Telecommunications Infrastructure Specifications

Riverside County

Communications Bureau

July 10, 2020

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A. Purpose of Document

1. Riverside County (hereinafter the County) provides this Specifications document to the Construction Professionals who will incorporate the County's inside plant (ISP) and

outside plant (OSP) telecommunications pathway and space requirements in the construction and bid documents as well as in the constructed work, accordingly. This Specifications document is not intended to be exhaustive and is confined to only the fundamentals of telecommunications space and pathway requirements. Because every project is unique and the County departments have divergent requirements that are specific to their operational needs at each facility, the Construction Professionals will elicit input and obtain signoffs on the design and construction of the telecommunications infrastructure from the designated RCIT Communications Bureau Infrastructure Engineer in every phase of the building design process from facility space programming to production of the construction and bid documents; and throughout all stages of the construction.

a. *Note that the modal verb "will" as used in this Specifications document denotes creation of promise and contractual obligation to perform.*
b. *Prior to completion of each design phase, the Construction Professional will complete the checklist provided in Section L of this document to ensure that all RCIT requirements specified in this Specifications document are incorporated in the construction contract documents and drawings.*

B. Definitions

Unless otherwise specified or indicated, technical terms used in this specification will be as defined in ANSI/TIA/EIA-758, ANSI/TIA/EIA-568, TIA/EIA-569, TIA/EIA-606, and ANSI J-STD-607 standards, per the most current edition including associated, ratified addendums.

as-built drawings: AutoCAD drawings prepared by the Construction Professionals responsible for installation (usually the Contractor) as they construct the telecommunications infrastructure upon which they document the actual locations of the constructed components and changes to the original construction contract drawings in AutoCAD provided by the Construction Professionals (usually the Architect or Engineer on Record); these, or a copy of same, are turned over to the County at the completion of the project.

backbone: A facility (e.g., pathway, cable or conductors) between telecommunications spaces within or between buildings/campuses.

backbone cabling: Cabling connecting two or more telecommunications spaces.

backbone pathway system: the structures that conceal, protect, support, and provide access to telecommunications systems and electronic safety and security cabling from a telecommunications space to another telecommunications space; the components of the system typically include conduits, sleeves, cores, cable trays, cable runways, and other support facilities.

can: The modal verb "can" as used in this Specifications document denotes being permitted or having the ability.

Construction Professionals: Firms and individuals hired by and/or contracted with Riverside County, including, but not limited to, Architects, Building Engineering Consultants, Construction Management Consultants, General Contractors, Subcontractors, Specialty Contractors, Multi-Prime Contractors, Interior Designers, System Furniture Vendors, Developers (including Design Professionals, Vendors, and Contractors hired by and/or

contracted with the Developers to deliver the County per the contract between the County and the Developers).

horizontal cabling: Cabling that emanates from the telecommunications room, equipment room, server room, entrance facility (MPOE) to the data outlets, access control field devices, surveillance cameras, and burglar alarm devices.

horizontal pathway system: the structures that conceal, protect, support, and provide access to telecommunications cabling from the outlet/connectors at workstation areas and all other locations, security system field devices, and surveillance cameras in the serving area to the entrance facility room, equipment room, or telecommunications room; the components of the system typically include conduits, J-hooks, raceways, sleeves, cores, cable trays, cable runways, and other support facilities.

inside plant (ISP): Telecommunications infrastructure that is designed and installed inside the building, for the purpose of this Standards document, the ISP components are those supporting structures (i.e., conduits and cable trays) required to link telecommunications spaces, and those (i.e., conduits) from workstation outlets and physical security field devices to the telecommunication spaces.

may: The modal verb "may" as used in this Specifications document denotes possibility.

must: The modal verb "must" as used in this Specifications document denotes necessity, i.e., the fact of being required or indispensable.

outside plant (OSP): Telecommunications infrastructure that is designed and installed externally to the building and typically routed into an entrance facility (MPOE); for the purpose of this Standards document, the OSP components include maintenance holes, handholes, innerducts for both in conduits and direct buried conduits, multi-cell conduits, aerial support structures, and all other aboveground and underground support structures required to link serving facilities to outlying locations and enable voice, data, video, and other low-voltage systems. The County's demarcation point begins at the property line where the Construction Professionals hired by or contracted with the County will install an underground handhole or maintenance hole to which the County's OSP conduits enter from the entrance facility and the serving public telephone company's conduits enter at the opposite end from the street.

physical security field devices: Peripheral devices, e.g., card reader, siren, sensor, lock, position switch, request to exit motion (REX), button, and push plate connected to the access control panels; cameras connected to video surveillance systems; and panels, key pads, zone expanders, motion detectors, door contacts, and glass break detectors connected to the burglar alarm system.

record drawings: Drawings prepared by the Construction Professionals of Record responsible for design, as compendium of the original design drawings, site changes taken from the redlined construction drawings, and as-built drawings by the Construction Professionals responsible for installation.

redlined construction drawings: Copy of contract drawings and specifications on which the redlines to reflect actual site and underground conditions that differ from those on the contract documents, or changes that have been made during construction according to the site conditions recorded by the Construction Professionals responsible for inst. Included in

such drawing sets are, as a minimum, measure horizontal and vertical locations of underground utilities and appurtenances, referenced to OSP infrastructure being installed and to permanent surface improvements; measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the OSP infrastructure being installed; field changes of dimension and detail; details not on original contract drawings. The Construction Professionals will always have such drawings onsite and be ready for review by the Authority Having Jurisdiction, Inspector of Record, and RCIT Communications Bureau Infrastructure Engineer.

Riverside County Information Technology (RCIT): The Information Technology (IT) department of Riverside County.

RCIT Communications Bureau Infrastructure Engineer: An RCIT resident information technology subject matter expert specializing in telecommunications infrastructure design and implementation.

serving public telephone company: An operator or service provider of any facility that is used to convey telecommunications signals to and from a customer premises.

shop drawings: Drawings, diagrams, schedules and other data specifically prepared by the Construction Professionals responsible for installation (usually the Contractor) to communicate how they intend to construct components of the telecommunications infrastructure, taking into account field measurements and field construction criteria to conform to the design intent of the Construction Professionals responsible for design (usually the Architect or Engineer of Record) as depicted on the contract documents; shop drawings must be reviewed and approved by the Architect or Engineer of Record prior to work being performed.

should: The modal verb "should" as used in this Specifications document denotes desirable or expected state.

telecommunications: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is information of any nature by cable, radio, optical, or other electromagnetic systems.

telecommunications bonding backbone: A copper conductor extending from the telecommunications main grounding busbar to the farthest floor telecommunications grounding busbar.

telecommunications entrance facility (entrance facility, also known as MPOE or Minimum Point of Entry): An entrance to a building for both public and private network service cables (including wireless) including the entrance point of the building and continuing to the entrance room.

telecommunications equipment room: An environmentally controlled centralized space for data and telecommunications equipment.

telecommunications grounding busbar (TGB): The grounding connection point for telecommunications systems and equipment in the area served by a telecommunications space.

telecommunications infrastructure (or infrastructure): A collection of those telecommunications components, excluding equipment, that together provide the basic

support for the distribution of all information within a building or campus; generally, a telecommunications infrastructure consists of telecommunications spaces, telecommunications pathways, telecommunications wiring, and telecommunications grounding and bonding.

telecommunications main grounding busbar (TMGB): A busbar in serving as the extension of the building alternating grounding electrode system for the telecommunications infrastructure; and as the central attachment point for the telecommunications bonding backbone. It is generally located in the Entrance Facility (MPOE) room.

telecommunications room (TR; also known as IDF): An enclosed room for housing telecommunications equipment, cable terminations, and cross-connect cabling.

telecommunications space: A room used for housing the installation and termination of telecommunications equipment and cable, e.g., equipment rooms, server rooms, telecommunications rooms, maintenance holes, handholes, handholes, entrance facilities.

will: The modal verb "will" as used in this Specifications document denotes creation of a promise and contractual obligation to perform. See Bryan A. Garner, *A Dictionary of Modern Legal Usage* (2d ed., Oxford U. Press 1995).

would: The modal verb "would" as used in this Specifications document denotes probable event or situation.

work area outlet (WAO): A data network connecting device in the work area on which data and audio-visual cable or outlet terminates.

C. General Design and Installation Requirements

1. The Construction Professionals will design and install the conduit systems for the telecommunications infrastructure according to this Specifications document and any additional requirements as determined by the RCIT Communications Bureau Infrastructure Engineer.

2. The Construction Professionals will conform to all requirements in this Specifications document and to those provided by the serving public telephone company or companies. Note that aerial distribution of telecommunications systems is allowed with written approval from RCIT Communications Bureau Infrastructure Engineer prior to commencement of design.

3. The Construction Professionals will coordinate with, and submit to, RCIT Communications Bureau Infrastructure Engineer for approval in writing all design drawings prior to completion of each design phase from Schematic Design to Design Development to Construction Documents to issuance of Bid Documents; shop drawings prior to construction; field redlined drawings, as-built drawings and record drawings as part of closeout documentation.

    a. **For Inside Plant (ISP) Engineering Design** – The Construction Professionals (specifically, the Architects, Civil Engineers and Electrical Engineers of Record hired by and/or contracted with the County or the Developer) will include legend sheet; site plan; plan view drawings; enlarged floor plans of the telecommunications rooms;

telecommunications grounding and bonding single-line diagram; and other drawings as deemed necessary by the RCIT Communications Bureau Infrastructure Engineer. Locations and sizing of all telecommunications spaces as well as pathways connecting the telecommunications spaces to house the required information technology systems, distributed antenna systems, emergency services communications systems, and intelligent building systems must be determined no later than completion of 100% Schematic Design.

b. **For Outside Plant (OSP) Engineering Design** – The Construction Professionals (specifically, the Architects, Civil Engineers and Electrical Engineers of Record hired by and/or contracted with the County or the Developer) will perform a search of all publicly available records (e.g., cities, towns, special districts that manage public functions) and those kept by the County departments (e.g., Economic Development Agency, Transportation and Land Management Agency) to find and show the existence and location of any underground utility pipes or structures on the design and construction documents. The design deliverables include survey reports; site plans; layout schematic of all conduits, maintenance holes and handholes in the scope; enlarged schematic of each individual handhole and maintenance hole into which specific conduits enter and exit; plan and profile sheet (an engineering drawing that combines a plan view, and XY plot of the elevation of the targeted linear feature, clearly depicting the change in elevation required for the underground conduits and all other underground utilities in proximity); butterfly layout drawing for each maintenance hole and handhole (showing duct configuration for each wall, dimensions and GIS coordinates of the maintenance hole and handhole); entrance facility point of entry (MPOE), clearly depicting required conduits and junction boxes; traffic control drawings for approval by Authority Having Jurisdiction; drawings required for permitting approval by Authority Having Jurisdiction; and all other drawings as deemed necessary by the RCIT Communications Bureau Infrastructure Engineer. The Construction Professionals responsible for design (usually the Architects and Engineers of Record) will be assure the accuracy and acceptability of the OSP design and for identifying right-of-way restrictions and/or incumbency with an explanation of each. In the event of discrepancies arising during construction, the Architects and Engineers of Record will be responsible for determining an acceptable solution and for revising the construction documents for approval by the Authority Having Jurisdiction and by RCIT Communications Bureau Infrastructure Engineer.

c. **For Outside Plant (OSP) Construction** – Prior to trenching, the Construction Professionals (specifically, the General Contractors and Electrical Contractors hired by and/or contracted with the County or the Developers) will investigate to determine the subsurface condition and existing foreign pipes and or ducts, including the location and elevation of existing water mains, gas mains, sanitary sewers, storm drains, electric conduits, telephone line and any other utilities which may conflict with the design and construction of the proposed OSP design. The Construction Professionals will take due precautionary measures to protect any utility lines shown and any other lines not of record or not shown on the design drawings; will utilize electronic locating devices and any other devices necessary or dig pot holes to locate underground obstacles. If foreign substructures are found in or along the trenching path, trenching will be stopped until their purpose and ownership is investigated for proper installation of underground conduits to each of the building locations as outlined.

d. **OSP Design Built Delivery Method** – The Constructions Professionals will conform to the above-delineated engineering design and construction requirements.

4. The Construction Professionals will familiarize themselves with all codes, ordinances, and industry standards specified by RCIT in this Standards document and ensure that all design deliverables and constructed work that pertain to telecommunications infrastructure conform to the latest issue and addenda of the National Electrical Code, the California Building Code, California Electrical Code (inclusive of all informational notes in Article 800), all local codes and ordinances as applicable, and the ANSI (American National Standards Institute), TIA (Telecommunications Industry Association), EIA (Electronic Industry Alliance), BICSI, NECA (National Electrical Contractors Association (NECA) standards, including but not limited to the those listed below, with the understanding that where conflicts exist between codes and standards or between standards, the most stringent requirement of all will prevail.

   a. United States Department of Labor, Occupational Safety and Health Administration, Code of Federal Regulations
      1) Title 29, Part 1926: *Safety and Health Regulations for Construction*
      2) Title 29, Part 1910: *Occupational Safety and Health Standards*
   b. State of California Public Utilities Commission (Cal. P.U.C.) Publication: G.O. 128 *Rules for Construction of Underground Electric Supply and Communications Systems*
   c. American Society for Testing Materials (ASTM) Publications
      1) ASTM C478: *Standard Specification for Precast Reinforced Concrete Manholes Sections*
      2) ASTM C857: *Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures*
      3) ASTM C858: *Standard Specification for Underground Precast Concrete Utility Structures*
      4) ASTM C891: *Standard Practice for Installation of Underground Precast Concrete Utility Structures*
      5) ASTM C1037: *Standard Practice for Inspection of Underground Precast Concrete Utility Structures*
      6) ASTM D1751: *Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)*
      7) ASTM D1557: *Test Method for Laboratory Compaction Characteristics Using Modified Effort (56,000 ft-lbf/ft^3 (2,700KN-m/m^3)*
      8) ASTM E814 - 10 *Standard Test Method for Fire Tests of Penetration Firestop Systems*
   d. National Electrical Manufacturer's Association (NEMA) Standards
      1) NEMA 250 – *Enclosures for Electrical Equipment (1000 Volts Maximum)*
      2) NEMA FB 1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit Electrical Metallic Tubing and Cable*
      3) NEMA RN 1 – *Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel*
      4) NEMA TC-2 *Electrical Polyvinyl Chloride (PVC)Tubing and Conduit*
      5) NEMA PTC-3 *Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing*

6) NEMA TC-6&8 *Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations*
7) NEMA TC-9 *Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation*

e. Underwriters Laboratories Inc. (UL) Publications
1) UL 6 Electrical Rigid Metal Conduit – Steel
2) UL 514B Fittings for Conduit and Outlet Boxes
3) UL 651 Schedule 40 and 80 Rigid PVC Conduit
4) UL 467 Electrical Grounding and Bonding Equipment

f. National Utility Contractors Association (NUCA) – *HDD Installation Guidelines*
g. HDD Consortium *Horizontal Directional Drilling Good Practices Guidelines*
h. ANSI/TIAEIA-568.1-D, *Commercial Building Telecommunications Cabling Standard*
i. ANSI/TIA/EIA-606-C, *Administrative Standard for the Telecommunications Infrastructure*
j. ANSI/TIA/EIA-607-C, *Commercial Building Grounding and Bonding Requirements for Telecommunications*
k. ANSI/TIA/EIA-569-C, *Commercial Building Standards for Telecommunications Pathways and Spaces*
l. TIA/EIA/EIA-758-B, *Customer Owned Outside Plant Telecommunications Cabling Standard*
m. ANSI/TIA/EIA-862-B, *Structured Cabling Infrastructure Standard for Intelligent Building Systems*
n. ANSI/TIA/EIA-5017, *Telecommunications Physical Network Security Standard*
o. *ANSI/NECA/BICSI 568, Standard for Installing Commercial Building Telecommunications Cabling*
p. ANSI/NECA/BICSI 607, *Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings*
q. *ANSI/BICSI 004, Information and Communication Technology Systems Design and Implementation Practices for Healthcare Institutions and Facilities*
r. ANSI/BICSI 005, *Electronic Safety and Security (ESS) System Design and Implementation Best Practices*
s. BICSI G1, *ICT Outside Plant Construction and Installation: General Practices*
t. Unless otherwise specified or noted, designs and installation of the telecommunications underground infrastructure will conform to the following BICSI Publications:
1) Outside Plant (OSP) Design Reference Manual
2) Telecommunications Distribution Methods Manuals
u. *National Electrical Safety Code (ANSI)*, also known as *Institute of Electrical and Electronic Engineers (IEEE) Standard C2*
v. California State Transportation Agency, *Standard Specifications* (Divisions II through XI that pertains to outside plant construction)
w. Manufacturer's recommendations and installation guidelines

D. Deviations From ANSI/TIA/EIA Standards

1. If the Construction Professionals feel that deviation from a given standard is warranted, they will submit a written deviation request to the Riverside County Information Technology Communications Bureau Infrastructure Engineer. The request will, at a

minimum, indicate the standard from which there is a proposed deviation, the substitution being proposed in place of the standard, the reason the request is being made, and an explanation of the justifications (economic, technical or otherwise) for the deviation. The Construction Professionals will not incorporate any deviations without written approval from the Riverside County Information Technology Communications Bureau Infrastructure Engineer

E. Telecommunications Room Specifications

1. **Applicability** – The requirements are for standard commercial office buildings. The Construction Professionals will coordinate and obtain approval from the designated RCIT Communications Bureau Infrastructure Engineer for room sizing and other additional requirements in special function facilities (e.g., hospitals, police stations, fire stations, network communications hubs, facilities to house radio communications systems, public safety operations center, data centers, auditoriums).

2. **Room Use** – The Construction Professionals will design and construct the Telecommunications Rooms to house only telecommunications and information technology functions and related support facilities for the room; and will not place equipment or systems that do not directly support the Telecommunications Room (e.g., building power system, fire monitoring, building automation system, custodial sinks, disposal pluming pipes, mechanical duct work).

3. **Room Completion** – The Construction Professionals will ensure that all trades finish construction of the Telecommunications Spaces upon the substantial completion date per contract, and a minimum of forty-five (45) days for buildings larger than 20,000 square feet prior and a minimum of thirty (30) days for buildings smaller than 20,000 square feet prior to tenancy. Finish means that all trades have installed – and obtained completion signoff from the Inspector of Record (IOR) and RCIT Communications Bureau Infrastructure Engineer for everything specified, including but not limited to, plywood lining and painting, lighting, electrical outlets, HVAC, ceiling tiles, grounding, floor tiles, and door lock with three (3) sets of keys.

4. **Location** – The Construction Professionals will coordinate with RCIT Communications Bureau Infrastructure Engineer to locate the Telecommunications Rooms as close as possible to the center of the occupied space. Maximum distance from the center of the Telecommunications Room to the farthest Work Area Outlet must not exceed a radius of 175 feet unless reviewed and approved by RCIT Communications Bureau Infrastructure Engineer. If occupying more than one floor of a building, a separate Telecommunications Room will be provided on each floor, stacked above one another wherever possible. In multi-story facilities with three (3) or more floors and multi-Departmental occupancy, an additional Telecommunications Equipment Room dedicated only for telephone and data use will be provided next to the 1st Floor Telecommunications Room building voice and data communications systems. Provisions will be made available for easy access into the Telecommunications Room for telephone and data wiring. Telecommunications Rooms must not be located next to elevators, restrooms, electrical rooms, airshafts, mechanical rooms, and outside walls. If occupying

more than one building, each building will require Telecommunications Rooms that meet the above requirements.

5. **Minimum Room Sizes** – The Telecommunications Room must be rectangular in shape and conform to the following inside room dimensions:

Leased Premises – sq. ft.	Room Size
5,000 sq. ft. or less	12’ x 10’
5,000 – 10,000 sq. ft.	12’ x 12’
10,000 – 30,000 sq. ft.*	12’ x 14’
30,000 sq. ft. or larger**	12’ x 14’

* May require more than one room

** Will require more than one room.

The MPOE must be rectangular in shape and conform to the following inside room dimensions:

Leased Premises – sq. ft.	Room Size
10,000 sq. ft.* or larger	10’ x 10’

The Telecommunications Equipment Room must be rectangular in shape and conform to the following inside room dimensions:

Leased Premises – sq. ft.	Room Size
3 – 5 Floors and higher	12’ x 10’
6 – 10 Floors and higher	12’ x 14’
11 – 15 Floors and higher	12’ x 20’

6. **Plywood Wall Lining** – All walls will be lined with AC grade or better, void-free, 4’x8’ sheets of 3/4" plywood. Plywood sheets will be mounted vertically from ceiling height towards floor. Plywood must be painted on all sides with one coat of primer and two coats of white fire-resistant paint. The plywood will be installed with the grade “C” surface facing the wall.

7. **Doors** – The door will be a minimum of three (3) feet wide and 80 inches tall and be located as near as possible to a room corner. The door will be equipped with a lock. Where practical, the door should open outward to provide additional usable space.

8. **Air Conditioning** – A dedicated environmental control system for the Telecommunications Room will always maintain a room temperature between 18°C and 24°C (64°F and 75°F), 24 hours per day, 365 days per year. If a building’s HVAC system cannot ensure continuous operation (including weekends and holidays), provide a standalone HVAC unit with independent controls for the Telecommunications Room. If an emergency power source is available in the building, connect the HVAC system that serves the Telecommunications Room to the emergency power source. Sensors and controls must be in the Telecommunications Room, placed 5 feet AFF as specified on the

Telecommunications Room drawing provided by RCIT Communications Bureau Infrastructure Engineer. If an in-room air conditioner is installed, the air conditioner will be hard wired to the thermostat and RCIT Communications Bureau Infrastructure Engineer must approve the location before installation. If remote-monitoring equipment is available, this room will have its own independent sensor. Average heat load for equipment is approximately 150 BTU per square foot of the Telecommunications Room space (specific heat load will be provided for each room).

9. **Fire Sprinklers** – If fire sprinklers are required in the Telecommunications Room, the sprinkler will have a high temperature standard response full circle head with a heavy-duty cover. Sprinkler lines located inside the Telecommunications Room will not be "charged" under normal conditions. Coordinate placement of the sprinklers with RCIT Communications Bureau Infrastructure Engineer. Sprinkler heads must be a minimum of 10 ft. AFF.

10. **Room Lighting** – Lighting will provide a minimum of 500 lux (50-foot candles) measured 3 ft. AFF. Coordinate placement of light fixtures with RCIT Communications Bureau Infrastructure Engineer to avoid interference with low voltage equipment. Light fixtures must be a minimum of 10 ft. AFF. Use white paint on the walls and ceiling to enhance room lighting. Power for the lighting will not come from the power panel located inside the Telecommunications Room.

11. **Emergency Lighting** – Emergency lighting within the Telecommunications Room will be provided to ensure that the loss of power to normal lights will not hamper an emergency exit from the room.

12. **Floors** – The floor will be designed to support a minimum load bearing of one hundred (100) pounds per square foot and maximum concentration loading of 2,000 lbs. per foot. Standard VCT floor covering will be installed unless otherwise specified.

13. **Ceiling** – If a ceiling is installed in the Telecommunications Room, it must be installed at a minimum of 10 feet AFF. Ceiling protrusions (e.g. sprinkler heads) must be placed to assure a minimum clear height of 10 feet that is clear of obstructions, to provide space over the equipment frames for cables and suspended cable trays. Ceiling finish must minimize dust and be light colored to enhance the room lighting. A hard ceiling will not be allowed in the Telecommunication Room.

F. Electrical Requirements for Telecommunications Spaces

1. **Dedicated Power Feeder** – The Construction Professionals will design and construct each Telecommunications Space with its own dedicated power feeder terminated in an electrical panel located inside the room and flush mounted in the wall. Location of this electrical sub-panel will be closely coordinated with RCIT Communications Bureau Infrastructure Engineer to ensure it does not adversely affect the overall design and use of the space within the room. A separate feeder, conduit, and distribution panel will supply power required for other equipment in the room (e.g. fluorescent lighting, motors, air conditioning equipment). If an emergency power source is available for the building, connect the Telecommunications Room electrical sub-panel into it.

2. **General Purpose Outlets in Telecommunications Room** – The Construction Professionals will design and install 120 Volt 20 Amp duplex outlets at standard height on each of the four walls of the Telecommunications Room; maximum spacing between outlets will not exceed 12 feet.

3. **Electrical Outlets for Equipment Racks** – The Construction Professionals will design and install one (1) dedicated 120 VAC 20 Amp circuit and one (1) 208V 30 Amp circuit with isolated grounds for each equipment rack. The breaker number will be identified on each of outlets with an equipment-generated label. Circuit terminated in a surface mounted 4S box will be attached to the ladder rack using CPI Power Box Bracket Part # TS1006073 (no known equal). Equipment Rack locations, circuit locations and quantity will be specified in the room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

4. **Electrical Outlet for Paging System** – The Construction Professionals will design and install one (1) dedicated 120 VAC 20 Amp circuit with isolated ground terminated on a double duplex outlet in a 4S box (44" AFF). The location of the outlet will be specified in the Telecommunications Room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

5. **Electrical Outlets for Access Control System** – The Construction Professionals will design and install two (2) dedicated 120 VAC 20 Amp circuits with isolated ground terminated on double duplex outlets in a 4S box for every 16 doors. The location of the outlet(s) will be specified in the Telecommunications Room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

6. **Electrical Outlet for Video Surveillance System** – The Construction Professionals will design and install one (1) dedicated 208 VAC 30 Amp circuit with isolated ground terminated on a single NEMA 6-30 receptacle. The location of the outlet(s) will be specified in the Telecommunications Room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

7. **Electrical Outlet for Burglar Alarm System** – The Construction Professionals will design and install one (1) dedicated 120 VAC 20 Amp circuit with isolated ground terminated on double duplex outlets in a 4S box. The location of the outlet will be specified in the Telecommunications Room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

8. **Emergency Air Conditioner Outlet** – The Construction Professionals will design and install one (1) dedicated 208 VAC 20 Amp circuit with isolated ground terminated on a single NEMA 6-20 receptacle. The location of the outlet will be specified in the Telecommunications Room layout provided by the RCIT Communications Bureau Infrastructure Engineer.

9. **Grounding** – The Construction Professionals will design the telecommunications grounding system and install a Telecommunications Main Grounding Busbar (TMGB) in the Telecommunications Space at the location specified by the RCIT Communications

Bureau Infrastructure Engineer. The Grounding Busbar must be CPI Chatsworth Products part #13622-020 (no known equal). The busbar must be insulated from its supporting structure by at least two inches of separation. Bond the busbar to the building AC grounding electrode system. The minimum size of the bonding conductor will be #3 AWG and be sized to carry the maximum short time rating Amps of the building grounding electrode conductor. A supplemental bonding connection is required to be exothermically welded to the structural steel of the building and local AC sub-panel located inside the telecommunications room. Resistance will be no more than 0.1 ohms between the TMGB and the building main grounding source measured following the two-point bonding test method using an earth ground resistance tester. All grounding conductors must be run in EMT conduit.

G. Inside Plant (ISP) Telecommunications Infrastructure Systems and Physical Security Systems Conduit Requirements

1. General ISP Conduit Requirements (Walker-duct conduit system not allowed)

a. **Electrical Metallic Tubing (EMT) Trade Size 4-Inch Conduit Pipes**– All steel EMT conduit pipes must be compliant with the ANSI C80.1 and be listed according to the Underwriters Laboratory (UL)-6 standard; all fittings must conform to NEC requirements.

b. **Flex Conduits** – Flex conduits are not allowed in any conduit runs.

c. **Liquid-Tight Conduits** – Liquid-tight conduits are allowed only in seismic joints between buildings or parts of a building; where required, increase the size by one trade size, e.g., where four 4-inch EMT pipes are specified, install four 5-inch liquid-tight conduits when going through a seismic joint, at the shortest possible length.

d. **Conduit Size, Quantity and Location for Backbone Pathway** – The RCIT Communications Bureau Infrastructure Engineer will determine the size, quantity and location of conduits; the Construction Professionals (usually the Architect and the Electrical Engineers of Record) will perform interdisciplinary coordination with other building engineering consultants to ensure constructability.

e. **Conduit Runs** – Design and install in the most direct route possible. Install an appropriately sized pull box for any conduit run with more than the equivalent of two 90-degree bends. Ream all conduit ends and fit with insulated bushings. Bond conduit ends to the telecommunications grounding system according to California Electrical Code, Riverside County and other applicable ordinances.

   1) **For horizontal cabling** – Each WAO or field device location will have its own dedicated conduit run. Provide a pull string with minimum tensile strength of 50 lbs. from end to end of each section of every conduit run.

   2) **For backbone cabling** – Each conduit run will be continuous the entire length with appropriately-sized pull boxes as required. Install a mule tape from end to

end of each section of every conduit run with footage markings and with minimum tensile strength of 2500 lbs. in each conduit section.

f. **Daisy Chaining** – Daisy chaining in conduits is not allowed.

g. **Radius of Conduit Bends** – The inside radius of all conduits must be at least ten times the outside diameter of the conduit. Conduit bends must be smooth, even and free of kinks or other discontinuities.

h. **Pull Boxes for Conduits** – Provide an appropriately-sized pull box for every conduit run that has the equivalent of more than two 90-degree bends, or where a reverse bend (i.e., between 100 degrees and 180 degrees) exists. Conduits must enter from, and exit to, opposite walls of pull box. Do not use pull boxes to replace conduit bends and do not use conduit fittings (e.g., LB condulet) in any conduit runs. Ensure that all pull boxes are accessible upon completion of construction.
   1) **For horizontal cabling** – Provide an appropriately-sized pull box, i.e., one 6 in W x 16 L x 3 in D for 3/4-inch to 1-1/4-inch conduits; increase the width of pull box by 3 inches for each ¾-inch to 1-1/4-inch conduit. Provide a separate pull box for each of the various systems (data, access control, video surveillance, burglar alarm).
   2) **For backbone cabling** – Provide an appropriately-sized pull box (i.e., minimum size 24 in W x 36 L x 12 in D for two 4-inch conduits and increase the width of box by 8 inches for each additional 2-inch to 4-inch conduit; install a pull box at both ends of liquid-tight conduits in each seismic joint of building(s).

i. **Accessible Ceilings**
   1) **For horizontal cabling** – When there is an accessible ceiling such as suspended acoustical tile, provide the EMT conduit pipe stubbed into the ceiling space from the junction box. Ceiling must be accessible from the WAO or field device location back to the Telecommunications Room. If any inaccessible ceilings partially exist in the path from WAO or field device location to the Telecommunications Room, coordinate with RCIT Communications Bureau Infrastructure Engineer to provide appropriately-sized conduits.
   2) **For backbone cabling** – The entire length of backbone cabling must be contained in conduits; provide pull boxes as required.

j. **Non-Accessible Ceilings** – Consult RCIT Communications Bureau Infrastructure Engineer to determine pull box and access panel locations during design development phase and to finalize during 90% construction document phase of the electrical engineering design.
   1) **For horizontal cabling** – Provide a dedicated EMT conduit pipe above the ceiling void on the same floor of workstation outlet or field device location all the way to the Telecommunications Room or to the nearest accessible ceiling space with the shortest distance to the telecommunication room; increase the conduit size by one trade size (e.g., where 3/4-inch conduit is specified from junction box to accessible ceiling void, increase the conduit size to 1-inch in non-accessible ceiling space; similarly, where 1-inch conduit is specified in accessible ceiling, increase it to 1-1/4-inch). Provide a pull box and access panel where there exists an aggregate of bends greater than 180 degrees between pull points or pull boxes or where a reverse bend exists; the minimum pull box size for one conduit is 6 inch W x 20 inch H x 3 inch D and where multiple conduits converge at a pull box, increase the width by three inches for each additional 3/4-inch to 1-1/4-inch trade size conduit. Where pull box is installed,

provide an appropriately-sized access panel with the dimension slightly larger than the pull box width and length.

2) **For backbone cabling** – Where pull box is in non-accessible ceilings, provide an appropriately-sized access panel with the dimension slightly larger than the pull box width and length.

2. **Conduits for Data Work Area Outlets**

a. **Wall Outlet Backbox** – Provide one 1-inch EMT conduit pipe and one 4 in W x 4 in H x 2.5 in D junction box with a 2-inch x 4 inch with reducing adapter installed at the same height as the adjacent electrical outlet. Provide and install two (2) WAO locations for each enclosed office.

b. **System Furniture Wall In-feed** – Provide one 1-1/4-inch EMT conduit pipe and a 4 in W x 4 in H x 2.5 in D junction box per three (3) WAO locations of systems furniture. The conduit will be stubbed into the ceiling area. In-feed location will be accessible either by cutout or access panel in furniture or placed next to furniture where location will be accessible for service. Consult RCIT Communications Bureau Infrastructure Engineer for location, quantity, and size of in-feeds; final location to be verified with Furniture Vendor.

c. **System Furniture Floor Poke-Thru In-Feed** – Provide one (1) Wiremold P/N 6ATCFFxx poke-thru device with a trade size 2-inch EMT conduit pipe per six (6) WAO locations of systems furniture; color to be specified by Architect of Record. The conduit will be continuous with no more than two 90-degree bends and stubbed into the ceiling area of the floor being serviced with pull string installed; no pull box is allowed. Anchor the junction box for furniture supplier power whip connections to the ceiling of the floor below with strut channel; ensure that the junction box is within six feet of the furniture whip connection. Each poke-thru device will include (1) Wiremold P/N 152CHA bottom housing assembly for communications, and (1) Wiremold P/N 1BHA bottom housing assembly. Consult RCIT Communications Bureau Infrastructure Engineer for location, and quantity; final location to be verified with Furniture Vendor.

d. **Hard Wall Office Floor Poke-Thru** – Provide one Wiremold P/N 8ATC2PAVxx poke-thru device with one (1) trade size 1-1/4-inch EMT conduit pipe; color to be specified by Architect of Record. The conduit will be continuous and stubbed into the ceiling area of the floor being serviced with no more than two 90-degree bends; no pull box is allowed. Each poke-thru device will include (1) Wiremold P/N 6B blank device mounting plate, (1) Wiremold P/N 1125CHA bottom housing assembly for communications, and (1) Wiremold P/N 1BHA bottom housing assembly. Consult RCIT Communications Bureau Infrastructure Engineer for location and quantity; final location and connection requirements to the conference table will be verified with Furniture Vendor by Electrical Contractor.

e. **Hard Wall Office Power and Data Floor Boxes** – Provide Wiremold P/N EFB6S Floor Box with (1) trade size 1-1/4-inch EMT conduit pipe for communications; color to be specified by Architect of Record. The conduit will be continuous with no more than two 90-degree bends and stubbed into the ceiling area of the floor being serviced; no pull box is allowed. Each box will be configured for dual service which will require accessory items for separation of power and data. Every box will include (2) Wiremold P/N EFB6-M mounting bracket for power, (1) Wiremold P/N EFB6-MB

mounting bracket for communications, (4) Wiremold P/N blank device plate. Consult RCIT Communications Bureau Infrastructure Engineer for approximate location and quantity; final location to be verified and coordinated with Furniture Vendor by Electrical Contractor.

f. **Wall Phone Outlet** – Provide one 1-inch EMT conduit pipe and (1) 4 in W x 4 in H x 2.5 in D outlet box with a 2 in x 4 in reducing adapter installed at a height that conforms to the ADA requirements as determined by the Architect of Record; without clear dimension from the Architect, install the outlet at 44 inches AFF to the center of the backbox. Install (1) additional 4 in W x 4 in H x 2.5 in D outlet box with a 2 in x 4 in reducing adapter at standard floor height; connect the bottom of the wall height box to the top of the standard floor height box with (1) EMT 1-inch conduit pipe.

3. **Conduits for Access Control Field Devices, Door Hardware and Door Power**

a. **Card Reader (CR)** – Provide one 3/4-inch EMT conduit pipe and (1) 4 in W x 4 in H x 2.5 in D outlet box with a 2 in x 4 in reducing adapter installed at a height that conforms to the ADA requirements as determined by the Architect of Record; without clear direction from the Architect, install the outlet at 44 inches AFF to the center of the backbox.

b. **Gate Card Reader (Gate CR)** – Provide one pedestal mounting post at 48 inches AFF to center. Install a PVC Schedule 40 trade size 1-inch conduit from the building to motor control unit and a PVC Schedule 40 trade size 1-inch conduit from motor control unit to the pedestal mounting post. Transition the PVC Schedule 40 trade size 1-inch conduit from motor control unit to trade size 1-inch EMT conduit if conduit is above ground and on the outside of the building. Install one 4-inch W x 4-inch H x 3-1/2-inch D junction box to transition into the building and a trade size 1-inch conduit from the junction box into the building space.

c. **Request to Exit (REX) Motion** – Provide one 3/4-inch EMT conduit pipe and one 4 inch W x 4 inch H x 2.5 inch D deep junction box with a single gang mud Ring installed in a horizontal position; the junction box is mounted center of door at 6 inches above the top door frame.

d. **Request to Exit (REX) Sensor/Button** – Provide one 3/4-inch EMT conduit pipe and one 4-inch W x 4-inch H x 2.5-inch D junction box with a single gang mud ring installed in a vertical position to center at 48 inches AFF.

e. **Door Position Sensor/Door Contact** – Provide one 3/4-inch EMT conduit pipe stubbed into the top of door frame. A 3/4-inch recessed door contact will be used on all metal doors and frames; and a 3/8-inch recessed door contact on all non-metal doors (vinyl, wood, et cetera). Door contacts will be installed 6 inches from latch on top side of door.

f. **ADA Push Plate** – At motorized doors that require ADA functions, provide one 3/4-inch EMT conduit pipe and one 4 inch W x 4 inch H x 2.5 inch D junction box with a single gang mud ring installed in a vertical position for all ADA push plates at a height that conforms to the ADA requirements as determined by the Architect of Record; without clear direction from the Architect, install the junction box at 44 inches AFF to the center of the backbox.

g. **Door Hardware** – Based on the door schedule, the Construction Professionals will coordinate closely with the County Department occupying the facility and the RCIT

Communications Bureau Infrastructure Engineer to determine and finalize the electrified door hardware. The Construction Professionals will ensure that all electrified door hardware, transfer hinges and wiring are provided, installed and terminated from door frame by the door Hardware Vendor (wiring from access control panel down the door frame will be provided and installed by the Access Control Vendor). The Construction Professionals will ensure to specify that Door Hardware Vendor be responsible for all electrified door trouble calls within the door hardware warranty period; and that the door hardware vendor will collaborate with the RCIT access control group to troubleshoot and resolve the initially reported incident within 48 hours.

h. **Door Power** – All electrified crash bars, lever-sets and mortise locks will have a 3/4-inch EMT conduit stubbed into hinge side of the door frame. All electrified strikes will have a 3/4-inch EMT conduit stubbed into latch side of the door frame. All access control door operators (e.g. ADA doors) will have a 3/4-inch EMT conduit into the motor control junction box.

4. **Conduits for Video Surveillance System Cameras**

a. **Interior Cameras** – All interior cameras are to be mounted directly to the ceiling with no conduit necessary for all accessible ceiling voids. In non-accessible ceiling void, provide one EMT trade size 1-inch conduit pipe from the camera to the nearest accessible ceiling space.

b. **Exterior Cameras** – Where the ceiling void is accessible, provide a 1-inch EMT sleeve stub-out slanting outward from ceiling void to the exterior camera location. Where the ceiling void is not accessible, provide a 1-inch EMT pipe slanting outward from the closest accessible ceiling void to the exterior camera location; terminate conduit on a 4-inch W x 4 inch H x 2.5 inch D junction box with a single gang mud ring. Tamper screws are required to secure all exterior cameras.

5. **Conduits for Burglar Alarm System Devices**

a. **Alarm Panel** – Coordinate panel location with the County department occupying the facility and RCIT Communications Bureau Infrastructure Engineer. Provide one 4-inch W x 4-inch W x 2.5-inch D junction box with a single gang mud ring installed in vertical position and one 1-inch EMT conduit pipe stubbed to the ceiling void.

b. **Zone Expander** – Coordinate with RCIT Communications Bureau Infrastructure Engineer to determine each expander location; one expander is required for every 8 zones. Provide one 4-inch W x 4-inch W x 2.5-inch D junction box with a single gang mud ring installed in vertical position and one 1-inch EMT conduit pipe stubbed to the ceiling void.

c. **Keypads** – Coordinate with the County department who will occupy the facility and RCIT Communications Bureau Infrastructure Engineer to determine each keypad location. Provide one 4-inch W x 4-inch H x 2.5-inch D junction box with a single gang mud ring installed in vertical position and one 1-inch EMT conduit pipe stubbed to the ceiling void. The junction box will be at a height that conforms to the ADA requirements as determined by the Architect of Record; without clear direction from the Architect, install the junction box at 44 inches AFF to the center of the backbox.

d. **Motion Detectors** – All motion detectors are to be mounted directly to the ceiling with no conduit necessary for all accessible ceiling voids. In non-accessible ceiling void, provide one EMT trade size 3/4-inch conduit pipe from the camera to the nearest accessible ceiling space.
e. **Door Position Sensor/Door Contacts** – Provide one 3/4-inch EMT conduit pipe stubbed into the top of door frame. A 3/4-inch recessed door contact will be used on all metal doors and frames; and a 3/8-inch recessed door contact on all non-metal doors (vinyl, wood, et cetera). Door position sensors/door contacts will be installed at the top of door at 6 inches from latch side door.
f. **Glass Break Detector** – All glass break detectors are to be mounted to the ceiling and no conduits are if the ceiling void is accessible. In non-accessible ceiling void, provide one EMT trade size 3/4-inch conduit pipe from the glass break detector to the nearest accessible ceiling space.

6. **Conduits Connecting Telecommunications Spaces in Same Building**

a. **Telecommunications Rooms on Same Floor** – When two or more Telecommunications Rooms exist on the same floor, provide two (2) 4-inch EMT conduit pipes between the main Telecommunications Room and each secondary Telecommunications Room.
b. **Telecommunications Rooms in Same Building on Different Floors** – When two or more Telecommunications Rooms exist on different floors, provide a minimum of two (2) EMT trade size 4 conduit pipes between the main Telecommunications Room and each secondary Telecommunications Room. In multi-level buildings, stack the Telecommunications Rooms whenever possible and provide sleeves from the ceiling of the lowest level to the floor of the top level; where stacking is not possible, provide both vertical and horizontal conduit runs to connect the Telecommunications Rooms.
c. **Entrance Facility (MPOE)** – In the MPOE (minimum point of entry) provide and install two (2) trade size 4 conduit pipes from the MPOE to the First Floor Telecommunications Room.

7. **Conduits Connecting Entrance Facility Room (MPOE) to Service Provider's Handhole**

a. Refer to Section J of this Specifications document for requirements to construct telecommunications outside plant pathway and spaces.

8. **Conduits Connecting Telecommunications Rooms in Multiple Buildings on Same or Adjacent Properties**

a. Refer to Section J of this Specifications document for requirements to construct telecommunications outside plant pathway and spaces.

H. Cable Tray

1. The Construction Professionals will design and install a cable tray system to support the voice and data cabling in buildings with structural ceiling height greater than 15 feet AFF or the occupied space is greater than 20,000 square feet. Elicit from the RCIT

Communications Bureau Infrastructure Engineer the requirements of the cable tray system. The Constructional Professionals will engage a licensed Structural Engineer to design the cable tray system supports according to codes and manufacturer specifications and submit the design to the RCIT Communications Bureau Infrastructure Engineer for review and acceptance.

a. **Interdisciplinary Coordination** – The Construction Professionals will perform interdisciplinary coordination to remove potential conflicts between the cable tray and other utilities (e.g., ductwork, piping, conduits).
b. **Installation Standard** – Conform to NEMA VE2. Install expansion connectors where recommended by manufacturer.
c. **Cable Tray Support** – Support trays and fasten to structure and finishes per manufacture specifications. Install supports at each connection point, at end of each run, and at other points to maintain spacing between supports of 10 ft **maximum.**
d. **Grounding and Bonding** – Conform to codes, ordinances, and ANSI/TIA/EIA 607 standards. Provide continuity between tray components; and use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
e. **Warning Signs** – Install warning signs at 50 feet centers along cable tray, located to be visible.
f. **Shop Drawings** – Construction Professionals responsible for installation will submit for review prior to installation shop drawings that have been field-coordinated with all trades to ensure that no conflict exists between cable trays and mechanical ducts, electrical conduits, plumbing piping, et cetera.

I. Firestopping

1. Provide and install STI EZ-Path® Series 44+ fire-rated pathway sleeves (no known equivalent) for all cable pathways (e.g., conduits, cable trays) passing through fire-rated walls. The Construction Professionals will coordinate the location and quantity of sleeves with the RCIT Communications Bureau Infrastructure Engineer during both design and construction phases.

J. Telecommunications Outside Plant (OSP) Underground Pathways and Spaces

1. The Construction Professionals will not place telecommunications underground pathways and spaces in the same vertical plane as other utilities, such as water or power that share the same trench; utility services will be located horizontally with respect to each other.

2. **General OSP Conduit Requirements**

a. **Conduit Types, Rigid Conduit Sweeps and Their Applications**
1) **Rigid Trade Size 4-Inch Nonmetallic Polyvinyl Chloride (PVC) Schedule 40 for Direct Buried** – Unless otherwise noted in this Standards document or requested by RCIT Communications Bureau Infrastructure Engineer during design or to rectify unforeseen conditions during construction, direct buried conduits will be rigid trade size 4-inch nonmetallic Polyvinyl Chloride (PVC)

Schedule 40 that are rated for use with 90-degree C conductors, UL-listed for direct burial and concrete encasement, and meeting the requirements of NEMA TC 6 (outside diameter 114.30 mm and inside diameter 102.36 mm). All ends of conduit must be reamed.

2) **PVC-Coated, Threaded Rigid Steel Conduit Within 10-Foot Zone of Circumference Around the Building Foundation** – OSP conduit must transition from PVC to PVC-coated, rigid steel conduit when it enters a 10-foot zone of circumference around the building foundation and must route from that point to the building Entrance Facility. PVC-coated, rigid steel conduit is intended to provide protection from the shearing effect of excavated ground settling around the building foundation. It also provides protection from future landscaping activities near the building. In extreme locations where conduits cannot be encased in concrete but pass under paved surfaces capable of supporting motor vehicle traffic, transition conduit to PVC coated rigid steel a minimum of 10' outside the footprint of the paved surface. The PVC-coated conduits must comply with Underwriters Laboratory (UL) 6, ANSI C80.1, ASTM D1151, and NEMA RN-1 standards. All fittings must conform to NEC requirements for aboveground wet locations.

3) **Electrical Metallic Tubing (EMT) Trade Size 4-Inch for Aboveground** – All steel EMT trade size 4-inch conduits must be of no less than 4.334 inches in nominal inside diameter and the conduit wall thickness be no less than 0.166 inch, be compliant with the ANSI C80.1 and be listed according to the Underwriters Laboratory (UL)-6 standard; all fittings must conform to NEC requirements for aboveground wet locations.

4) **Intermediate Metal Conduit (IMC) Trade Size 4-Inch for Aboveground** – IMC conduits will be installed if deemed necessary by the RCIT Communications Bureau Infrastructure Engineer. All steel Intermediate Metal Conduit (IMC) trade size 4-inch conduits must be of no less than 4.166 inches in nominal inside diameter and the conduit wall thickness be no less than 0.3 inch, be compliant with the ANSI C80.6 and be listed according to Underwriters Laboratory (UL)-1242 standard. All fittings must conform to NEC requirements for aboveground wet locations.

5) **Galvanized Rigid Steel (GRC) Trade Size 4-Inch Conduit Sweeps** – For conduit runs greater than 150 feet, GRC sweeps with long sweeping radius not less than 12.5 feet must be installed. GRC conduit fittings must be hot-dipped galvanized steel, including threads.

6) **Flex Conduits** – Flex conduits are not allowed in any conduit runs.

b. **Depth Requirements** – The installed underground conduits will not be less than 36 inches below finished grade and the measurement must be taken from the top of conduit.

c. **Quantity and Routing** – The RCIT Communications Bureau Infrastructure Engineer will determine the quantity; the Construction Professionals (usually the Architect or Electrical Engineers of Record) will coordinate with RCIT Communications Bureau Infrastructure Engineer to finalize the conduit routing and then perform interdisciplinary coordination with other engineering consultants to ensure constructability.

d. **Maximum Length of Individual Conduit Section** – Conduit runs between maintenance holes, handholes, or any other telecommunications space must

contain no continuous sections longer than 300 feet. If runs total more than 300 feet, a handhole or maintenance hole need to be inserted.

e. **Clearances** – Conduit separation must be maintained according to National Electrical Safety Code and applicable codes and ordinance as determined by the Authority Having Jurisdiction; and as specified in this document. As a minimum, separate the telecommunications conduits from power up 10 1KVA by 12 inches of well-tamped earth, 4 inches of masonry, and 3 inches of concrete; and from other foreign structures (e.g., gas, water, oil) by 6 inches when crossing and by 12 inches when parallel. When in conflict, the most stringent requirement of all prevails.
    1) **Between Telecommunications Conduits** – Conduits must maintain a minimum 2-inch separation from each other and be supported on factory fabricated, non-metallic, duct/conduit support spacers. The spacers must be modular, keyed interlocking type, "built-up" to accommodate quantity, size orientation and spacing of installed conduits. The spacers must maintain a constant distance between adjacent conduit supports and hold conduits in place during conduit encasement and trench backfill operations. Anchor duct/conduit support spacers with rebar rods along the conduit length of the conduit to prevent the "rising" of the conduits during concrete encasement. Minimum support spacer installation interval along with length of conduit run must be not more than every 6 feet.
    2) **Adjacent Conduits of Similar Systems** – Conduits must be separated from adjacent conduits of similar systems (100 volts and less) by a minimum of 2 inches; conduits for non-power systems (100 volts or less to ground) must be separated by a minimum of 12 inches from power circuits (over 100 volts to ground) of well-packed earth, or 3 inches of concrete.
    3) **Hot Water Piping, Exhaust Flues/Chimneys and Steam Piping** – Conduits must be separated by a minimum of 12 inches.

f. **Conduit Sweeps** – Bends must consist of a single arc of a minimum 15-foot radius. Conduit must have no more than 180 degrees of cumulative bends between pull points or more than 90 degrees of bends at any one point. All sweeps must be factory manufactured and meet the ANSI/TIA/EIA 569 requirements, with the inside diameter of the sweep at a minimum of ten times the internal conduit diameter, i.e., 40 inches. Two 90-degree sweeps separated by less than 10 feet is not permissible. Standard electrical elbows and mechanically of manually bent radius are not allowed.

g. **Metallic Elbows** – Provide metallic elbows where conduits rise out of ground.

h. **Reverse (U-Shaped) Bend** – Provide a pull box where a reverse bend exists.

i. **Back-To-Back 90-Degree Bend** – No back-to-back 90-degree bends allowed.

j. **Drain Slope** – A drain slope towards the maintenance hole or handhole of no less than 1 percent grade is required (e.g., 12.5 inches for every 100 feet). All conduits and conduit sleeves entering a building must be pitched to drain away from the building to avert water intrusion.

k. **Spacers and Conduit Orientation** – Conduit must be supported with spacers at 6-foot intervals to maintain the same orientation at all points of access.

l. **Reinforcement Bars** – Provide a minimum of two vertical reinforcement bars spaced every three feet and four #5 continuous horizontal reinforcement bars the entire length of the duct bank. Fasten the horizontal reinforcement steel with vertical

reinforcement bars and into the connecting walls of manholes, vaults and buildings, et cetera to protect against shearing.

m. **Encasement** – The entire length of underground telecommunications conduits must be encased with minimum concrete strength of 1.5-sack slurry. Higher strength may be required depending upon placement locale. Concrete encasement of conduits must be continuous without voids. The encasement must extend 3-inches past the edges of all conduits. The conduit runs must be inspected and approved by the RCIT Communication Bureau Infrastructure Engineer or appointed owner's representative prior to pouring of concrete. At least 48 hours prior notice will be given to RCIT Communication Bureau Infrastructure Engineer that a pour will be taking place. Failure to schedule inspection and obtain RCIT Communication Bureau Infrastructure Engineer's approval in writing prior to pouring of concrete will result in the removal and re-installation of the section of duct bank in question.

n. **Shearing Prevention** – To prevent conduit shearing, conduits entering through the outside walls of a building must be metal and extend to undisturbed earth where such backfill is susceptible to load bearing tension.

o. **Penetration Through Foundation or Footing of Building** – Where duct banks penetrate foundation or footings of building, install rigid metallic conduits with expandable rubber shields. Conduits entering building must transition from PVC to rigid metallic conduits from twenty-four inches beyond the exterior of the foundation to six inches within the building. Conduits entering building must slope downward away from the building

p. **Duct Plugs** – Conduits must have duct plugs (Tyco Jackmoon #JM-BLA-40D402U or RCIT-approved equivalent) installed to keep debris from entering them. Duct plugs must be adjustable with a screw-type expandable outer rubber surface to prevent water infiltration. Duct plug must be equipped with a rope tie device to allow securing of pull rope to the plug's back compression plate.

q. **Mandrel Testing** – All conduits must be mandrel-tested with a mandrel 1/4" less than the inside diameter of the conduit prior to turning over to RCIT for occupancy. Ensure the presence of RCIT Communications Bureau Infrastructure during all tests.

r. **Pull Ropes** – All conduits that do not have inner duct installed inside of them must be threaded with pull ropes with footage markers. Install pull rope with tracer line in each conduit immediately after the conduit has been cleaned and mandreled. Pull rope will be ¼-inch diameter polypropylene or polyethylene rope, braided or twisted with tracer. Leave a minimum of 10 feet looped and tied off at each end of the conduit to Tyco Jackmoon duct plugs #JM-BLA-40D402U.

s. **Innerducts** – Inner ducts must have the ends plugged upon installation to keep debris from entering them. All inner ducts must be threaded with pull ropes with footage markers. Inner duct must not be directly buried or concrete incased as a replacement to conduits.

t. **Condition of Completed Conduit Installation** – All precautions must be taken during construction by the Construction Professionals to prevent the lodging of dirt, plaster or trash in all conduit, tubing, fittings and boxes. All conduits in floors, concrete or below grade must be swabbed free of debris and moisture before wires are pulled. After installation, all conduits must be verified clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings prior to acceptance by the Riverside County Information Technology. Conduits must be capped for protection, labeled for identification, reamed and fitted with bushings

prior to acceptance by the Riverside County Information Technology. Seal the inside-the-building end of the conduits to prevent rodents, water or gases from entering the building. Use rubber conduit duct plug Commscope JM-BLA-40D402U or equivalent, or duct sealer, depending upon field conditions. Obtain in writing by RCIT Communication Bureau Infrastructure Engineer's approval and acceptance of the constructed system.

3. **Service Entrance Conduits**

a. **Two Entrance Points** – The Construction Professionals will provide two underground entrance points for each building – one for telco network services and another for Metro Ethernet/Cable TV services; quantity of underground entrance conduits to each building will be determined according to the building size, as follows:

1) **Underground Telco Network Entrance Conduits**

< 10,000 square feet	Two trade size 4 conduits
10,001 – 50,000 square feet	Four trade size 4 conduits
> 50,001 square feet	To be determined by RCIT Communications Bureau Infrastructure Engineer

2) **Underground Metro Ethernet/Cable TV Services**

< 50,000 square feet	Two trade size 4 conduits
> 50,001 square feet	To be determined by RCIT Communications Bureau Infrastructure Engineer

b. **Service Connection to Every Building on Campus** – Unless deemed unnecessary by RCIT Communications Bureau Infrastructure Engineer, the Construction Professionals will provide a conduit system on campus to ensure that every building has a pathway to enter the nearest, existing entrance maintenance hole/hand hole or new maintenance hole/hand hole at the property line.

c. **Conduit Termination** – The termination of entrance conduit within a building must meet one the following requirements:
   1) **Through Finished Floor** – Extend 4 inches above the finished floor.
   2) **Through Walls** – Turn conduits down into space and extend them to 8 feet 6 inches above the finished floor.
   3) **Through Ceiling** – Extend conduits down in the room to 8 feet 6 inches above finished floor.

d. **Seismic Zone Requirements** – The Construction Professionals responsible will provide the specifications for conduit support system to comply with the applicable seismic zone requirements.

4. **Conduits Connecting Telecommunications Rooms in Multiple Buildings on Same or Adjacent Properties**

   a. **Conduit Quantity** – Connect the main building on campus to every other building on campus with a two-4-inch conduit system, unless otherwise specified by the RCIT Communications Bureau Infrastructure Engineer.
   b. **Direct Route** – Conduits will be routed from the main building directly to each of the other buildings without going through any other building.
   c. **Shared Maintenance Holes and Handholes** – Where possible, conduits from the main building to all other buildings should share the maintenance holes and handholes, unless otherwise specified by the RCIT Communications Bureau Infrastructure Engineer.

5. **General Requirements for Maintenance Holes (MH) and Handholes (HH)**

   a. **Joint Use** – Joint use of maintenance holes and handholes is not allowed.
   b. **Physical Placement** – Place maintenance holes and handholes out of roadways wherever possible. The desired location for maintenance hole and handhole is under sidewalks paralleling roadway. Establish finish grade prior to placing maintenance holes and handholes; and install precast neck and shaft sections to bring maintenance hole and handhole cover to be flush with finished elevation and the existing grade. A maintenance hole or handhole must be placed in any conduit run that exceeds 300 feet. Construction Professionals will not place any manholes until sections of the ducts to adjoining manholes or handholes have been proven feasible by digging test holes.
   c. **Bedding** – Provide 12” deep bedding base of 1” river run gravel in the bottom of the excavation. Bedding must be level and well compacted by a minimum of four passes with a plate type mechanical vibrator. Do not set maintenance holes and handholes prior to inspection and signoff by RCIT Communications Bureau Infrastructure Engineer.
   d. **Precast Structure** – Precast structure must be installed to provide for keying and concrete envelope of the conduit/duct line into the wall of the structure. Mechanical vibrators must be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the precast structure.
   e. **Free from Defects and Damages** – Maintenance holes and handholes will be free from damaged joint surfaces, cracks, or other damage that would permit infiltration. Repair of defects is not acceptable,
   f. **End Bells** – Entrances of conduits/ducts must terminate with end bells inside the precast entrances into the manhole or handhole and is a minimum of 29 inches below ceiling of the maintenance hole or handhole. Maximum conduit slope must not exceed 1 inch per “running” foot of conduit. Conduit bells must be sealed with approved materials to preclude water infiltration and seepage.
   g. **“LB” and “Y” Conduit Fittings** – No “LB” and “Y” conduit fittings are allowed.

h. **Conduit Entry Points** – Conduits entering the maintenance holes and handholes must be from the short walls and placed at opposite walls at the same elevation. For existing maintenance holes and handholes, install new ducts to enter the maintenance hole with factory-formed bell end of the conduit, and a seal around the conduit must be applied after installation. Retrofit existing maintenance holes to meet the required racking, and grounding and bonding per this Specifications document.

i. **Window and Duct Entry** – H style with (2) 4 x 4 4" conduit duct entry in the lower half of the maintenance hole on each end and (2) 4 x 4 4" conduit duct entry in the upper half of the maintenance hole on each end.

j. **Sump** – Every maintenance hole and handhole must be equipped with a 6-icnh to 8-inch sump for proper drainage.

k. **Ladder and Steps** – Provide steps or a ladder in handholes as determined by RCIT Communications Bureau Infrastructure Engineer; in maintenance holes, ladder must be attached to collar rungs. Install steps at the neck of maintenance holes to meet conditions. Each maintenance hole must be furnished with a detachable galvanized steel ladder, secured to a top support arm in the maintenance hole. Hardware must be steel, hot dip galvanized after fabrication.

l. **Cable Racking** – Install double bay, heavyweight cable racking with adjustable arms in the center of each maintenance hole and handhole side walls. Attach the racks with adjustable inserts set in the concrete walls. Install corner standoff brackets 6 to 8 inches from wall.

m. **Galvanized Interior Hardware** – Bonding inserts, struts, entry ladder, steps, and other hardware must be galvanized after fabrication.

n. **Pulling Eyes** – Maintenance holes and handholes must be equipped with pulling eyes at least 7/8 inch in diameter.

o. **Grounding and Bonding** – Install two 5/8" x 10' copper clad steel ground rods in every maintenance hole and handhole at each entrance wall diagonally across from each other and with #2 AWG pigtails for connection to interior ground conductors. Bond metallic hardware in the maintenance hole or handhole to the pre-cast bonding tabs. Bond the bonding tabs to the ground rod using a brass clamp. Bond and braze together the reinforcing steel in the walls of maintenance holes and handholes to the bronze inserts of each section per the manufacturer's specifications. The ground inserts must be attached to the steel rebar to provide a point of attachment for the ground wires or bonding ribbon. The inserts must be bronze, flush mounted, and brazed to the rebar cage of all the sections of the maintenance holes (bottom, intermediate, and roof sections).

p. **Sealants** – Install sealant at all joints with Ram-Nek, Kent Seal or approved equal products; comply with ASTM C891 requirements.

q. **Water Proofing** – Maintenance hole and handhole outer surface must be coated with a water proofing material at the factory before delivery and an additional coating performed on site to all seals and collars (for maintenance holes).

r. **"Knock-Outs"** – Provide two "knock-outs" on each sidewall of the maintenance hole with 5-foot stub-outs for future use.

s. **Covers** – Frames and covers used in roads or driveways must be rated H20 traffic rating to withstand wheel loading; covers must be engraved with "County Communications." Maintenance hole covers must be round, minimum 30 inches and be centrally located; handhole covers can be round or 2-piece torsion frame

cover design, as determined by RCIT Communications Bureau Infrastructure Engineer in selecting the handhole to be installed.

t. **Concrete Strength** – The strength of concrete must be 1.5-sack slurry; stronger concrete may be required in certain conditions.

u. **Pull-Through Point** – Handholes must not have more than four 4-inch conduits and be used as pull- through points only; they must not be used as splice points.

v. **Splice Point** – Maintenance holes must be used as splice point or when there are more than four 4-inch conduits.

w. **Sealed Joints** – Install tongue-and-grove double sealed joints on mating edges of pre-cast components. The joints must firmly interlock adjoining components and be sealed with watertight joint sealant in accordance with the manufacturer's installation guidelines.

x. **Finish Painting** – Finish the inside wall and ceiling of maintenance holes and handholes with one coat of white, waterproof coating.

y. **Post Construction Inspection** – Jointly with the RCIT Communications Bureau Infrastructure Engineer, inspect maintenance holes and handholes three months after completion of construction for indications of water ingress. Where leakage is observed, remove water and seal leak sources. Reinspect after two months and reseal remaining leak sources. Repeat process at two month intervals until all leaks are corrected

6. **Maintenance Holes (MH; also known as manholes)**

a. **County-Approved Maintenance Hole –** Oldcastle Drawing Number C19-684 5’-0” W x 10’-6” L x 6’-6” D (No known equivalent). Substitution is not allowed without written preapproval by RCIT Communications Bureau Infrastructure Engineer.

b. **Requirements** – Maintenance holes must be precast and conform to all applicable ASTM standards, including C478 with 28-day 5500 psi minimum compressive strength concrete and designed for AASHTO H-20 loading per AASHTO HB 14. Incidental and miscellaneous accessories supplied with a maintenance hole must be supplied by the same manufacturer.

1) Maintenance holes must be Type A, end wall entrance only, with center conduit window.

2) Install steps at the neck of maintenance holes to meet conditions. Each maintenance hole must be furnished with a detachable galvanized steel ladder, secured to a top support arm in the maintenance hole.

7. **Handholes (HH; also known as Vaults)**

a. **County-Approved Handholes (HH)** – Substitution is not allowed without written preapproval by RCIT Communications Bureau Infrastructure Engineer. RCIT Communications Infrastructure Engineer will determine which approved handhole(s) to be installed at each location for every project.

1) Jensen K3660-DP48-13PSA 3'-0” W x 5'-0” L x 4'-0” D H20-rated

2) Jensen K3660-DP48-13SA 3'-0” W x 5'-0” L x 4'-0” D light traffic rated

3) Oldcastle Drawing Number C19-749 3'-0” W x 5'-0” L x 4'-6” D H20-rated

4) Oldcastle Drawing Number C19-739 3'-0” W x 5'-0” L x 4'-6” D light traffic rated

5) Oldcastle Drawing Number C19-748 1'-5" W x 2'-6" L x 2'-0" D light traffic rated; to be used with three or fewer conduits at property line to connect to service provider's incoming conduits or as pull points where needed.

b. **Requirements** – Handholes must be precast and conform to all applicable ASTM standards, including C478 with 28-day 5500 psi minimum compressive strength concrete and designed for AASHTO H-20 loading if located in a roadway and to AASHTO H-10 otherwise. Incidental and miscellaneous accessories supplied with a handhole must be supplied by the same manufacturer.

c. **Maximum Conduit Quantity** – Install a handhole for up to four conduits.

8. **Excavation and Trenching**

a. **Examination** – Verify routing and termination locations of duct bank prior to excavation for rough-in. Verify locations of maintenance holes and handholes prior to excavation for installation.

b. **Protection** – Submit for review and approval of Construction Professionals responsible for design (usually the Architect and Engineer of Record) description of sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

c. **Existing Utilities** – The Construction Professionals will verify exact location of existing utility lines where work crosses existing utilities and where connections are to be made by test hole before starting work. Identify required lines, levels, contours, and datum. Locate and protect all existing utilities, whether noted in the design drawings or discovered during the construction work. Upon discovery of any discrepancies or utility not identified in the design drawings, immediately notify the Construction Professionals responsible for design (usually the Architect and Engineer of Record). Notify utility companies, municipalities, County, and other involved jurisdictions when excavation occurs within vicinity of existing underground service such as sewers, water, electric, gas, and telephone. Repair or replace utility lines damaged or injured as directed and approved by the involved jurisdiction. Extend existing duct bank installations using materials and methods compatible with existing installation.

d. **Conduit Trench** – Trench must be min 35 inches wide and 48 inches deep. Bottoms of trenches must be cut parallel to "finished grade" elevation. Trenching work must be performed in compliance with the Federal and California State OSHA trenching and excavation safety requirements, including but not limited to, 29 Code of Federal Regulations (CFR) Part 1926, Subpart P.

e. **Removal of Water** – Grade to prevent surface water from flowing into all excavations and trenches. Provide pumps, hoses, pipe, labor and fuel, necessary to keep excavations free of water accumulation. Discharge water in manner not to undermine or disturb existing or adjacent structures or land. Do not discharge dirt, backfill, debris, into sanitary or storm drainage systems.

f. **Repair and Replacement** – Repair or replace items that are damaged by excavation.

9. **Excavation Temporary Cover**

    a. **Code and Ordinance Compliance** – Comply with local ordinances and Caltrans requirements.
    b. **Visible Barrier** – Provide a visible barrier along the excavation path on each side of the trench with highly visible "Caution Tape" supported to construction cones.
    c. **Steel Plating** – Provide temporary steel plating and shoring support for the plates, to completely cover the excavation created across the roadway and conform to all requirements of the Jurisdiction Having Authority. The temporary plating must be a minimum of 0.75-inch thickness steel, but in no case must the thickness be less than required to support AASHO-H20 traffic loading. As a minimum, provide temporary steel plating under one or more of the following conditions:
        1) Excavations "open" for more than four (4) calendar days
        2) Excavations "open" over weekends (Saturday, Sunday) or Holidays

10. **Grounding and Bonding**

    a. **Grounding and Bonding Components** – Furnish and install grounding and bonding components in accordance with ANSI/TIA J-STD-607-A, IEEE C2, and NFPA 70. Non-current-carrying metal parts in maintenance holes and handholes will be connected to a ground rod with a No. 4/0 bare copper ground conductor and ground clamp.
    b. **Bonding Conductors** – Bonding conductors must be routed with a minimum number of bends; all components must be UL-listed and exothermic welding used.
    c. **Multiple Bus Bars** – Multiple bus bars must be directly bonded together with a #2 AWG copper conductor.
    d. **Ground Resistance** – Ground resistance will not be more than 0.1 ohms, measured following the two-point bonding test method using an earth ground resistance tester.

11. **Backfilling Trenches**

    a. **Code and Ordinance Compliance** – Comply with local ordinances and Caltrans requirements.
    b. **Field Quality Control** – Perform laboratory material tests in accordance with ASTM D1557 AND AASHTO T180; and in place compaction tests every 300 feet of trench and around all electrical and telecommunications manholes and handholes (density tests per ASTM D1556, ASTM D2167, or ASTM D6938; moisture test per ASTM D6938). When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
    c. **Inspection** – Do not backfill prior to inspection and signoff by the Authority Having Jurisdiction, County Inspector of Record, and RCIT Communications Bureau Infrastructure Engineer.
    d. **Backfill Materials** – Conduit trenches must be backfilled with 12 inches of finished grade with damp sand after installation of conduit and concrete is completed. Remainder of backfill must be native soil. Soil must have no stones or aggregate greater than 3 inches. Backfill must be machine vibrated in 6-inch lifts to provide not less than 90 percent compaction.
    e. **Backfilling Tolerances**

1) Top Surface of Backfilling Within Building Areas: Plus, or minus 1 inch from required elevations
2) Top Surface of Backfilling Under Paved Areas: Plus, or minus 1 inch from required elevations
3) Top Surface of General Backfilling: Plus, or minus 1 inch from required elevations

f. **Redlined Construction Drawings** – The Construction Professionals installing the underground OSP systems will provide two copies of redlined construction drawings to the County, 2 days prior to any concrete pour; and a record of concrete encasement elevations prior to trench backfill.

g. **Soil Compaction Test** – The Construction Professionals who install the OSP system must have soil compaction tested according to the specifications provided by the Authority Having Jurisdiction and tested by a lab authorized by the Authority Having Jurisdiction. Provide a copy of the lab test report to the Authority Having Jurisdiction and the County Inspector of Record for review and acceptance.

h. **Tracer Tape** – Provide a continuous 6-inch wide flat electronically detectable tracer tape, orange in color and located 12 inches above the conduits in the trench or no greater than 36" from surface. The tracer tape must be imprinted with "Caution Fiber Optic Cable Below" a minimum of 24 inches on center. Tracer tape must terminate in ALT High Traffic Cast Iron Test Well with H20 load rating #3111-1 or equivalent. Where necessary as determined by the RCIT Communications Bureau Infrastructure Engineer, test well will be located at each end of the conduit run; tracer tape will be continuous from end to end or if length prohibits a continuous run, additional test wells will be installed.

i. **Patching** – Perform patching of the construction work. Patching must be of the same material, thickness, workmanship and finish as existing and accurately match surrounding work to the satisfaction of the County.

j. **Repaving** – Repaving must be placed in such a manner that interference with traffic, including pedestrian traffic, will be kept to a minimum. The Construction Professionals will establish a program of repaving acceptable to the County.

k. **Job Completion** – On completion of the work, clean the entire site; remove surplus earth, large stones and debris, to off-site legal disposal. Remove tools and equipment and leave the entire area in a neat condition. Repave, reseed and completely restore the area to the condition prior to the start of excavation and trenching work. Landscaping must be restored to its original state.

12. **Protection of Installed Infrastructure**

a. **Damage Prevention** – Provide temporary and removable protection for installed products; control activity in immediate work area to prevent damage.
1) Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
2) Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
3) Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
4) Prohibit traffic from landscaped areas.

13. **Building Penetrations**

    a. **Penetrations in Building Walls** – Caulk and seal cable access penetrations in walls, ceilings and other parts of the building in accordance with California Building Code and as interpreted by Authority Having Jurisdiction over this project. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with applicable code requirements.
    b. **UL-Listing** – Copies of Underwriter Laboratories-listed firestopping assemblies must be submitted to the County for approval prior to installation of any materials.

14. **Horizontal Directional Drilling**

    a. **Design and Key Installation Criteria**
        1) Drilling Steering System – Remote with continuous electronic monitoring of boring depth and location.
        2) Maximum distance for single bores and between boring pits:

Pipe Size	Boring Distance
1 to 1-1/2 inches	400 feet
2 to 2-1/2 inches	350 feet
3 to 6 inches	300 feet

        3) Ratio of Reaming Diameter to Pipe Outside Diameter:
            a) Nominal Pipe Diameter of 6 Inches and smaller: 1.5 maximum.
            b) Nominal pipe diameter larger than 6 Inches: Submit recommended ratio and reaming procedures for review.
    b. **Erection Tolerances**
        1) Maximum variation from horizontal position: 12 inches
        2) Maximum variation from vertical Elevation: 2 inches.
        3) Minimum horizontal and vertical clearance from other utilities: 12 inches
        4) When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

15. **Metallic Enclosures**

    a. **Hoffman Product or Equivalent** – All enclosures must be no smaller than 36"W x 36"H x 12" D.
        1) **Construction** – Lockable NEMA-3 rated galvanized steel enclosure.
        2) **Covers** – Continuous hinge, held closed by flush latch operable by T-Handle
        3) **Finish** – ANSI 61 grey polyester powder paint inside and outside

16. **Shop Drawings**

a. Submit shop drawings to the County for review for limited purpose of checking for conformance with information given and approved design concept expressed in contract documents; and as approved by the Jurisdiction Having Authority. The shop drawings will show quantities and part numbers for all components including conduits, manholes, handholes, junction boxes, and all other associated components. The shop drawings will include, but not be limited to, plan and elevation drawings of every manhole, handhole, and junction box, fabrication and installation drawings, seismic bracing and anchoring drawings, coordination drawings for use on site, engineering calculations, methods of construction and/or installation as may be required to show that the materials, component, accessories, or systems and the positions thereof conform to the requirements of this specification or regulatory requirements and submissions, or both.
b. Shop drawings will establish the actual detail of all fabricated or installed items, indicate correct relation to adjoining work, and amplify design details in accurate relation to physical spaces.
c. For horizontal directional boring, also submit technical data for equipment, method of installation, and proposed sequence of construction. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment and mobile spoils removal unit.
d. By submitting shop drawings and product data, the Construction Professionals represent that they have carefully reviewed and verified materials, quantities, field measurements, existing underground facility, and field construction criteria related thereto. It also represents that the Construction Professionals have checked, coordinated, and verified that information contained within shop drawings and product data conform to the requirements of the work and of the Contract Documents. The Construction Professionals remain responsible for the design concept expressed in the Contract Documents.
e. The County's approval of shop drawings and product data submitted by the Construction Professionals will not relieve them of responsibility for deviations from requirements of the contract documents, unless the Construction Professionals have specifically informed the County in writing of such deviation at the time of submittal, and the County has given written approval of the specific deviation. The Construction Professionals will continue to be responsible for deviations from requirements of the contract documents not specifically noted by the Construction Professionals in writing, and specifically approved by the County in writing.
f. The County's approval of shop drawings and product data will not relieve the Construction Professionals of responsibility for errors or omissions of the design submitted and accepted by the County in such shop drawings and product data.
g. The County's review and approval, or other appropriate action upon shop drawings and product data, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. The County's review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as quantities, or for substantiating instructions for installation, all of which remain the responsibility of the Construction Professionals as required by the Contract Documents. The review will

not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures.

17. **Inspection Requests**

    a. **48-Hour Notice Prior to Concrete Pour** – Inspection notices and requests must be given to the Authority Having Jurisdiction, County Inspector of Record, and RCIT Communications Bureau Infrastructure Engineer a minimum of 48 hours prior to scheduling a concrete pour to encase conduits including sweeps and placing maintenance holes and handholes.

18. **Video Scope Inspection**

    a. The County may direct the Construction Professionals to inspect any or all sections of ducts installed; the cost will be borne by County. Any substandard conditions revealed by video scope inspection will be corrected by the Construction Professionals with no additional cost to the County.

19. **Documentation**

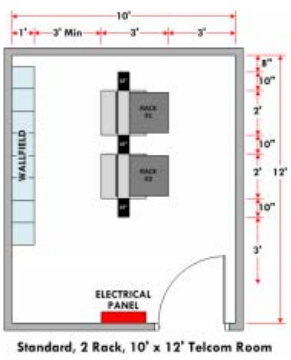
    a. **Redlined Construction Drawings** – The Construction Professionals will provide a copy of the field redline drawings that they use during onsite construction.
    b. **As-Built Drawings** – The Construction Professionals responsible for installation (usually the Contractor) will submit to the County the as-built information in revision clouding format on scaled construction drawing provided as part of the contract documents, indicating location of all underground routes, if different than original design drawings. The as-built drawings will record duct bank bends (radius and center point) ±1-foot by 0-inch accuracy; the installed length of each conduit in the duct bank to the nearest footage; and all existing utility within 25-feet of the telecommunications infrastructure installed. The as-builts will be provided in three hard copies and in AutoCAD (version to be determined by RCIT Communications Bureau Infrastructure Engineer) files on three electronic storage devices within 14 calendar days after the completion of trench backfill and paving. For horizontal directional boring, record actual depth of pipe at 25-foot interval and actual horizontal location of installed pipe; show depth and location of abandoned bores.
    c. **Record Drawings** – The Construction Professionals responsible for the original design (usually the Architect and Electrical Engineer of Record) will prepare, stamp and submit the record drawings to the County within 14 calendar days after receipt of the as-built drawings from the County.

20. **Contractor Warranty**

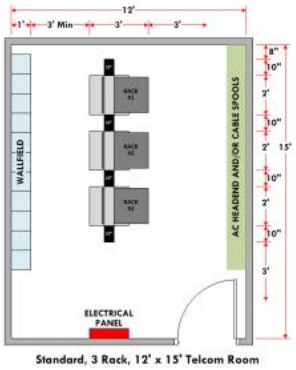
    a. Provide a two-year service warranty against defects in materials and workmanship. Warranty period will commence upon acceptance of the work by County of Riverside

K. Sample Drawings

1. Telecom Room Sizes

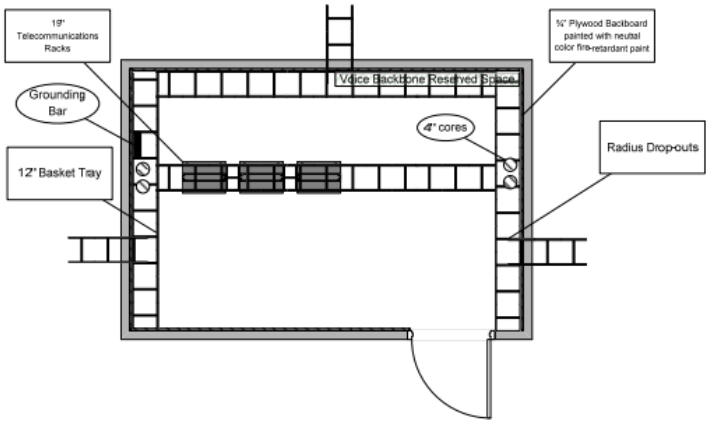


Standard, 2 Rack, 10' x 12' Telcom Room

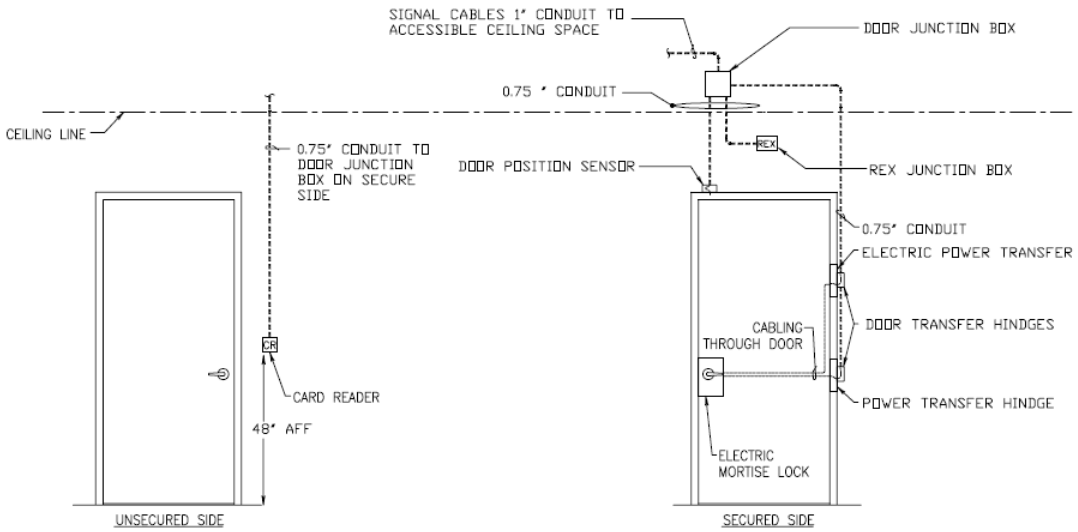


Standard, 3 Rack, 12' x 15' Telcom Room

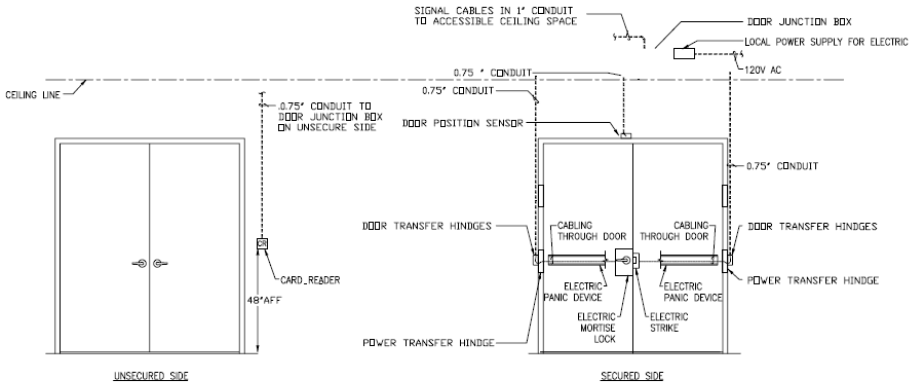
2. Telecom Room Layouts



3. **Access Control Field Devices and Door Hardware**

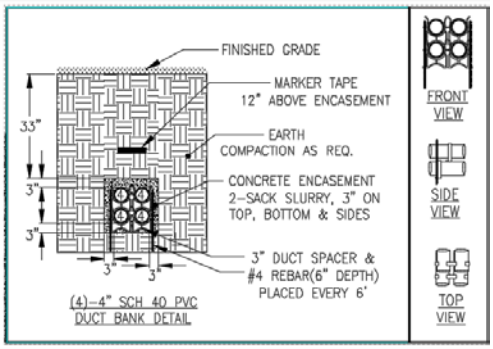


SECURITY SINGLE DOOR SECURITY DEVICE AND LOCKING HARDWARE ROUGH-IN

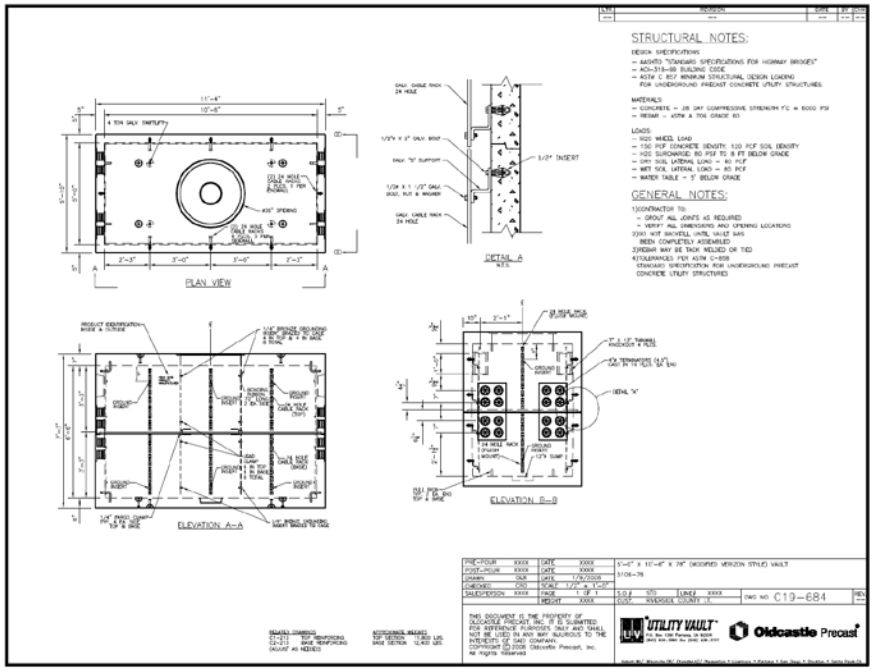


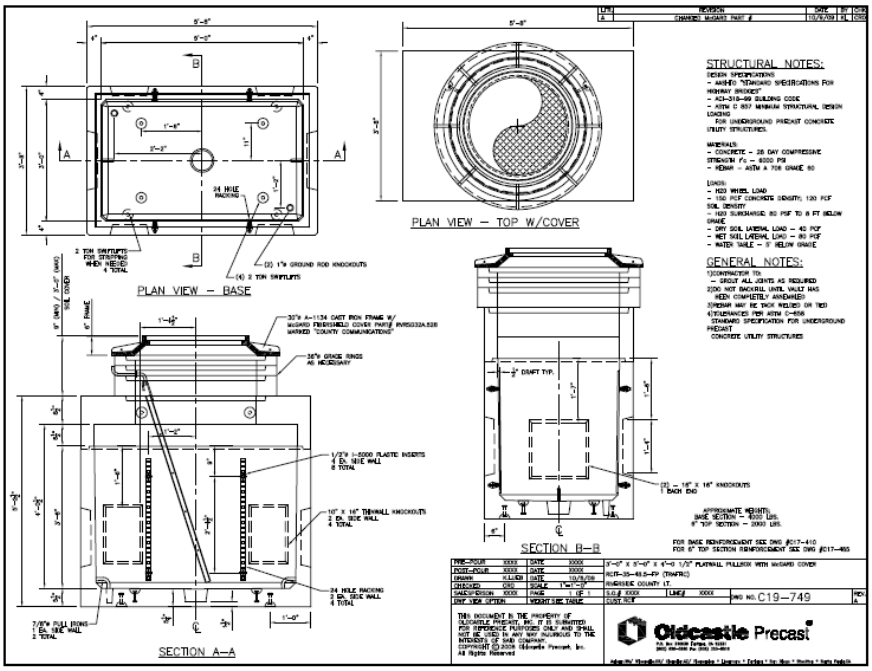
SECURITY DOUBLE DOOR SECURITY DEVICE AND LOCKING HARDWARE ROUGH-IN

4. Marker Tape Placement

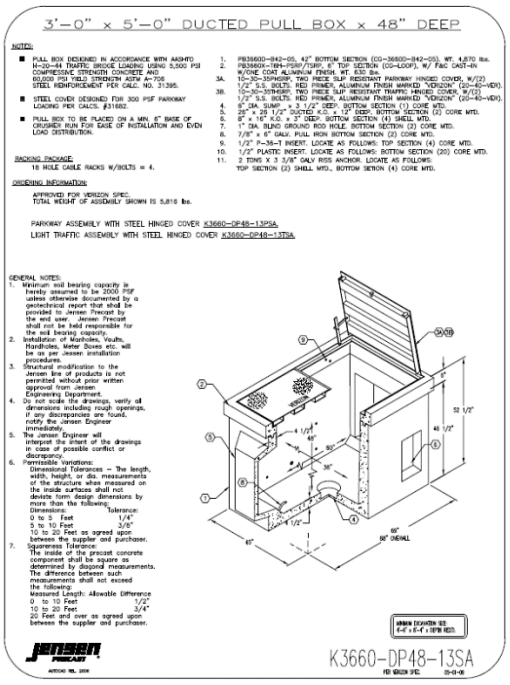


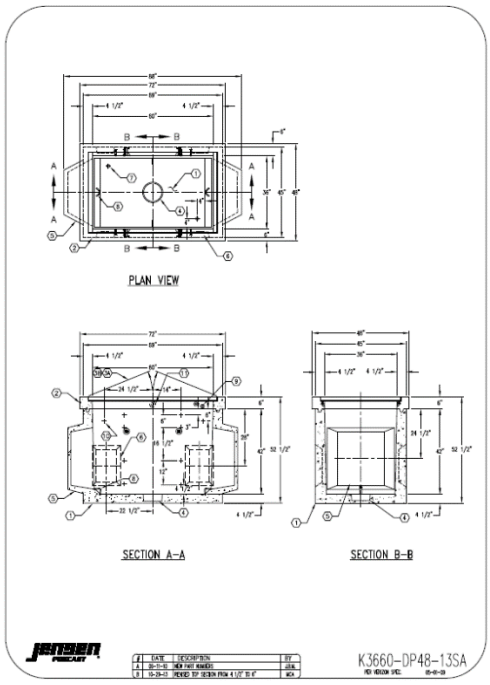
5. Maintenance Holes

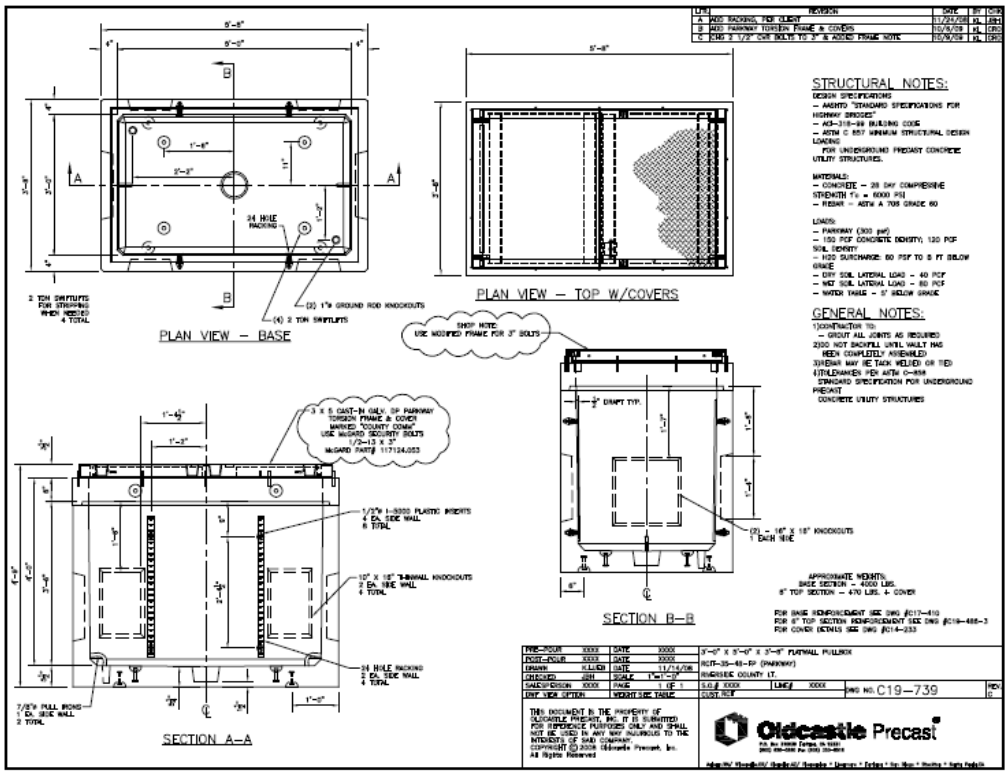


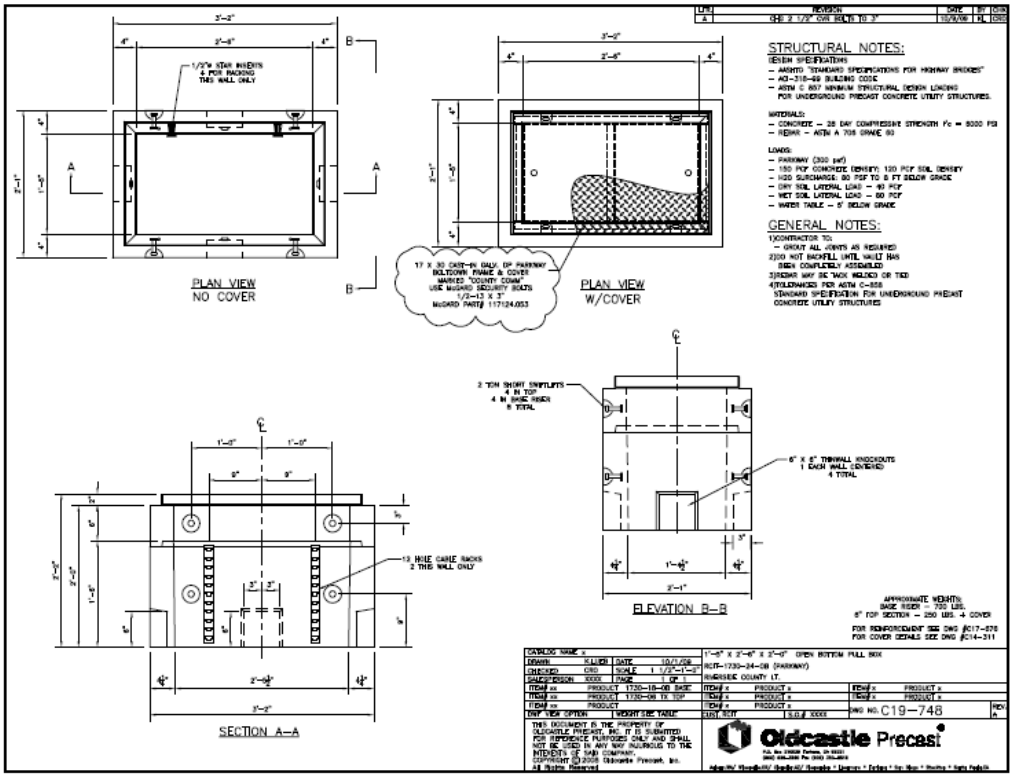

PLAN VIEW – BASE
PLAN VIEW – TOP W/COVER
SECTION A–A
SECTION B–B
STRUCTURAL NOTES:
GENERAL NOTES:
Oldcastle Precast

6. **Handholes**


3'-0" x 5'-0" DUCTED PULL BOX x 48" DEEP
NOTES:
PULL BOX DESIGNED IN ACCORDANCE WITH AASHTO H-20-44 TRAFFIC BRIDGE LOADING USING 5,500 PSI COMPRESSIVE STRENGTH CONCRETE AND 60,000 PSI YIELD STRENGTH ASTM A-706 STEEL REINFORCEMENT PER CALC. NO. 31395.
STEEL COVER DESIGNED FOR 300 PSF PARKWAY LOADING PER CALCS. #31682.
PULL BOX TO BE PLACED ON A MIN. 6" BASE OF CRUSHED RUN FOR EASE OF INSTALLATION AND EVEN LOAD DISTRIBUTION.
RACKING PACKAGE:
18 HOLE CABLE RACKS W/BOLTS = 4.
ORDERING INFORMATION:
APPROVED FOR VERIZON SPEC.
TOTAL WEIGHT OF ASSEMBLY SHOWN IS 5,816 lbs.
PARKWAY ASSEMBLY WITH STEEL HINGED COVER K3660-DP48-13PSA
LIGHT TRAFFIC ASSEMBLY WITH STEEL HINGED COVER K3660-DP48-13TSA
1. PB36600-842-05, 42" BOTTOM SECTION (CQ-36600-842-05), WT. 4,870 lbs.
2. PB36600X-18H-PSRP/TSRP, 8" TOP SECTION (CQ-LOOP), W/ F&C CAST-IN W/ONE COAT ALUMINUM FINISH, WT. 630 lbs.
3A. 10-30-35HHSRP, TWO PIECE SLIP RESISTANT PARKWAY HINGED COVER, W/(2) 1/2" S.S. BOLTS, RED PRIMER, ALUMINUM FINISH MARKED "VERIZON" (20-40-VER).
3B. 10-30-35THSRP, TWO PIECE SLIP RESISTANT TRAFFIC HINGED COVER, W/(2) 1/2" S.S. BOLTS, RED PRIMER, ALUMINUM FINISH MARKED "VERIZON" (20-40-VER).
4. 9" DIA. SUMP - x 3 1/2" DEEP, BOTTOM SECTION (1) CORE MTD.
5. 6" x 4" OVAL - x 3" DEEP, BOTTOM SECTION (2) CORE MTD.
6. 8" x 12" O.D. - x 3" DEEP, BOTTOM SECTION MTL SHELL MTD.
7. 1" DIA. BLIND GROUND ROD HOLE, BOTTOM SECTION (2) CORE MTD.
8. 7/8" x 6" GALV. PULL IRON BOTTOM SECTION (2) CORE MTD.
9. 1/2" P-36-T INSERT, LOCATE AS FOLLOWS: TOP SECTION (4) CORE MTD.
10. 1/2" PLASTIC INSERT, LOCATE AS FOLLOWS: BOTTOM SECTION (20) CORE MTD.
11. 2 TONS X 3 3/8" GALV RISS ANCHOR, LOCATE AS FOLLOWS: TOP SECTION (2) SHELL MTD., BOTTOM SETION (4) CORE MTD.
GENERAL NOTES:
1. Minimum soil bearing capacity is hereby assumed to be 2000 PSF unless otherwise documented by a geotechnical report that shall be provided to Jensen Precast by the end user. Jensen Precast shall not be held responsible for the soil bearing capacity.
2. Installation of Manholes, Vaults, Handholes, Meter Boxes etc. will be as per Jensen installation procedures.
3. Structural modification to the Jensen line of products is not permitted without prior written approval from Jensen Engineering Department.
4. Do not scale the drawings, verify all dimensions including rough openings, if any discrepancies are found, notify the Jensen Engineer immediately.
5. The Jensen Engineer will interpret the intent of the drawings in case of possible conflict or discrepancy.
6. Permissible Variations:
Dimensional Tolerances – The length, width, height, or dia. measurements of the structure when measured on the inside surface shall not deviate from design dimensions by more than the following:
Dimensions Tolerance:
0 to 5 Feet 1/4"
5 to 10 Feet 3/8"
10 to 20 Feet as agreed upon between the supplier and purchaser.
7. Squareness of Ends:
The ends of the precast concrete component shall be square as determined by diagonal measurements. The difference between such measurements shall not exceed the following:
Measured Length: Allowable Difference
0 to 10 Feet 1/2"
10 to 20 Feet 3/4"
20 Feet and over as agreed upon between the supplier and purchaser.
K3660-DP48-13SA

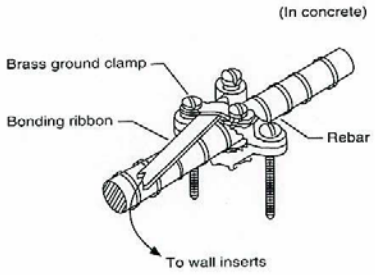

PLAN VIEW
SECTION A–A
SECTION B–B
K3660-DP48-13SA


REVISION
A ADD RACKING, PER CLIENT
B ADD PARKWAY TORSION FRAME & COVERS
C CMS 2 1/2" CVR BOLTS TO 3" & ADDED FRAME NOTE
PLAN VIEW – BASE
PLAN VIEW – TOP W/COVERS
SECTION A–A
SECTION B–B
STRUCTURAL NOTES:
GENERAL NOTES:
SHOP NOTE: USE MODIFIED FRAME FOR 3" BOLTS
3 X 5 CAST-IN GALV. SP PARKWAY TORSION FRAME & COVER MARKED "COUNTY CONN." USE McGARD SECURITY BOLTS 1/2-13 X 3"
McGARD PART# 117124.053
1/2"Ø I-5000 PLASTIC INSERTS 4 EA. SIDE WALL 8 TOTAL
10" X 18" 7-8WALL KNOCKOUTS 2 EA. SIDE WALL 4 TOTAL
24 HOLE RACKING 4 EA. SIDE WALL 4 TOTAL
7/8"Ø PULL IRONS 1 EA. SIDE WALL 2 TOTAL
(8) – 16" X 18" KNOCKOUTS 1 EACH WALL
APPROXIMATE WEIGHTS:
BASE SECTION – 4000 LBS.
8" TOP SECTION – 470 LBS. + COVER
FOR BASE REINFORCEMENT SEE DWG #C17–410
FOR 8" TOP SECTION REINFORCEMENT SEE DWG #C19–488–3
FOR COVER DETAILS SEE DWG #C14–233
5'-0" X 5'-0" X 3'-6" FLATWALL PULLBOX
RCTF-35-48-FP (PARKWAY)
RIVERSIDE COUNTY LT.
DWG NO. C19–739
Oldcastle Precast

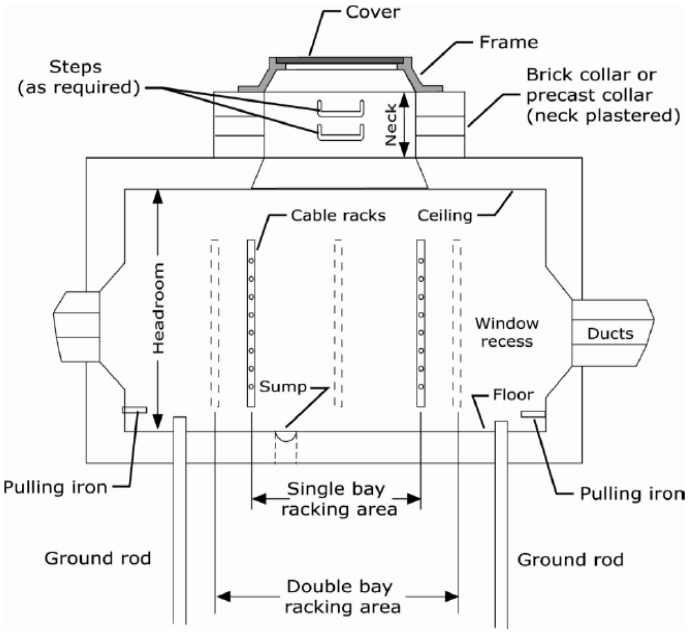


7. **Ground Rod Bonding**

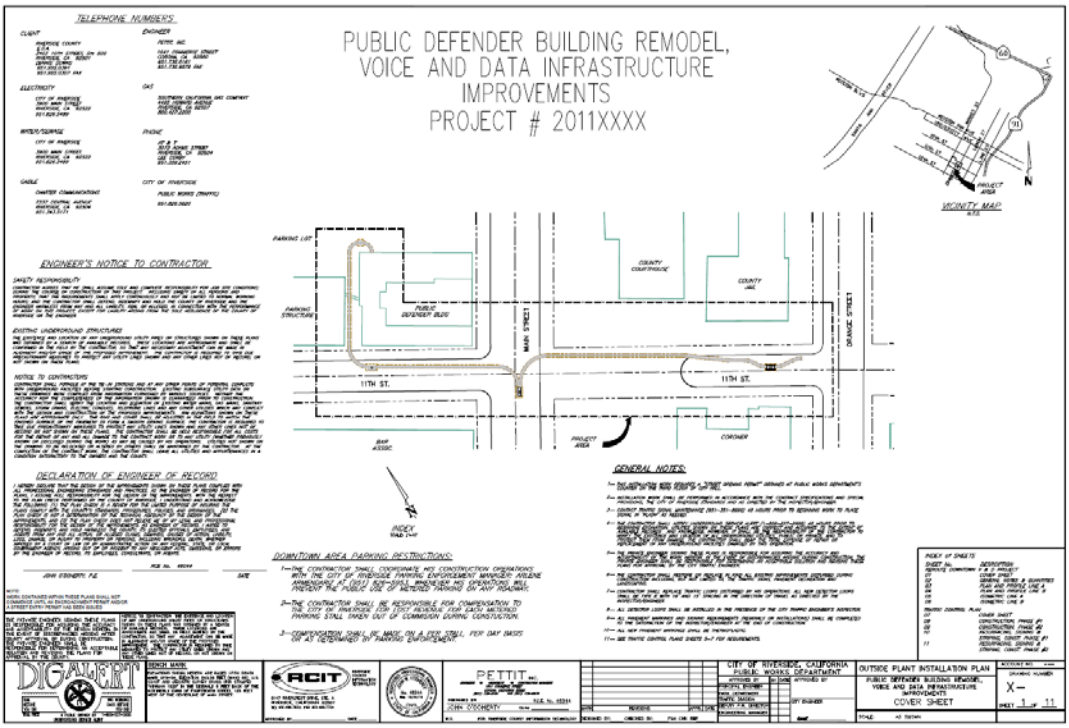
Clamped bonding attachment to rebar for precast or site-poured maintenance hole

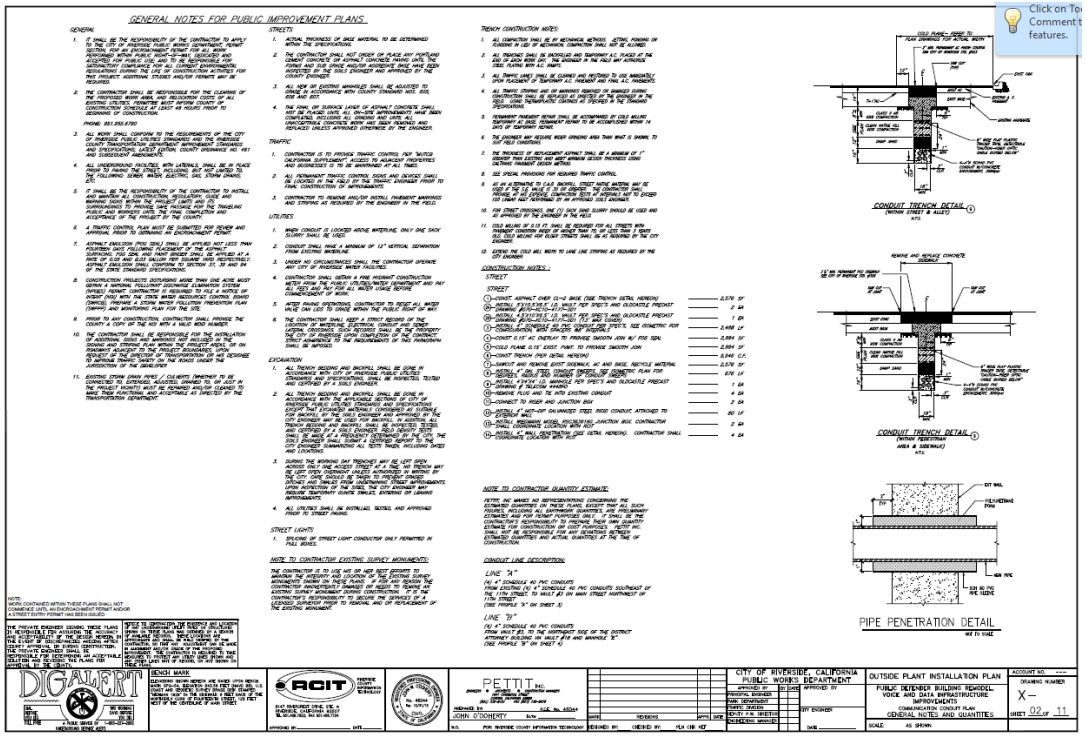


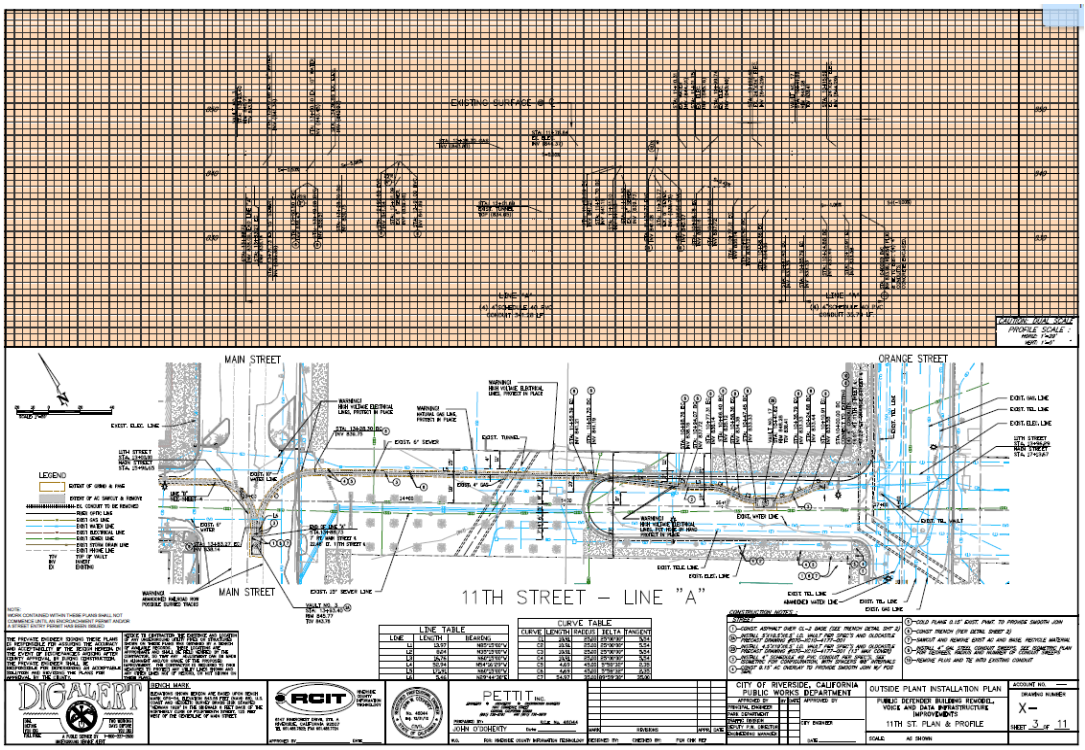
8. **Ground Rod in Maintenance Hole**

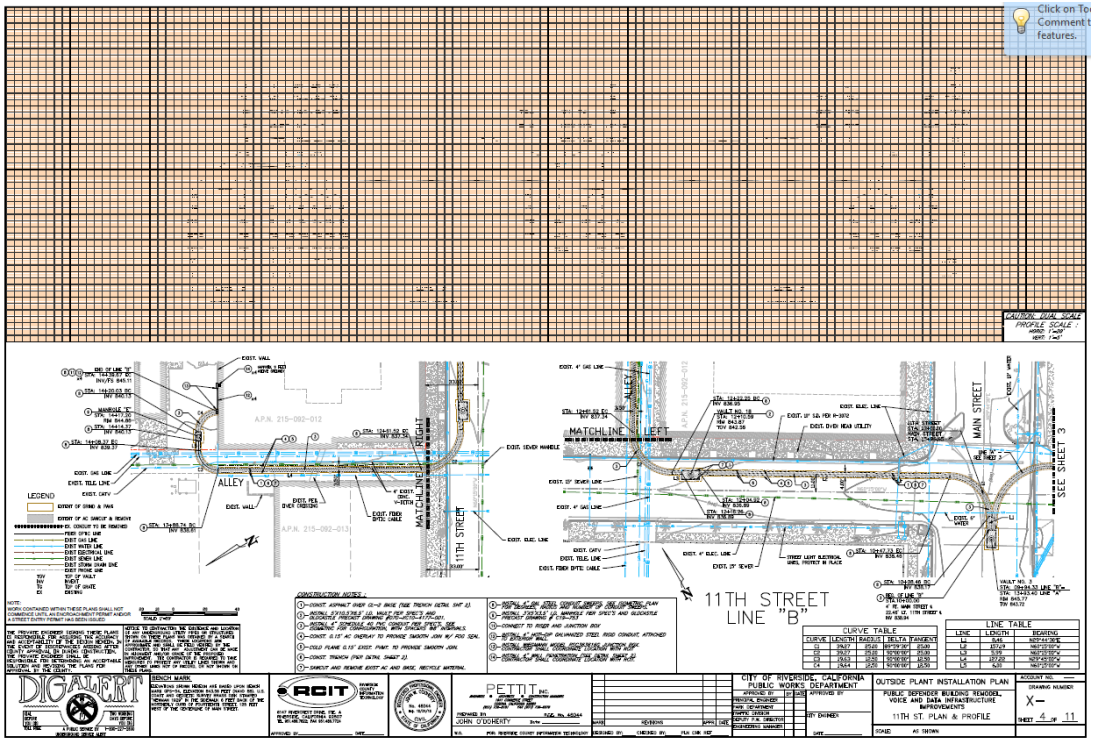


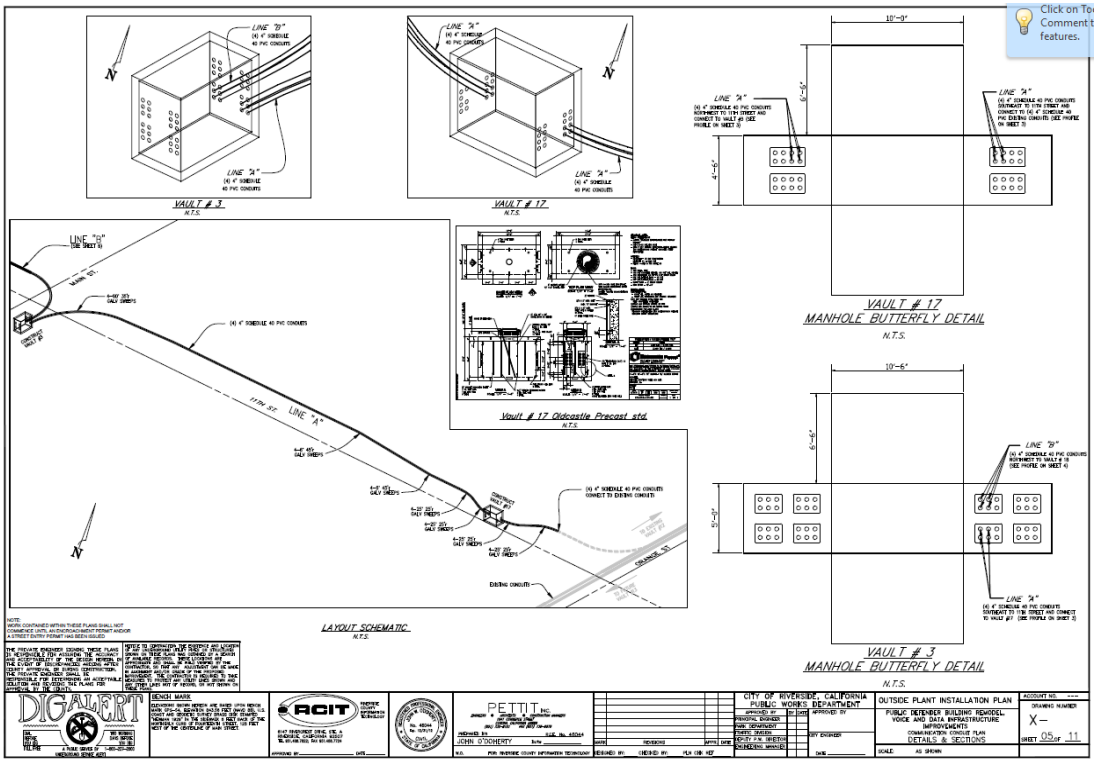
9. **OSP Design Drawings**

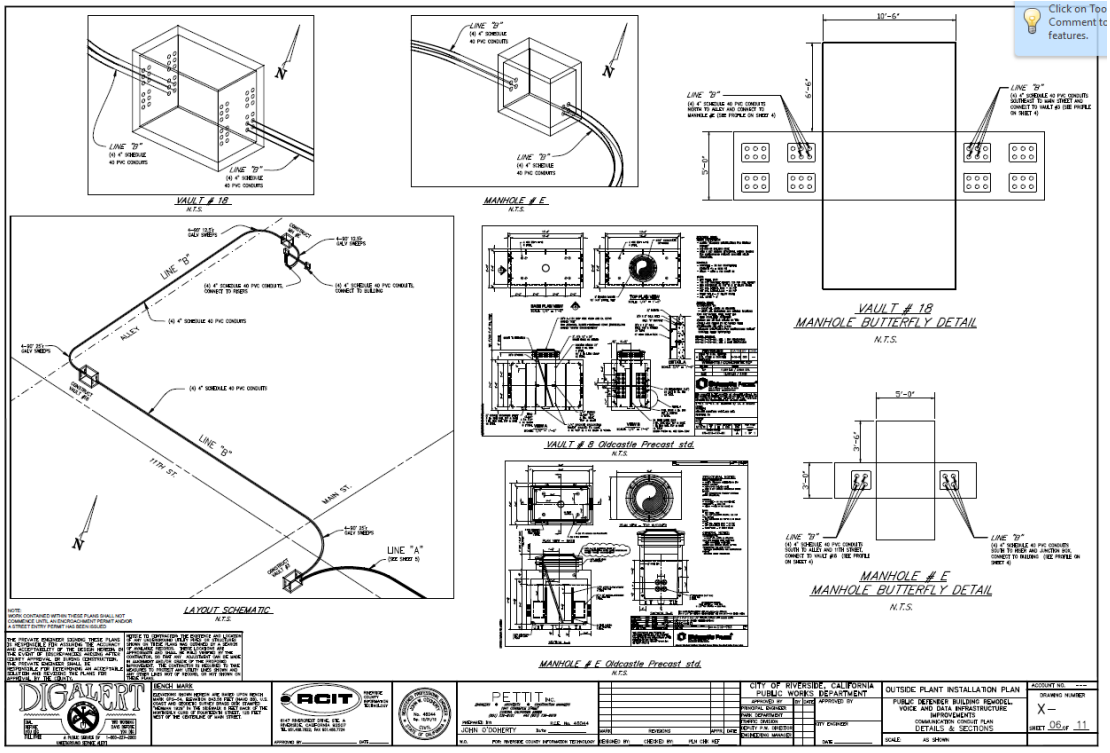



GENERAL NOTES FOR PUBLIC IMPROVEMENT PLANS
CONDUIT TRENCH DETAIL
CONDUIT TRENCH DETAIL
PIPE PENETRATION DETAIL
CITY OF RIVERSIDE, CALIFORNIA
PUBLIC WORKS DEPARTMENT
OUTSIDE PLANT INSTALLATION PLAN
PUBLIC DEFENDER BUILDING REMODEL, VOICE AND DATA INFRASTRUCTURE IMPROVEMENTS
COMMUNICATION CONDUIT PLAN
GENERAL NOTES AND QUANTITIES
DRAWING NUMBER X–
SHEET 22 OF 11


EXISTING SURFACE OF ℄
LINE "A"
LINE "B"
CAUTION DUAL SCALE
PROFILE SCALE : HORIZ. 1"=40'
VERT. 1"=4'
MAIN STREET
ORANGE STREET
11TH STREET – LINE "A"
LEGEND
LINE TABLE
CURVE TABLE
CITY OF RIVERSIDE, CALIFORNIA
PUBLIC WORKS DEPARTMENT
OUTSIDE PLANT INSTALLATION PLAN
PUBLIC DEFENDER BUILDING REMODEL, VOICE AND DATA INFRASTRUCTURE IMPROVEMENTS
11TH ST. PLAN & PROFILE
DRAWING NUMBER X–
SHEET 3 OF 11


11TH STREET
LINE "B"
MATCHLINE "LEFT"
MATCHLINE "RIGHT"
MAIN STREET
ALLEY
SEE SHEET 3
CURVE TABLE
LINE TABLE
CITY OF RIVERSIDE, CALIFORNIA
PUBLIC WORKS DEPARTMENT
OUTSIDE PLANT INSTALLATION PLAN
11TH ST. PLAN & PROFILE


VAULT # 3
VAULT # 17
VAULT # 17
MANHOLE BUTTERFLY DETAIL
Vault # 17 Oldcastle Precast std.
LAYOUT SCHEMATIC
VAULT # 3
MANHOLE BUTTERFLY DETAIL
CITY OF RIVERSIDE, CALIFORNIA
PUBLIC WORKS DEPARTMENT
OUTSIDE PLANT INSTALLATION PLAN
DETAILS & SECTIONS



L. Construction Professional Checklist

	Item	Yes, No, or NA (Provide justification and signoff by RCIT in the next column if the answer is "No" or "NA")	Page number of Construction Document spec section or drawing number where the requirements are incorporated	Justification & signoff by RCIT for deviation(s)
Purpose of RCIT Standards document	Does Paragraph A.1 of the RCIT Standards document clearly explain the document purpose?			
Definitions	Are all definitions in Section B of the RCIT Standards document understood?			
Conduit pathway design requirements	Does the design documents submittal for review conform to requirements per Paragraphs C.1 and C.2 of the RCIT Standards document?			
Design drawing submittal to RCIT for review	Are all drawings included per Paragraphs C.3.a, C.3.b, C.3.c, and C.3.d of the RCIT Standards document?			
Codes and industry standards	Have the design engineers familiarized themselves with all referenced codes and standards per Paragraph C.4 of the RCIT Standards document?			
Deviations from ANSI/TIA/EIA standards	If there are deviations from ANSI/TIA/EIA standards in the design, are they justified and approved by RCIT Communications Bureau Infrastructure Engineer per Paragraph D.1 of the RCIT Standards document?			
Applicability of telecommunications room	Has the design team coordinated with, and obtained approval from, the RCIT Communications Bureau Infrastructure Engineer for the telecom room sizing according to the building usage per Paragraph E.1 of the RCIT Standards document?			
Telecommunications room use	Is the telecommunications room designed to house only telecommunications and IT functions per Paragraph E.2 of the RCIT Standards document?			
Telecommunications room completion	Is completion timeline of the telecommunications rooms scheduled per Paragraph E.3 of the RCIT Standards document?			
Telecommunications room location	Has the design team coordinated with the RCIT Communications Bureau Infrastructure Engineer to determine telecom room location per Paragraph E.4 of the RCIT Standards document?			
Telecommunications room sizes	Is every telecommunications room rectangle in in shape and of the right dimension per Paragraph E.5 of the RCIT Standards document?			
Plywood wall lining Telecommunications rooms	Are all walls lined with AC grade plywood per Paragraph E.6 of the RCIT Standards document?			
Telecommunications room doors	Is the door of every telecommunications room a minimum of 36"W x 80"H, equipped with a lock, and be able to open outward per Paragraph E.7 of the RCIT Standards document?			
Cooling unit in telecommunications rooms	Is a dedicated, 150-BTU per SF environmental control system provided in each telecommunications room and to be installed per Paragraph E.8 of the RCIT Standards document?			
Fire sprinklers in telecommunications rooms	Does each sprinkler in the telecom rooms have a high temperature standard response full circle head with a heavy-duty cover, at 10 ft AFF, not be “charged” under normal conditions per Paragraph E.9 of the RCIT Standards document?			
Lighting in telecommunications rooms	Does lighting provide a minimum of 500 lux measured 3 ft AFF per Paragraph E.10 of the RCIT Standards document?			
Emergency lighting in telecommunications rooms	Is emergency lighting provided to ensure that the loss of power to normal lights will not hamper an emergency exit from the room per Paragraph E.11 of the RCIT Standards document?			

Floor in telecommunications rooms	Is the floor designed to support a minimum load bearing of one hundred (100) pounds per square foot and maximum concentration loading of 2,000 lbs. per foot per Paragraph E.12 of the RCIT Standards document?			
Ceiling in telecommunications rooms	If a ceiling is installed in the Telecommunications Room, is it at a minimum of 10 feet AFF per Paragraph E.13 of the RCIT Standards document?			
Dedicated power feeder in telecommunications rooms	Is a dedicated power feeder and subpanel provided for each telecommunications room; and connected to the emergency power per Paragraph F.1 of the RCIT Standards document?			
General purpose electrical outlets in telecommunications rooms	Are general purpose electrical outlets provided in the telecommunications rooms per Paragraph F.2 of the RCIT Standards document?			
Electrical outlets for IT equipment	Are electrical outlets for IT equipment provided as specified and coordinated with RCIT Communications Bureau Infrastructure Engineer per Paragraphs F.3, F.4, F.5, and F.6 of the RCIT Standards document?			
Emergency air conditioner outlet	Is Emergency air conditioner outlet per Paragraph F.8 of the RCIT Standards document?			
Grounding busbar	Is the grounding busbar specified per Paragraph F.9 of the RCIT Standards document?			
General inside plant conduit requirements	Are conduit requirements specified and depicted on the drawings per Paragraphs G.1.a, -b, -c, -d, -e, -f, -g, -h, -i, and -j of the RCIT Standards document?			
Conduits for data work area outlets	Are conduit requirements for data outlets specified and depicted on the drawings per Paragraphs G.2.a, -b, -c, -d, -e, and -f of the RCIT Standards document?			
Conduits for access control field devices, door hardware and door power	Are conduit requirements for access control field devices specified and depicted on the drawings per Paragraphs G.3.a, -b, -c, -d, -e, -f, -g, and -h of the RCIT Standards document?			
Conduits for video surveillance system cameras	Are conduit requirements for video surveillance system cameras specified and depicted on the drawings per Paragraphs G.4.a and -b of the RCIT Standards document?			
Conduits for burglar alarm system devices	Are conduit requirements for burglar alarm system devices specified and depicted on the drawings per Paragraphs G.5.a, -b, -c, -d, -d, and -f of the RCIT Standards document?			
Conduits connecting telecom rooms and MPOE in same building	Are conduits connecting telecom rooms and MPOE provided per Paragraphs G.6.a, -b, and -c of the RCIT Standards document?			
Conduits from MPOE to service provider's vault and conduits connecting buildings	Are underground conduits from MPOE to provider's handhole identified in Paragraph G.7.a and conduits between buildings identified in Paragraph G.8.a designed per Section J of the RCIT Standards document?			
Cable tray placement	Has interdisciplinary coordination been performed per Paragraph H.1.a of the RCIT Standards document to eliminate potential conflicts between cable tray and other utilities?			
Cable tray specifications	Is cable tray installation specified per Paragraphs H.1.b, -c, -d, and -e of the RCIT Standards document?			
Firestopping	Is firestopping specified per Paragraph I.1 of the RCIT Standards document?			
OSP Shared trench(es)	Has placing telecom underground pathways and spaces in the same vertical plane as other utilities been avoided per Paragraph J.1 of the RCIT Standards document?			
Application of conduit types in OSP	Are the application of each conduit type clearly specified per **J.2.a** of the RCIT Standards document?			
OSP conduit depth requirements	Has the conduit depth been specified per Paragraph J.2.b of the RCIT Standards document and noted on pertinent drawings?			
OSP conduit quantity and routing	Has the designated RCIT Communications Bureau Infrastructure Engineer signed off on the conduit quantity and routing per Paragraph J.2.c in the RCIT Standards document?			

Maximum OSP conduit section	Is a maintenance hole or handhole placed for every conduit section longer than 300 feet per Paragraph J.2.d in the RCIT Standards document?			
OSP conduit clearances	Is the design compliant with the clearance requirements per Paragraphs J.2.e of the RCIT Standards document? Are all clearance requirements incorporated and specified in the construction documents accordingly?			
OSP conduit installation requirements	Are conduit installation requirements specified per Paragraphs J.2.f, -g, -h, -I, -j, -k, -l, -m, -n, -o, -p, -q, -r, -s, and -t of the RCIT Standards document?			
Two service entrance points	Are there two service entrance points per Paragraph J.3.a of the RCIT Standards document?			
Service connection to every building on campus	Is a conduit system provided per Paragraph J.3.b of the RCIT Standards document for every building on campus to enter the nearest entrance maintenance hole/hand hole at the property line?			
Entrance conduit termination and conduit support system	Are conduit termination and seismic support requirements specified per Paragraphs J.3.c and -d of the RCIT Standards document?			
Conduits connecting telecom rooms or MPOEs in different buildings	Are conduits connecting telecom rooms or MPOEs in different buildings provided per Paragraphs J.4.a, -b, and -c of the RCIT Standards document?			
General requirements for maintenance holes and handholes	Are general requirements for maintenance holes and handholes specified per Paragraphs J.5.a, -b, -c, -d, -e, -f, -g, -h, -I, -j, -k, -l, -m, -n, -o, -p, -q, -r, -s, -t, -u, -v, -w, -x, and -y of the RCIT Standards document?			
County-approved maintenance holes	Are County-approved maintenance holes specified per Paragraphs J.6.a and -b of the RCIT Standards document?			
County-approved handholes	Are County-approved handholes specified per Paragraphs J.7.a, -b and -c of the RCIT Standards document?			
Excavation and trenching requirements	Are excavation and trenching requirements include those in Paragraphs J.8.a, -b, -c., -d, -e, and -f of the RCIT Standards document?			
Excavation temporary cover	Are excavation temporary requirements include those in Paragraphs J.9.a, -b and -c of the RCIT Standards document?			
OSP grounding and bonding	Are grounding and bonding requirements include those in Paragraphs J.10.a, -b, -c, and -d of the RCIT Standards document?			
Backfilling trenches	Are requirements to backfill trenches include those in Paragraphs J.11.a, -b, -c, -d, -e, -f, -g, -h, -I, -j, and -k of the RCIT Standards document?			
Protection of installed infrastructure	Are requirements to protect the installed infrastructure include those in Paragraph J.12.a of the RCIT Standards document?			
Building penetrations	Are requirements to penetrate buildings include those in Paragraph J.13.a and -b of the RCIT Standards document?			
Horizontal directional drilling	Are requirements for horizontal drilling include those in Paragraphs J.14.a and -b of the RCIT Standards document?			
Metallic enclosures	Are requirements for metallic enclosures include those in Paragraph J.15.a of the RCIT Standards document?			
Shop drawings	Are requirements for shop drawings include those in Paragraphs J.16.a, -b, -c, -d, -e, -f, and -g of the RCIT Standards document?			
Inspection request	Are requirements for inspection requests include those in Paragraph J.17.a of the RCIT Standards document?			
Video scope inspection	Are requirements for video scope inspection include those in Paragraph J.18.a of the RCIT Standards document?			
Documentation	Are requirements for documentation include those in Paragraphs J.19.a, -b and -c of the RCIT Standards document?			
Contractor warranty	Are requirements for contractor warranty include those in Paragraph J.20.a of the RCIT Standards document?			

Sample drawings	Are contract drawings incorporate all concepts and requirements provided in samples in Paragraphs K.1, -2, -3, -4, -5, -6, -7, -8, and -9 of the RCIT Standards document?			
Design checklist	Has the design checklist provided in Section L of the RCIT Standards document been completed?			