.
2. Contractors shall sign a non-disclosure agreement and abide by the requirements to keep confidential all information concerning bid documents and this project.

F. Use of Subcontractors
1. Successful bidder shall inform COH's contact and General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired.
2. COH or COH's designated contact must approve the use of Subcontractors in writing prior to the Subcontractor's hiring and start of any work.

G. The Contractor's designated Project Manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications, references, and drawings) to ensure a quality installation and attend project meetings with the telecommunication Consultant, HITS and others.

H. Coordination
1. Coordinate installation work with other trades (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) to resolve procedures and installation placement for cable trays and cable bundle pathways.
2. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components.
3. Exchange information and agree on details of equipment arrangements and installation interfaces.
4. Coordinate with electrical contractors and plan for the pathway routes used communications cabling to minimize cable lengths. Report any potential over distance cable runs for approval before pulling the cables.
5. Record agreements with other trades and distribute record to other participants, HITS and telecommunication Consultant.

1.8 PRE-INSTALLATION MEETINGS

A. Communications Contractor shall attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section. This venue is to ask and clarify questions in writing with Consultant, project manager, and COH IT representative.

B. Agenda
1. Safety
2. Work to be performed
3. Scheduling
4. Coordination
5. Submittals (Product Data, Shop Drawings, Test Report, As-built Drawings, Warranty)
6. Construction Inspection
7. Final Acceptance

C. Attendance

1. Communications project manager/supervisor shall attend meetings arranged by General Contractor, CoH PM, COH's IT representatives, and other parties affected by work of this document.
2. All individuals who will serve in an on-site supervisory capacity, including project managers, site supervisors, and lead installers, shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation and testing of communications cables on the project.

1.9 CONTRACT ADMINISTRATION

A. IT Consultant shall perform site visits and provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the client.

B. Construction team shall coordinate with CoH IT representatives and provide advanced notice (minimum of one week) for the inspection of all communications-related items (pathway, cabling, racks, etc.) before they are covered (underground, in-wall, above ceiling, etc.).

C. Job Field Report outline:
1. General: The general installation progress in relation to scheduled work made by the Contractor up to that date.
2. Deficiencies and/or Items of Note: observations of the cable installation that may require corrective action by the Contractor.

D. Contractor shall correct all deficiencies in the Job Field Report and provide photo evidence before they are covered.

1.10 POST INSTALLATION MEETINGS

A. At the time of substantial completion, the contractor shall call and arrange for a post installation meeting to present and review all submittal documents to include but not be limited to As-Built Drawings, Test reports, Warranty paperwork, etc.

B. Attendees shall include
1. Communications Contractor
2. Project Manager/COH IT Representative
3. General Contractor
4. IT Consultant.
5. Other trades that the GC deems appropriate.

C. At this meeting the Communications Contractor shall present and explain all documentation.

D. Any discrepancies or deviations noted by and agreed to by participants shall be remedied by the Communications Contractor and resubmitted within one (1) week of the meeting.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.

B. Communications Contractor requirements:
1. Be responsible for prompt material deliveries to meet contracted completion date.
2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.

4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
5. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.
6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants.
7. Equipment damaged prior to system acceptance shall be replaced at no cost to COH.
8. Contractor shall be responsible for all handling and control of equipment. Contractor is liable for any material loss due to delivery and storage problems.

C. COH/General Contractor shall provide the security requirements for Contractor to follow.

1.12 PROJECT/SITE CONDITIONS

A. For all environmental recommendations, refer to master Architectural section.

B. For all security recommendations, refer to related consultant sections.

C. Contractor shall provide daily a clean work environment that is free from trash/rubbish accumulated during and after cabling installation.

D. Contractor shall keep all liquids (drinks, sodas, etc.) away from finished spaces. If any liquid or other detriment (cuts, soils, stains, etc.) damages any finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

E. Damage by Communications Contractor to the work of others will be remedied at the Contractor's expense in a timely manner.

1.13 WARRANTY

A. The Contractor shall be a certified Manufacturer's Value Added Reseller (VAR) and/or Authorized Installer and provide an end-to-end product warranty, adhere to the industry standard engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this project.

B. Contractor shall coordinate with manufacturer for warranty paperwork and procedures prior to the start of the project.

C. Contractor shall provide a minimum one (1) year warranty on installation and workmanship PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system and shall commit to make available local support for the product and system during the Warranty period.
1. The Extended Product Warranty shall apply to all passive structured cabling system components and shall cover the replacement or repair of defective products and labor for the replacement or repair of such defective products for a minimum of one (1) year.
2. The System Assurance Warranty provides a complete system and product warranty that will be extended to the end-user, ensuring the structured cabling system will be free of defects in materials and workmanship, will meet or exceed applicable performance requirements defined in the contract documents, and support all current and future network applications for a minimum of twenty (20) years.

D. Contractors Warranty
1. General requirements: Comply with additional requirements in contract general requirements and extended warranties required in other specification sections.

Refer to all other 27xxxx sections for specific additional warranty requirements that exceed or are in addition to those of this section.

2. Contractor warranty: Provide all services, materials and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

   a) Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name. Replace material and equipment that require excessive service during guarantee period as determined by Owner.
   b) Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by the installation contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.
   c) Submit copies of equipment and material warranties to Owner before final acceptance.
   d) At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner.
   e) If warranty work problems cannot be corrected immediately to Owner's satisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary, to resolve problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.
   f) Owner's rights: This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.

3. Pathways Material and Installation warranty: Provide all services, materials and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

4. Grounding and Bonding Material and Installation warranty: Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. Scope of warranty includes all equipment,

devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

5. Firestopping Material and Installation warranty: Provide all services, materials and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

E. SCS Manufacturers Extended Warranty

1. SCS Systems will be covered by a two-part certification program provided by a manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow-on program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support the applications for which it is designed, during the minimum 15-year warranty of the certified system.

2. The second portion of the certification is a minimum 15-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).

3. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.

4. Documentation proving the cabling system's compliance to the End-to-End Link Performance recommendations, as listed in ANS/TIA-568-B shall be provided by the Vendor prior to the structured cabling system being installed.

5. The cabling system must conform to the current issue of industry standard ANSI/TIA -568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.

6. Purchaser demands strict adherence to the performance specifications listed in ANSI/TIA -568 series standards.

7. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacturer the product used in this cabling system.

F. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturer, registering the installation.

1.14 PAYMENT

A. Refer to the General Contractor contract documents and/or master specifications issued by Architect for project and cost payment details.

1.15 SUBMITTALS

A. Refer to Requirements of Division 1

B. Refer to Sections 271300 and 271500

C. The Communications Contractor shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until HITS has approved

the respective submittal in writing. Such work shall be in accordance with approved submittals.

D. The Design Consultant and the City of Houston Information Technology Department (COH HITS) must both approve all product data prior to procurement for all materials referenced in Division 26, 27.

E. Other City Departments may have specific needs in addition to the specification listed within. It is the design consultant responsibility to ensure other City departments get a chance to review the Division 26 and 27 specifications referenced in this specification.

F. Pre-Installation Submittal Requirements

1. Communications Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
2. City, county, and/or state telecommunication cabling permits as required by Authority Having Jurisdiction (AHJ).
3. Executed non-disclosure agreement.
4. Appoint a Project Manager and provide the name and contact information.
5. Shop Drawings
    a) Communications Contractor shall submit, for approval, floor plans that identify all device locations, cable routes and quantities, cable types, riser locations, and references to installation details and diagrams.
        1) Communication Contractor shall notify HITS of cable routes exceeding permanent link length limit.
    b) Communications Contractor shall submit, for approval, diagrams that show room layouts, rack layouts (including elevations), riser layouts, etc.
    c) The Contractor shall make any corrections as required by the consultant team and submit revised shop drawings to the team for approval.
    d) Approval by the Consultant of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules. Requests to deviate shall be submitted in writing to the Architect.
6. Product Data Cut-sheets
    a) Communications Contractor shall submit catalogue cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten and/or highlighted to indicate exact selection.
    b) Communications Contractor shall identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.
7. Warranty
    a) The Communications Contractor shall submit appropriate documentation from the certifying manufacturer showing the project is registered and qualified for the System Assurance Warranty.
    b) All subsequent work shall be in accordance with approved submittals. The Communications Contractor shall not perform any portion of the work requiring approval of the System Assurance Warranty manufacturer’s warranty registration qualification procedures that would

disqualify any part or all of the wiring system from that warranty qualification.

8. Qualifications

   a) Communications Contractor shall submit a list of the Contractor's previous projects that demonstrate qualification for this project. This list shall include, but not be limited to:

      1) At least ten (10) other projects in the last five (5) years
      2) Name and location of project
      3) Project contacts, email addresses, and phone numbers
      4) Total square footage
      5) Total number of cables/drops
      6) Types of media

   b) Communications Contractor shall submit an up-to-date and valid statement of qualifications for those assigned to perform the work specified herein at time of bid submission.

      1) Communications Contractor Employees
      2) Subcontractors

   c) Manufacturer certifications for Contractor and installers.

9. Cable Testing Plan

   a) The Contractor shall provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber components and accessories prior to beginning cable testing.

   b) The following minimal items shall be submitted for review:

      1) A testing plan that clearly describes procedures and methods.
      2) Product data for test equipment.
      3) Certifications and qualifications of all persons conducting the testing.
      4) Calibration certificates indicating that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
      5) Examples of test reports, including all graphs, tables, and charts necessary for display of testing results.

10. Samples

    a) For workstation outlet connectors, jack assemblies, housings and faceplates for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and COH representative for color before purchasing materials.

11. Unit Pricing

    a) Provide add/deduct unit pricing for a permanent link, including all components, with an average cable length of a linear 150'-0". All requirements and specifications will be enforced.

12. Technology Implementation Plan

a) Submit the Technology Implementation Plan in accordance with section 2.7 and Appendix A.
b) All major components of the communications systems shall be included in the implementation plan for review and approval.

G. Closeout Submittal Requirements

1. As-Built Drawings

a) Communications Design drawings are to be supplied to the Architect to prepare the master “As-Built” drawings.
b) Submit one electronic copy and one hard copy with project deliverables within three (3) weeks subsequent to substantial completion.
c) As-Built drawings shall include one copy in AutoCAD format and one copy in PDF, same version as used by Architect and consultant. Dimensions and scale of the drawing sheets submitted shall match the size of the drawing sheets used for the contract documents.
d) Utilize normal recognized drafting procedures that match AutoCAD standards, Architect and Consultant guidelines, and methodology.
e) The As-Built drawings shall incorporate all changes made to the building identified in, but not limited to, addendum, change notices, site instructions or deviations resulting from site conditions.

1) Contractor shall clearly identify any resubmitted drawing sheets, documents or cut sheets either by using a color to highlight or cloud around resubmitted information.
2) Maintain drawing numbering or page/sheet scheme consistency as per previously issued drawings/documents.

f) Provide dimensioned plan and elevation views of networking components, showing:

1) All work area outlet locations complete with outlet/cable labeling.
2) Rack and/or cabinet locations complete with labeling.
3) One-line diagram of equipment/device interconnections with the cable plant.
4) Standard or typical details of installations unique to COH’s requirements.
5) Graphic symbols and component identification on detail drawing shall conform to CoH IT standards and industry best practices.

2. The Communications Contractor shall deliver the Installer's Extended Product Warranty and Manufacturer's signed System Assurance Warranty of installed cabling system to include all components that comprise the complete cabling system.

a) Delivery shall be completed within two (2) weeks of the time of final punch list review.
b) Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

3. Cable Testing Report Requirements

a) Submit certified test reports of Contractor-performed tests. Contractor shall submit the required Test Reports in the format and media specified, upon completion of testing the installed system.
b) The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.

c) Three (3) sets of electronic and hardcopy versions of test reports shall be submitted together and clearly identified with cable designations.

d) Cable inventory data shall be submitted for all fiber, copper, and coaxial cabling and termination components. Include products furnished:

1) Manufacturer's name
2) Manufacturer's part numbers
3) Cable designations
4) Location and riser assignments
5) Product Data

H. The Contractor’s BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all documents prior to submitting. The Contractor’s RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of telecommunications cabling products and shall be the manufacturer’s latest standard design in satisfactory use for at least one year prior to bid opening.

B. All material and equipment, as provided, should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products.

1. All shall be typical commercial designs that comply with the requirements specified.

2. All material and equipment shall be readily available through manufacturers and/or distributors.

C. All equipment shall be standard catalogued items of the manufacturer and shall be supplied complete with any optional items required for proper installation.

D. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility.

E. All materials shall be UL- and/or ETL-approved and labeled in accordance with NEC for all products where labeling service normally applies.

F. Materials and equipment requiring UL 94, 149 or 1863 listing shall be so labeled. Modification of products that nullifies UL labels is not permitted.

G. Backward Compatibility: The provided products shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the basic link and channel measures shall meet or exceed the lower category’s specified parameters.

H. Component Compliance: The provided products shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent link and channel, regardless of the fact that tests for link and channel ultimately meet required specifications.

I. All hardware, software, firmware, and/or operating system requirements given are the minimum requirements. The Contractor's product shall meet or exceed these requirements. The product selected shall meet the operational, functional, and

performance requirements specified herein. Additionally, due to the rapid advancement and antiquation of technology related products, the supplied product shall be the “contemporary technical equivalent” of that specified without additional cost to Owner. “Contemporary technical equivalent” shall be based on a comparison of technology at the time of publication of specification to the technology at the time of the first product submittal. Final product approval is at the sole discretion of the City.

2.2 PRODUCT SUBSTITUTION

A. City of Houston has established standards on the IT and Communications system products in order to meet the performance, compatibility, system warranty, and cybersecurity requirements of the critical IT infrastructure system. As such substitution for certain products including but not limited to the following are not permitted:
   1. Cisco (and Meraki) network equipment products
   2. HD2 for Digital Signage Players
   3. Evoko for Room Schedulers
   4. CommScope for voice/data cabling system
   5. Corning for fiber cabling system
   6. CPI for equipment racks/cabinet and vertical/horizontal cable managers
   7. Extron for AV Control/Switching

B. Products listed as “No Substitution” or “Substitution not permitted” shall not be substituted. Substitution may only be considered when a product becomes unavailable through no fault of the Contractor.

C. For products listed as “or approved equal”, substitution products from different manufacturers are allowed. Include written substitution request with product submittal for review and approval.

D. Product substitution shall not void, alter or change manufacturers’ structured cabling system warranty.

E. Document substitution requests with complete data substantiating compliance of proposed substitution with Contract Documents. Include the following in each request for substitution:
   1. Product identification, manufacturer’s name and address
   2. Reason for the substitution
   3. Product Data:
      a) Description, performance and test data, reference standards, finishes and colors.
      b) Samples: Finishes.
      c) Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
      d) Data relating to changes required in construction schedule.
      e) Cost comparison between specified and proposed substitution.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. HITS will be the final judge of acceptability, with review by IT Consultant and the distribution of the acceptance by the Architect.

H. No substitute shall be ordered, installed or utilized without written verification of acceptance from HITS.

2.3 PROCUREMENT

A. Due to the rapid development of technology, the contractor shall ensure that all communications products are timely fashion, but not outdated by the installation date.

B. Submit a copy of Appendix A “Technology Implementation Plan” as a part of the Product Submittals required elsewhere in this document.

C. The “Procurement Lead Time” shall be expressed in days or weeks, and shall include time required for the contractor’s personnel to order and receive the material. Substantiation may be required.

D. “Installation Start Date” and “Installation Duration” should be an accurate estimate based on known facts in the project. Substantiation may be required.

E. The Contractor shall not purchase any materials requiring submittals until HITS approves the submittal for that material and the Technology Implementation Plan.

F. The Contractor shall not purchase any materials requiring submittals until the date established by HITS as the Purchasing Authorized Date.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements
1. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

B. Established Dimensions
1. Where field measurements cannot be made without delaying the work, coordinate with the General Contractor to establish dimensions.
2. When approved in writing, proceed with fabricating units without field measurements.
3. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

C. Pre-installation inspection
1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
2. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to Owner.

3.2 INSTALLATION

A. General
1. Contractor shall install work in accordance with specifications, drawings, manufacturer’s instructions and approved submittal data.

B. Allowable cable bend radius and pull tension:

a) In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation.
b) Refer to cable manufacturer's bend radius recommendations for the maximum allowable limits.
c) After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.

C. Pull Strings
1. Provide pull strings in all new conduits, including all conduits with cable installed (trailer strings) as part of this contract.
2. Data and video cables can be pulled in tandem with pull strings.
3. The pull strings must move freely to prevent cable jacket/cable damage during pulls.

D. Labeling
1. Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
2. Flat-surface labels: Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.
3. Provide transparent plastic label holders, and 4-pair marked colored labels.
4. In accordance with ANSI/TIA-606-B "Administration Standard for Commercial Telecommunications Infrastructure":
    a) Install colored labels according to the type of field as per color code designations.
    b) Use “designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields”.
5. Pathway Labels and Labeling System
    a) Labeling system shall consist of a hand-held portable printer
    b) Conduits: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive. Label size shall be appropriate for the conduit size. Font size shall be legible from the finished floor.
    c) Inner duct: Polyethylene general-purpose tagging material attached using tie wraps.
    d) Junction boxes: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name. Font size shall be easily visible from the finished floor.
    e) All labels shall be permanent, i.e. will not fade, peel, or deteriorate due to environment or time.
    f) Identification
        1) All conduits, junction boxes, gutters, and pull boxes shall have machine-generated labels easily visible from the finished floor.
        2) Conduits shall be labeled with the word “communications” and the conduit’s origination room number and destination room number.
        3) The Contractor shall label conduit at each wall and floor penetration and at each conduit termination, such as outlet boxes, pull boxes, and junction boxes, or as otherwise specified in other sections.
        4) Junction boxes, gutters and pull boxes shall be labeled with identification name or number as determined by contractor and submitted for approval.
        5) The Contractor shall label conduit sleeves at each wall and floor penetration.

E. Firestop
1. Provide approved fire-resistant materials to restore originally-designed fire-ratings to all wall, floor, and ceiling penetrations used in the distribution and installation for communications cabling system.

2. Install and seal penetrations (conduit, sleeves, slots, chases) in fire-rated barriers created for communications infrastructure to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.
3. The firestopping material shall maintain/establish the fire-rated integrity of the wall/barrier that has been penetrated.
4. All through penetrations in a fire rated surface require a sleeve, regardless of penetration diameter or penetrating cable count.
5. Using a “ring and string” method of installing cabling for membrane penetrations in a wall cavity is acceptable, provided the solution was accepted by HITS in writing. Code-compliant firestopping rules still apply.
6. Coordinate firestopping procedures and materials with General Contractor.
7. Sharing the pathway of other trades/utilities through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant firestopping.
8. Provide and install removable, intumescent mechanical systems in floor chases for all openings greater than 0’-4”.
9. Provide and install removable, intumescent, firestop bricks for all openings greater than 0’-4” where there are penetrations through walls.
10. Bricks shall be listed for insertion in fire-rated openings and require restraining materials or apparatus as needed per manufacturers’ specifications.
11. Provide manufacturer recommended material for rated protection for any given barrier.
12. Laminate and permanently affix adjacent to chases the following information:

    a) Manufacturer of firestop system.
    b) Date of installation/repair.
    c) Part and model numbers of system and all components.
    d) Name and phone numbers of local distributor and manufacturer’s corporate headquarters.
13. Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.
14. Materials shall be installed per manufacturer instructions, be UL-listed for intended use, and meet NEC and locals codes for fire stopping measures.
15. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.
16. Develop training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

F. Within the normal environment, the installed systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.

G. Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in cables, positions in patch panels, cross connects, and terminal strips, and space in cable pathways and backboard layouts to accommodate 20% future increase in structure cable system capacity.

H. In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to make the cabling system work and comply with the applicable manufacturer written technical recommendations and standards.

I. System Tests

1. Upon completion of the installation of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.

    a) Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
    b) Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
    c) Approved instruments, apparatus, services, and qualified personnel shall be utilized.
    d) The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing parameters listed elsewhere), and documentation as specified below.
    e) This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy and printed test data.

2. Non-Compliant Cabling

    a) Testing that shows some or all pairs of a cable do not comply with specifications, without written approval by HITS, shall be replaced at Contractor's expense (including respective connectors).
    b) With HITS's written approval, the over-length cable(s) shall be excluded from requirements to pass standardized tests and shall be explicitly identified.

        1) Testing is still required for non-compliant cabling.
        2) The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground.
        3) The test results must be within acceptable tolerances and shall be submitted with HITS's acceptance document.

3. Failed Tests

    a) If tests fail, Contractor shall correct as required to produce a legitimate passing test.
    b) Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
    c) If the Contractor is found to have manipulated or falsified any failing test result to show a "PASS" for any reason (without written notice and prior approval of HITS), the Contractor shall be required to employ a Third-Party Testing Agent selected by HITS to retest the complete cable plant and shall be required to pay all costs associated with this retesting.

4. HITS reserves the right to be present during any or all testing.

3.3 CLEANING

A. The Contractor will clean all surfaces prior to final acceptance by HITS.

3.4 COMPLETION INSPECTION AND PUNCH LIST

A. Before scheduling the completion inspection, the contractor's supervisor (RCDD) shall walk the site to verify that all scope of work has been completed per the construction

documents and the City's IT standards, and all required documentation (as-built drawings, test reports, etc.) have been submitted.

B. Provide the Engineer and HITS with a minimum one-week notice prior to scheduling the final completion inspection. Submit a completed Request for Communications Completion Inspection to the HITS representative and Engineer.

C. A Punch List will be generated during the Completion Inspection to document all deficiencies in need of corrective action.

D. Complete all punch list deficiencies within 10 working days. The work is not complete until all punch list deficiencies have been addressed.

3.5 ACCEPTANCE AND CLOSEOUT

A. Contractor must warrant in writing that 100% of the installation meets the requirements specified herein (Standards Compliance & Test Requirements).

B. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation soft and hard copies as described herein.

C. Once all work has been completed, closeout documentation has been submitted, and HITS is satisfied that all work is in accordance with contract documents, HITS shall notify Contractor in writing of formal acceptance of the system.

END OF SECTION 270000

Appendix A Technology Implementation Plan

Contractor Submittal							Submittal Response		
Item No.	Product Description	Spec Section and Para No.	Qty	Procurement Lead Time	Installation Start Date	Installation Duration	Submittal Approved	Purchasing Authorized Date	Remarks
1	Core Switch Cisco C9300-24S-E	272100-2.1	3	6-weeks	12/16/2024	4-weeks	Yes	11/21/2024	Include all accessories
2									
3									
4									
5									
6									
7									
8									
9									
11									
12									
13									
14									
15									
16									

Notes:

1. The above table is shown as an example only.
2. The contractor shall include all major communication system products required for the project.

Appendix B

CITY OF HOUSTON
REQUEST FOR COMMUNICATIONS SYSTEM COMPLETION INSPECTION

Building Name: _____
Building Address: _____
Contractor: _____

I hereby certify that:

1. The Communications system installation at the above-mentioned building is complete (terminated, tested, and labelled) and has been provided in accordance with the Contract Documents.
2. All systems and devices have been thoroughly pre-tested and all necessary corrections have been made.
3. All project documentation, including As-Built Drawings, Test Report, and other such information, has been submitted in accordance with the Contract Documents.

I request that a Communications System Completion Inspection be conducted

on (date)_____.

By:_____

Title:_____

Company:_____

Date of Request:_____