

## Section D7010 IT Pathways

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### D7010 - Introduction

This section includes minimum requirements and installation methods for the following:

1. EMT conduit systems
2. Cable tray systems
3. Surface metal raceway systems
4. Wireless Access Point (AP) mounts and enclosures
5. Audiovisual equipment (AV)

### D7010.11 – IT Pathway Requirements General

This section outlines IT Pathway internal to the buildings to support both Backbone cabling and Horizontal cabling. The main routes for these pathways shall be from the MDF/IDF rooms to the station faceplate location including riser pathway from floor to floor.

### D7010.21 – IT Pathway Materials

1. Refer to Appendix **D7010.211** for IT Pathway Materials.
2. D7010.212 – EMT Conduit Systems
  - a. Electrical Metallic Tubing (EMT): Electro-galvanized steel tubing 3/4" and larger diameter per project requirements:
    - i. Conduit joint couplings and connectors: steel double set screw indenter fittings
    - ii. Metal bushing for each connector for all sizes of conduit
    - iii. Metal bushings with grounding lugs as required
    - iv. Conduit sweeps: minimum 10 times the conduit inside diameter
    - v. Include required conduit straps, and hangers, heavy-duty malleable iron or steel
    - vi. LB fittings and plastic fittings are not permitted
    - vii. Nipple runs from one outlet box to another outlet box are not permitted
  - b. Outlet boxes: Galvanized steel sheet metal 4 – 11/16" x 4 – 11/16" x 2-1/8" deep minimum with single gang mud ring.
  - c. Pull-boxes: Minimum 14-gauge galvanized steel with screw fastened cover and trim for flush or surface mounting as required for project. Dimensions as required for project.

- i. Box extensions are prohibited for new construction however they are permitted on remodel work to extend existing installations.
    - d. Metal Flex Conduit (3/4") and deep Cut-In Boxes for outlets in existing walls for remodel projects only.
    - e. Mule-tape: polyester or aramid line with a minimum pull tensile strength of 200 pounds for backbone conduit.
    - f. Poly line: poly pull line with a minimum pull tensile strength of 200 pounds for station conduit.
  - 3. D7010.213 – Cable Tray and Support Systems
    - a. Cable Trays in Ceiling Areas:
      - i. Welded wire mesh cable system sized per drawings.
      - ii. Include components, and compatible fittings designed and manufactured by the cable tray manufacturer as required for a fully installed electrically continuous system.
      - iii. Include support kits, brackets, threaded rod hangers, lateral threaded rod braces, and other anchors and supports as required as specified in Section **D7010.315**.
    - b. Cable Support in Ceiling Areas:
      - i. J-hooks specifically designed for low-voltage cable support sized per drawings.
      - ii. Perforated pipe strap, bridle rings, or wire hangers are not permitted.
      - iii. Plastic cable ties are not permitted to support station cabling in any location.
  - 4. D7010.214 – Surface Metal Raceway Systems
    - a. Surface Metal Raceway Systems (SMRS):
      - i. Surface Raceway: Steel Raceway with Ivory color finish
      - ii. Surface Raceway Parts and Fittings (SRPF):
      - iii. Modular furniture shall use either the KeyConnect Decora Adapter with standard Decora wall plate or Angular MediaFlex Faceplate.
      - iv. Surface raceways shall use either the KeyConnect Decora Adapter with standard Decora wall plate or Angular MediaFlex Faceplate. For all fiber jacks these extension boxes MUST be used for all Faceplates mounted over electrical boxes with a single-gang mud rings, or cut-in single-gang boxes.
      - v. Extra deep Surface Single gang extension box for all faceplates on flat surfaces (e.g., inside fire alarm control panel).
      - vi. Include all parts and components: base and cover, compatible fittings, metal bushings, and supports designed and manufactured by the raceway manufacturer as required for a complete installation.
      - vii. Surface box for camera installation: Galvanized steel sheet metal 4 – 11/16" x 4 – 11/16" x 2-1/8" deep minimum with single gang mud ring. (see detail).
        - 1. Refer to Appendix **D7010.2143** for Camera Box Detail.
  - 5. D7010.215 – Wireless details shall refer to the OIT wireless standards.
  - 6. D7010.216 – Wireless Materials shall refer to the OIT wireless standards.
  - 7. D7010.217 – Anchoring Materials and Supports
    - a. Metal bars, plates, channel, tubing, etc. shall conform to ASTM Standards:
      - i. Steel plates, shapes, bars, and grating
      - ii. Cold-formed steel tubing

- iii. Hot-rolled steel tubing
    - iv. Steel pipe
  - b. Metal fasteners shall be zinc-coated.
  - c. Anchoring Materials:
    - i. Structural Steel
    - ii. Steel Channel: Galvanized or painted
    - iii. Uni-Strut
- 8. D7010.218 – Grounding and Bounding Materials
  - a. Mechanical Connectors: Bronze.
  - b. Bonding Conductor: 6 AWG minimum copper.
  - c. All grounding equipment shall be UL listed for that purpose.

**D7010.31 – IT Pathway Execution**

- 1. D7010.311 Pathway Installation
  - a. Place new pathways and support systems as shown on the project drawings.
  - b. Perform installation of pathways as specified in Section **D7010** including anchoring and supports, grounding and bonding, firestop, etc.
  - c. Conduit, cable tray, J-hook, and surface raceway systems shall be so installed, that no cable run will exceed 290' in length from the Telecommunications Room (TR) or Equipment Room (ER) to the farthest outlet. Where building conditions prohibit meeting this requirement, notify the OIT Construction Manager (CM) and Consultant immediately for resolution. Additional TRs or ERs may need to be provided.
  - d. Where any portion of a horizontal cable run will be routed outside, or under slab, 1" conduit shall be provided for the entire route from the outlet to the ER or TR.
  - e. Ceiling tile shall be removed as necessary for the conduit, cable tray, J-hook, and support system installation, and shall be put back in place without damaging or dirtying any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The Contractor is responsible for the cost of repair or replacement of any damaged or dirtied tiles or ceiling hardware.
  - f. When installing through tile ceiling grid, conduit or raceway shall be extended above top of ceiling grid to a pull box feeder system or within 6" of the cable tray. Ceiling tiles shall be notched to the size of conduit or raceway along the edge of the tile. Holes shall not be cut in the middle of ceiling tiles.
  - g. Coordinate pathway routes with other trades.
  - h. For J-hooks, cable tray, or non-metal pathways, maintain the following clearances from EMI sources:
    - i. Unshielded power lines or equipment less than 5 kVA: 12"
    - ii. Unshielded power lines or equipment equal to or greater than 5 kVA: 24"
    - iii. Power lines enclosed in grounded metal conduit less than 5 kVA: 6"
    - iv. Power lines enclosed in grounded metal conduit equal to or greater than 5 kVA: 12"
    - v. Fluorescent fixtures: 12"
    - vi. Motors or transformers: 48"
  - i. For grounded metal pathways (conduit), maintain the following clearances from EMI sources:

- i. Unshielded power lines or equipment less than 5 kVA: 6"
    - ii. Unshielded power lines or equipment equal to or greater than 5 kVA: 12"
    - iii. Power lines enclosed in grounded metal conduit less than 5 kVA: 3"
    - iv. Power lines enclosed in grounded metal conduit equal to or greater than 5 kVA: 6"
    - v. Fluorescent fixtures: 6"
    - vi. Motors or transformers: 36"
2. D7010.312 Conduit, Cable Tray, and Support System Installation
  - a. No section of conduit shall be longer than 30 m (100 ft) between pull points (e.g., outlet boxes, telecommunications closets, or pull-boxes).
  - b. The inside radius of a bend in conduit shall be at least 10 times the conduit internal diameter. Bends in the conduit shall not contain any kinks or other discontinuities that may have a detrimental effect on the cable sheath during cable pulling operations. Where cabling requires larger bends, the conduit bends shall comply with the cable manufacturers' and TIA requirements.
  - c. No section of conduit shall contain more than two 90° bends, or equivalent bends exceeding 180° total, between pull points. If there is a reverse (u-shaped) bend in the section, a pull-box shall be installed. Of the 180° offsets, kicks shall not exceed 30 degrees.
  - d. 3-point saddles are not permitted in conduit runs.
  - e. A minimum of two (2) 4" conduits shall be installed through gypsum walls and ceilings greater than 3' wide in corridors, and around all corridor corners or intersections with gypsum ceilings.
  - f. Provide pull-boxes as required to accommodate cable pulling and code compliance due to field conditions for each project.
  - g. Install pull-boxes in readily accessible locations. Equipment, piping, ducts, and the like shall not block access to the boxes. The Contractor shall coordinate access doors as required to provide access to pull-boxes in hard ceilings and similar inaccessible areas.
  - h. Collector/distribution conduit shall be 25' ± 5' between pull-boxes. Conduits and boxes shall be upsized per fill in area in accordance with BICSI guidelines. Install the conduit collector/distribution system so that the electrical continuity of the system for the main feed is maintained.
  - i. Conduits terminating into cable trays or J-hooks shall end no more than 6" away from the tray or J-hook and the conduits shall be bonded to the cable tray.
  - j. Conduit pathways shall not pass through electrical rooms.
  - k. J- hook runs shall not be installed in mechanical and electrical rooms. Install dedicated 1" conduit for each telecommunications outlet to the nearest pull-box, cable tray, or J-hook support system.
  - l. Where multiple outlets serve an area, a conduit feeder system may be required based on the attached drawing: **TYPICAL TELECOMMUNICATION CONDUIT LAYOUTS**. The conduit feeder system design shall be documented in drawing form and shall be approved in writing by the OIT Infrastructure Engineering department prior to installation.
    - i. Refer to Appendix **D7010.3121** for Typical Telecommunication Conduit Layouts.
  - m. Conduit for fiber optic fire alarm cable shall be separate, dedicated 1" conduit for the entire distance from the outlet to the MDF room and must be Red in color.

- n. Minimum conduit size for telecommunications station cabling shall be 1" for construction and ¾" flex conduits accepted for remodel when installing into existing walls. Stub out conduits through walls into the TRs and ERs only enough to attach connector and bushings with grounding lugs.
- o. Stub out conduits through floors into the TRs and ERs to extend a minimum of 6 inches above the finished floor.
- p. The ends of the metallic conduit shall be reamed and bushed using:
  - i. Metal bushings for each connector for all sizes of conduit
  - ii. Metal bushings with grounding lugs as required, including all conduit entering TRs and ERs
- q. Cut ends of metallic conduit shall be filed to remove burs.
- r. Bond all metallic pathways (conduit, cable tray, etc.) entering the TRs and ERs to the TGB or TMGB in the same room with #6 AWG grounding wire as straight as possible.
- s. Support conduits, cable tray, and J-hooks from building structure using suitable unistrut, threaded rod, straps, racks, or hangers. Supporting conduits, cable trays, or J-hooks from ceiling suspension wires is not permitted.
- t. Install conduit support within 18" of each termination, and a maximum of 7' between supports along the conduit route.
- u. Spacing between J-hooks shall not exceed 4' along the entire route.
- v. Support pull-boxes independently from building construction. Pull boxes shall not be supported from conduit.
- w. Install conduit expansion fittings with external grounding straps at building expansion joints.
- x. Install new Mule-tape in all new conduits prior to pulling backbone cable. The Mule-tape shall extend three feet from each end of the conduit and shall be knotted and secured to remain in place.
- y. Install new Poly line in all new conduits prior to pulling horizontal cable. The Poly line shall extend three feet from each end of the conduit and shall be knotted and secured to remain in place.
- z. Conduit, cable tray, and J-hooks shall not be installed adjacent to hot surfaces or in wet areas.
- aa. Metal flex conduit and deep cut-in boxes shall be installed for outlets in existing walls for remodel projects only. The flex conduit shall be connected to a pull-box within 4' of entering ceiling space from wall space. Flex conduit and deep cut-in boxes are not allowed in new construction.
- bb. Conduit, cable tray, and J-hook sizes and routes and pull-box sizes and locations shall be coordinated with the OIT Infrastructure Engineering Department for each project.
- cc. Conduit, cable tray, J-hooks and support systems shall be installed with adequate clearance from fire sprinkler heads so that they do not block any part of the sprinkler's coverage pattern.
- dd. If it is necessary to core drill surfaces or burn holes through webs of beams or girders, the receive written approval from UCB Facilities Management as to the location and size of the hole before proceeding with work. Abide with UCB Standard Section **B1013** for all cutting and patching work. All holes shall be cut or burned no larger than absolutely necessary.
- ee. Support cable tray with manufacturer's supports and/or using threaded, galvanized rod hangers with rods extended through support steel and double-nutted. Support members shall be sized

within load rating of the member section and without visible deflection. Excess threaded rod ends shall be cut off flush with the bottom of the double nut.

- ff. Install cable tray level and straight to the extent possible.
  - gg. Where cable trays abut walls, supports shall be provided to the walls.
  - hh. Install cable tray supports at a minimum of 8' on center and at all ends, intersections and angles.
  - ii. A minimum of 12" headroom shall be provided above all cable trays, except where specifically allowed in writing by OIT Infrastructure.
  - jj. A minimum of 8" horizontal clearance shall be provided on at least one side of all cable trays, except as specifically allowed in writing by OIT Infrastructure.
  - kk. A minimum 4" clearance shall be provided from the top of ceiling grid structure to the bottom of cable tray, J-hooks, and pull boxes.
  - ll. All cable tray shall be installed in compliance with EMI clearances specified in this section.
  - mm. Install the cable tray system so that the electrical continuity of the system is maintained.
  - nn. Install body expansion connectors for cable trays at building expansion joints.
  - oo. Install external grounding straps at expansion joints, sleeves, crossovers and other locations where cable tray continuity is interrupted.
  - pp. Support racks for telecommunications conduit and or cable tray must be dedicated for telecommunications pathways only. Multi-use suspension systems for plumbing and other piping along with electrical and telecommunications pathways are not permitted.
  - qq. Separate dedicated pathways (conduit, cable tray, J-hooks, etc.) shall be provided for backbone and horizontal telecommunications cabling. Cable trays shall be clearly divided between backbone and horizontal cabling. OIT pathways shall support only OIT cabling (access services, owner, lighting, etc. shall not be in the OIT pathways).
  - rr. Cable trays shall not pass through any firewall or fire-rated walls or surfaces. Cable tray shall end before the firewall and transition to the EZ Path per manufacturer's specifications. The cable through the EZ Path shall not exceed 60% fill, so that and 40% future fill shall remain.
  - ss. Firestop and seal all pathways and core drills through fire rated walls and floors as specified in Section **D7000.26**.
3. D7010.313 Surface Metal Raceway Installation
- a. For outlets in surface raceway, a single-gang extension box shall be installed on the front of the raceway so jacks do not protrude into pathway, as shown in the drawing attached at the end of this Section.
  - b. Perform installation of routing hardware as specified in Section **D7010**, including anchoring and supports, grounding and bonding, firestop, etc. Anchors shall be used for attachment to surface. Use of adhesives is prohibited.
  - c. Cut raceways square and ream ends to remove burrs at raceway connections to outlets.
  - d. Raceways shall be installed parallel or perpendicular to building walls, floors and ceilings.
  - e. Upon request per project and daily installs, coordinate finish selection with the Department of Facilities Management prior to final design. All coordination and disposal cost shall be included in fixed-pricing or project bid.
4. D7010.315 Anchoring Methods

- a. Anchor and brace all cabling, material, and equipment installed under this standard as required by all codes, regulations, and standards. Provide required supports, beams, angles, hangers, rods, bases, braces, straps, struts, and other items to properly support project work. Supports shall meet the approval of UCB.
  - b. Supports shall be fabricated from structural steel, steel channel, or uni-strut, rigidly bolted or welded to present a neat appearance.
  - c. Fastenings and supports shall be adequate to support loads with ample safety factors.
  - d. Fasten hanger rods, conduit clamps, outlet boxes, and pull-boxes to building structure.
  - e. Use toggle bolts, spider type expansion anchors, or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls.
  - f. Use lead expansion shields or expansion anchors or preset inserts in solid masonry walls.
  - g. Use self-drilling anchors or lead expansion anchor on concrete surfaces.
  - h. Use sheet metal screws in sheet metal studs.
  - i. Use wood screws in wood construction.
  - j. In pre-cast structures, use cast-in inserts wherever possible. Expansion anchors can be used with caution, but only with prior approval.
  - k. In cast-in-place concrete, use expansion anchors, preset inserts, or self-drilling masonry anchors.
  - l. Use lead expansion anchors, or preset inserts on metal surfaces.
  - m. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.
  - n. Power-actuated anchors, plastic or fiber expansion anchors, and drive pin anchors are prohibited.
  - o. Do not drill structural steel members.
  - p. Any anchoring must be able to be unsecured and removed should relocation be required. The old Hilti HIT-pin is not acceptable.
  - q. Where necessary and with approval from UCB, modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit project work. If necessary in stud walls provide special supports from floor to structure above.
  - r. For precast panels/planks and metal decks, support communication work as determined by manufacturer and UCB.
  - s. Provide heavy gauge steel mounting plates for mounting project work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.
  - t. Install freestanding telecommunications equipment on concrete pads.
  - u. Support surface mounted cabinets, enclosures, and panelboards with a minimum of four anchors.
  - v. On exterior concrete walls below grade, provide 1" steel channel stand-offs for cabinets and raceways.
  - w. Use stud bridges at top and bottom of cabinets and enclosures that are flush mounted on hollow drywall walls.
  - x. Use suitable vibration isolation pads for vibrating equipment.
5. D7010.316 Grounding and Bonding

- a. Bond all new metallic cable shields and metallic supporting structures, in all equipment rooms and service entrances, including racks, frames, protectors, and cabinets to the existing telecommunications grounding busbar (TGB), according to the manufacturer's specifications.
- b. Do not make connections between the telecommunications busbar system and building electrical grounds, or other types of connections, without UCB approval.
- c. Bond metallic surfaces of telecommunications hardware with #6 AWG grounding wire as straight as possible to the ground source.
- d. Ensure that the grounding system is physically secured.
- e. All grounding conductors leaving the ER and TRs shall be in a separate conduit from all communication cabling.
- f. All grounding items shall be installed in complete compliance with Electrical standards and NEC.

#### **D7010.41: Underground Ducts and Raceways for Communications Systems General**

This section outlines IT Pathway outside plant from building to building for both Backbone copper and fiber cabling. The main routes for these pathways shall be conduit with manholes or hand holes however some campus pathways include tunnel pathway with wall racking.

#### **D7010.51: Underground Ducts and Raceway Materials**

1. Refer to Appendix **D7010.511** for Underground Ducts and Raceway Materials.
2. D7010.512 – TRENCH/BACKFILL MATERIALS
  - a. Refer to Appendix **D7010.5121** for Trench/Backfill Details.
  - b. Trenching and Excavation Backfill: Select fill materials as specified in Section **G3000**
  - c. Concrete Slurry: Select Flow Fill as specified in Section **G3000**
  - d. Concrete Pavement: Select concrete paving materials as specified in Section **G2010**
  - e. Asphalt Pavement: Select asphaltic paving materials as specified in Section **G2010**
3. D7010.513 - CONDUIT SYSTEM
  - a. Non-Metallic Conduit:
    - i. PVC plastic pipe, ASTM D1785, Schedule 40 or 80 Type PVC 1120
  - b. Metallic Conduit: GRC with PVC coating (for building entrances, offsets and sweep bends).
  - c. Conduit Joint Couplings:
    - i. PVC non-metallic fittings must be installed with solvent applied couplings.
    - ii. An approved transition coupling shall be used to connect metal to plastic (PVC) conduits.
    - iii. Couplings may be threaded and/or glued to provide watertight seal at conduit junctions.
  - d. Outside Pull-Box: Minimum 14 gauge galvanized steel with weatherproof locking cover and hardware for surface mounting as required for project. Dimensions as required for project.
  - e. Test mandrel shall be ¼" smaller than inside conduit diameter and not less than 12 inches long.
  - f. Muletape: Polyester or aramid fiber.
  - g. Core Drill Seals for Building Walls, Exterior, Below Grade, and other Special Conditions: Link-Seal waterproof assembly or equal.
  - h. Conduit Caulking Compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving,



- noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.
- i. Underground Plastic Line marker: Manufacturer's standard permanent, continuous-printed polyethylene film tape with metallic core, intended for direct burial service; not less than 3" wide x 4 mils thick. Provide orange tape with black printing reading, "CAUTION TELEPHONE/DATA CABLE BELOW," or similar.
  - j. For all underground pathways submit shop drawings and material submittal for a complete Copperhead Utility Locating System to CU approval before completing construction. All Underground pathways shall have an approved Locate System installed. Refer to copperheadwire.com.
  - k. Spacers for 4" Conduit: Intermediate Spacer and Base Spacer.
  - l. Handhole: 2' x 3' x minimum 18" deep communications vault constructed of precast concrete with a minimum thickness of 1.25 inches: The cover shall be either precast concrete, steel, or cast-iron.
  - m. Manhole: 6'-0" X 12'-0" X 7'-0" two-piece precast concrete communications vault equipped with 30" frame and cover, 3", 6" and 12" grade rings as required. Including all necessary hardware: ladder, pulling-in irons, cable racks, "S" rack supports, steps, plastic conduit end bells, and lead tag for identification.
  - n. Duct Plug 4"
  - o. End Bell 4": Carlon E297N
  - p. Communication Drain Box: 2' x 2' inside dimension concrete block with 18" diameter lid for access from top and two (2) 1" PVC Schedule 8 pipes. Custom made per detail drawing attached at the end of this section
    - i. Refer to Appendix **D7010.5131** for Communication Drain Box Detail.
  - q. Squeegee is moistened pea-sized gravel and sand mixture
4. D7010.514 - CABLE ROUTING HARDWARE
- a. Cable Rack with Support Hardware as Required:
    - i. 18 Hole manhole rack
    - ii. Other Sizes as Required
  - b. Cable Rack Steps/Hooks:
    - i. 4"Hook
    - ii. Other Sizes as Required
  - c. "S" Rack Supports
  - d. Step Lock Wedge
  - e. Outside Cable Support:
    - i. Stainless Steel Ties
    - ii. Heavy Duty Plastic Tie Wraps only where specifically allowed by OIT in writing.
5. D7010.515 - HORIZONTAL DIRECTIONAL DRILLING EQUIPMENT
- a. The horizontal directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system.
  - b. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.
  - c. The directional drilling machine shall consist of a hydraulically powered system to drill into the ground at a variable angle.
    - i. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the boring.

- ii. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations.
- iii. The hydraulic system shall be free of leaks.
- iv. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
- d. The Guidance System shall be of a proven type and shall be set up and operated by personnel trained and experienced with this system.
  - i. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

**D7010.61: Underground Ducts and Raceways Execution****D7010.611 – TRENCHING AND BACKFILL**

1. Perform all trenching and backfill for new underground conduit system placement as shown on the project drawings.
2. Pavement removal and replacement shall be performed as specified in Sections **G2010**, and **G3000**.
3. Trenching, backfilling, and compaction shall be performed as specified in Sections **G3000**.
4. Pavement marking shall be performed as specified in Section **G2010**.
5. All utilities shall be located by the Contractor and exposed, if necessary, prior to construction. For locations on UCB campus right of way:
  - a. Colorado 811: 811

**D7010.612 – CONDUIT SYSTEM PLACEMENT**

1. Place new conduit system including handholes and manholes as shown on the project drawings.
2. No pathway shall have more than 180 degrees of bends between pull points.
3. Nomenclature example for Conduit drawings: 2PC4”C
  - a. 2 = 2 conduits
  - b. P = Polyvinylchloride      M = Metal
  - c. C = Conduit
  - d. 4” = 4” Inside diameter of conduits
  - e. C = Schedule 40 or 80
4. Twelve inch (12”) clearance from all utilities shall be maintained. If not possible, conduit shall be encased in concrete slurry (flow fill) where proper distance cannot be obtained.
5. Telecommunications conduit ducts shall cross below gas piping.
6. Trench, conduit, handhole and manhole details are shown on the project drawings. Detail drawings of the following Types 1, 2, 3, 4, and 5 are attached at the end of this section:
  - a. Type 1: Typical Construction – Protection: All locations except bends and street crossings
  - b. Type 2: Typical Construction – Protection: Street crossings – Schedule 80
  - c. Type 3: Typical Construction – Protection: All bends and where specified
  - d. Type 4: Typical Construction – Protection: 20’ each side of manholes
  - e. Type 5: Typical Construction – Protection: 4-way duct bank
7. All conduits shall be thoroughly cleaned before laying or using.
8. During construction, the ends of the conduits shall be plugged to prevent water washing mud into the conduits, manholes, or buildings. Particular care shall be taken to keep the conduits clean of concrete, dirt, or any other substance during the course of construction.
9. New and reopened trenches under asphalt roadways and parking lots must have concrete cap or be encased in concrete as required.
10. Support multiple conduits on preformed nonmetallic separators to provide not less than 1” spacing between exterior surfaces of conduit (Type 5). Spacing between separators shall be close enough to prevent sagging of conduits or breaking of couplings and watertight seals.
11. Squeegee sand shall be placed in the trench for 20’ on each side of the manholes (Type 4).

12. Conduits shall be securely anchored in place with nylon tie-downs to prevent movement during the placement of concrete slurry (flow fill), squeegee, and other backfill materials. Wire tie-downs are prohibited.
13. All conduit junctions and fittings shall be sealed watertight prior to pour of concrete slurry (flow fill). Conduit couplings shall be made in accordance with the manufacturer's recommendation for the particular type of conduit and coupling selected and as approved by UCB.
14. Unless otherwise noted on drawings, a minimum two foot (24") depth of cover is required above the top of all conduits.
15. Install a communication drain box for the conduit six feet (6') from building outside wall penetrations, as shown in project drawings. Conduit inside the drain box shall be perforated to allow water and gas to escape.
16. Transition to PVC coated GRC conduit no less than five feet (5') from building outside wall penetrations.
17. For all offsets and sweep bends, PVC coated GRC conduit shall be installed.
18. All conduit bends shall be a minimum 3' radius, or larger, as noted on drawings.
19. Bury underground plastic line marker one foot (12") above the telecommunications conduit.
20. Bury #6 copper tracer wire directly above the telecommunications conduit and extend 4" into each manhole space. Six inches (6") of tracer wire shall be extended into a tracer box on the outside wall of each building directly above conduit entry point. The tracer wire shall be installed inside the conduit for directional drilling.
21. Install plastic conduit bell ends at each PVC conduit termination and for all conduit entering manholes.
22. The new conduit shall extend through the wall into the building, tunnel, or crawl space a minimum of 4 inches.
23. Building, tunnel, and manhole coredrills shall be sealed around conduits with UCB approved waterproof plugging compound.
  - a. Openings around conduits that pass through outside building walls below grade shall be sealed with a complete Link-Seal assembly, or equal, for a waterproof seal. Slope conduit away from building.
  - b. Openings around conduits that pass through manhole walls shall be sealed with foundation foam on the interior of the core and silicone sealer on the inside and outside of the core, for a waterproof seal.
24. Handholes shall be placed with the long dimension in line with the conduit run. The conduit shall enter opposite ends of the handhole on the short sides so that the handhole shall not be used as a 90 degree bend in cable installations.
25. All conduits entering bottom of handhole shall be flush with the inside wall. Dirt shall be removed 6" below the bottom of conduits entering the handhole and pea-gravel shall be placed on the bottom to help water dissipate.
26. After conduit duct installation has been completed and concrete has set, pull a "D" test mandrel through all new conduit ducts to verify duct integrity and insure smooth interior surfaces free from burrs or obstructions that might damage cable sheaths.
27. Following mandrel testing, draw a cylindrical wire brush with stiff bristles through each conduit to clean the conduit and remove any concrete, dirt or other obstructions.
28. Conduits entering buildings shall be stubbed out only enough to attach connector and bushings with grounding lugs, except conduits shall rise a minimum of 6 inches above the finished floor.
29. Conduits entering buildings shall be extended to within 50 feet of the entrance protector using interior EMT conduit, as specified in this section. Conduit shall be installed for all portions of the pathway that pass through environmental air handling spaces for outside plant cable entering the building.
30. Install new Muletape in all new conduit. The Muletape shall extend three feet from the end of each conduit and shall be knotted and secured to remain in place.

31. Plug all ends of the new conduit with watertight rubber conduit plugs, removable conduit caulking compound, or conduit caps to ensure foreign matter does not enter the buildings.
32. Obtain an EH&S report from UCB prior to cutting or drilling any surface and comply with all EH&S requirements.

**D7010.613 – CABLE ROUTING HARDWARE**

1. Place new cable routing hardware in the tunnels and in crawl spaces beneath the building as required for the project and as shown on the drawings.
2. Perform installation of routing hardware as specified in Section **D7010** including anchoring and supports, grounding and bonding, etc.
3. Place new ladder, pulling-in irons, cable racks, “S” rack supports, steps in new and existing manholes as required for backbone cable routing.

**D7010.614 – HORIZONTAL DIRECTIONAL DRILLING**

1. UCB OIT shall be notified 48 hours in advance of starting horizontal directional drilling work. The directional drilling shall not begin until UCB OIT is present at the job site and agrees that proper preparations for the operation have been made.
2. No work shall commence until Traffic Control and Construction Permits from UCB and/or the City of Boulder are in place as applicable for the specific project.
3. Site Preparation
  - a. Prior to any alterations to work site, the entry and exit points shall be marked.
  - b. No alterations to the work site beyond what is required for operations shall be made.
  - c. All activities shall be confined to designated work areas.
4. Drill Path Survey
  - a. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings.
  - b. If a magnetic guidance system is being used, the drill path will be surveyed for any surface geomagnetic variations or anomalies.
5. All applicable environmental regulations shall be adhered to.
6. Following drilling operations, the equipment shall be de-mobilized and the worksite restored to its original condition. All excavations shall be backfilled and compacted, and landscaping shall be restored to original site conditions, in compliance with the requirements in the UCB Division 1 and 2 standards.

**Appendices**

**D7010.211 – IT Pathway Materials**

**Pre-Approved Equipment Schedule**

Line	Description	Manufacturer	Part Number
1	Wire mesh cable tray, 8” wide x 2” deep	Cope	CAT2-08SL-120
2	Wire mesh cable tray, 12” wide x 2” deep	Cope	CAT2-12SL-120
3	Wire mesh cable tray, 24” wide x 2” deep	Cope	CAT2-24SL-120
4	Wire mesh cable tray – Standard Bar Connector	Cope	SPLICE
5	Wire mesh cable tray – Bend & Intersection Bars	Cope	T-Bar
6	Wire mesh cable tray – Kwik-Latch Assembly	Cope	CAT-GC
7	Wire mesh cable tray – Trapeze Support Bracket	Cope	CAT-HSB-120
8	V2400 Base & Cover Two-piece steel single channel 1 29/32" W x 7/8" D	Wiremold	V2400BC
9	V2400 Entrance End fitting 1/2" - 3/4" KO for V2400	Wiremold	V2410C
10	Full capacity entrance fitting 3/4" - 1" KO for V2400	Wiremold	V2410FC
11	Fiber ready 2" radius full capacity flat elbow V2400	Wiremold	V2411FO
12	Fiber ready internal elbow for V2400	Wiremold	V2417FO
13	Fiber ready external elbow for V2400	Wiremold	V2418FO

14	V3000 Base single channel 2 3/4" W x 1 15/32" D	Wiremold	V3000B
15	V3000 Cover 2 3/4" x 5'	Wiremold	V3000CE
16	Entrance end fitting for V3000 1/2" - 1" KO	Wiremold	V3010C
17	Conduit Connector 1 1/2" for V300	Wiremold	V3082
18	Rigid inside coupling for V3000	Wiremold	V3001A
19	Device bracket for V3000	Wiremold	V3007C
20	Extension cover for V3000	Wiremold	V3051LE
21	Blank end fitting for V3000	Wiremold	V3010B
22	V4000 Base 4 3/4" W x 1 3/4" D	Wiremold	V4000B-10
23	V4000 Cover 4 3/4" x 5' (also fits V6000 raceway)	Wiremold	V4000C
24	Blank end fitting for V4000	Wiremold	V4010B
25	Full capacity entrance fitting 1" - 1 1/4" KO for V4000	Wiremold	V4010DFC
26	Fiber ready 2" radius full capacity flat elbow for V4000	Wiremold	V4011FO
27	One gang device plate for V4000 and V6000	Wiremold	V4047C-1
28	V6000 Base 4 3/4" W x 3 9/16" D	Wiremold	V6000B
29	V6000 Cover 4 3/4" x 5'	Wiremold	V6000C
30	Blank end fitting for V6000	Wiremold	V6014A
31	Panel connector for V6000 to connect to indoor pull box	Wiremold	V6086
32	Single gang surface box 4 5/8" L x 2 7/8" W x 1 3/4"D (For furniture)	Wiremold	V5748
33	Extra Deep Single-Gang Deep surface box 4 5/8" L x 2 7/8" W x 2 3/4" D	Wiremold	V5744

### **D7010.511 – Underground Ducts and Raceway Materials**

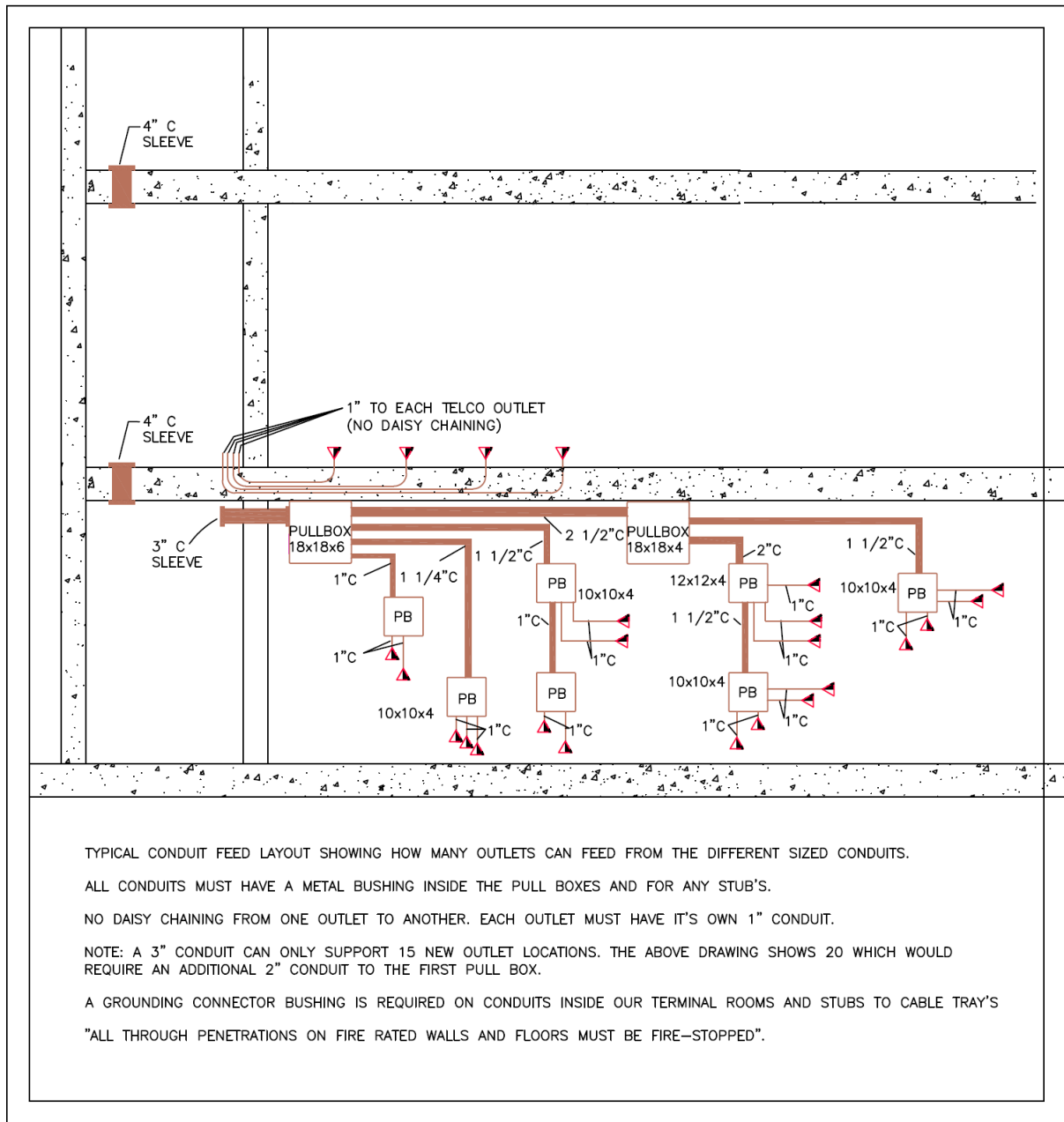
#### Pre-Approved Equipment Schedule

Line	Description	Manufacturer	Part Number
1	Link-Seals – Standard for use in water, direct ground burial, and atmospheric conditions	PSI/Thunderline/Link-Seal	C or L
2	Link-Seals – Stainless for chemical processing waste water treatment	PSI/Thunderline/Link-Seal	S-316
3	Link-Seals – Oil Resistant	PSI/Thunderline/Link-Seal	O or OS-316
4	Link-Seals – High/Low Temperature Extremes	PSI/Thunderline/Link-Seal	T
5	Link-Seals – Fire Seals	PSI/Thunderline/Link-Seal	FD or FS
6	Intermediate Spacer	Carlton	S289NJJN
7	Base Spacer	Carlton	S288NJJN
8	Duct Plug for a 4" conduit	Comstar Supply Inc.	JM40D402U
9	Handhole	Carson Industries LLC	H2436
10	Manhole 6' x 12'	OldCastle Precast	ATT 612-84 Manhole
11	End Bell 4"	Carlton	E297N
12	Cable manhole rack	Condux	08380200
13	Cable manhole rack	Hubbell	C203-1126
14	Cable manhole rack hooks	Condux	08380600
15	Cable manhole rack hooks	Hubbell	C203-1131



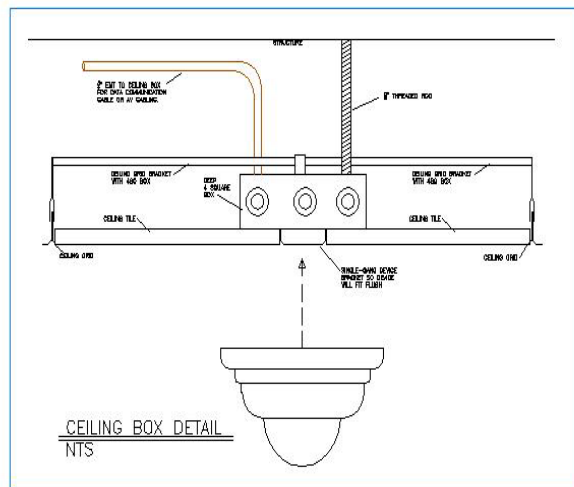
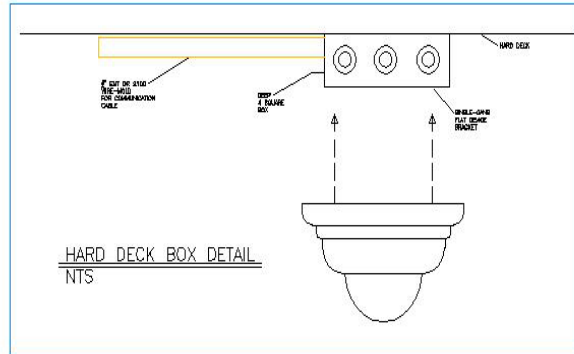
16	Cable manhole S rack support	Condux	08381500
17	Cable manhole S rack support	Hubbell	1101
18	Cable manhole rack Step Lock Wedge	Panduit	CHW-C20
19	Cable rack locking clip for support hooks	Hubbell	L1100

**D7010.3121 - Typical Telecommunication Conduit Layouts.**



TYPICAL TELECOMMUNICATION CONDUIT LAYOUTS  
(NO SCALE)

**D7010.2143 - Camera Box Detail.**

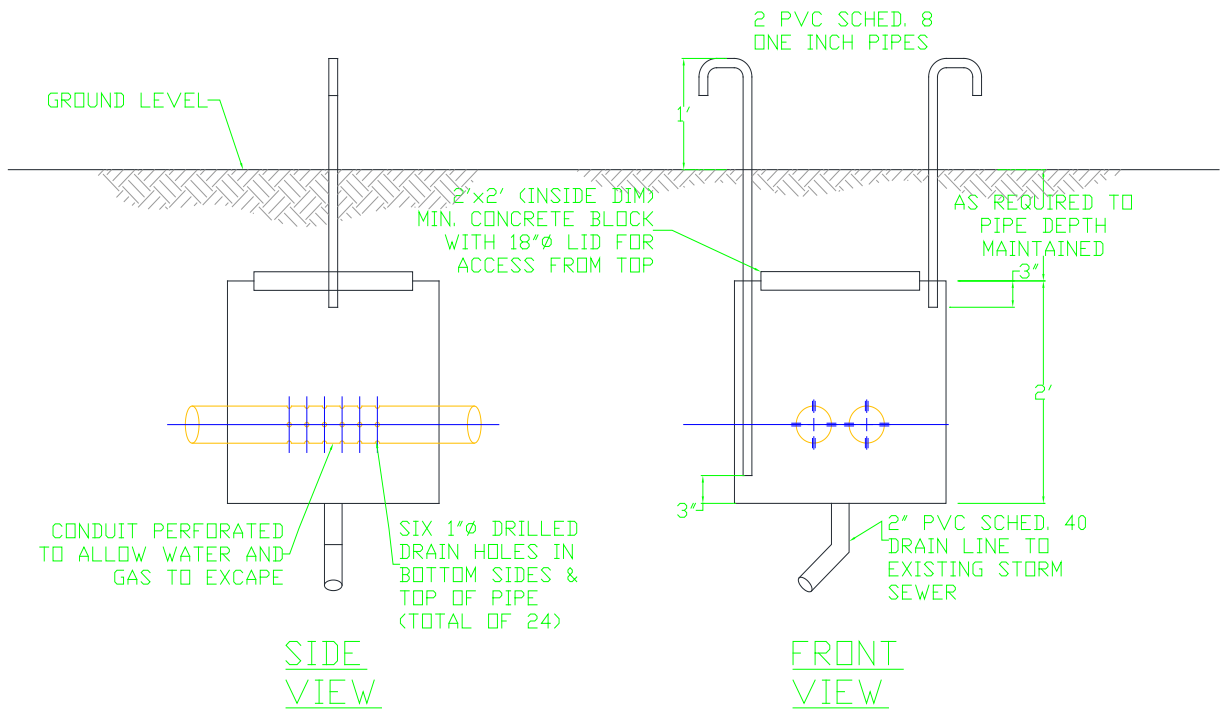




**D7010.5131 - Communication Drain Box Detail.**

## COMMUNICATION DRAIN BOX DETAIL

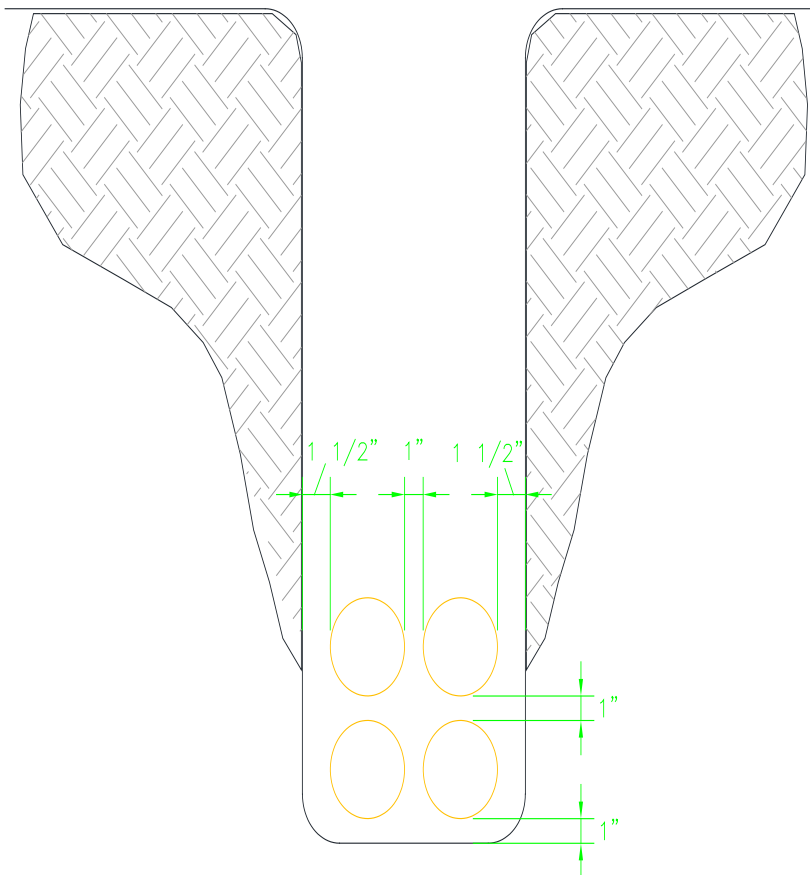
SCALE: 1"=1'-0"



**D7010.5121 - Trench/Backfill Details.**

## COMMUNICATIONS DUCTING TRENCH TYPICAL SPACING UNLESS NOTED OTHERWISE

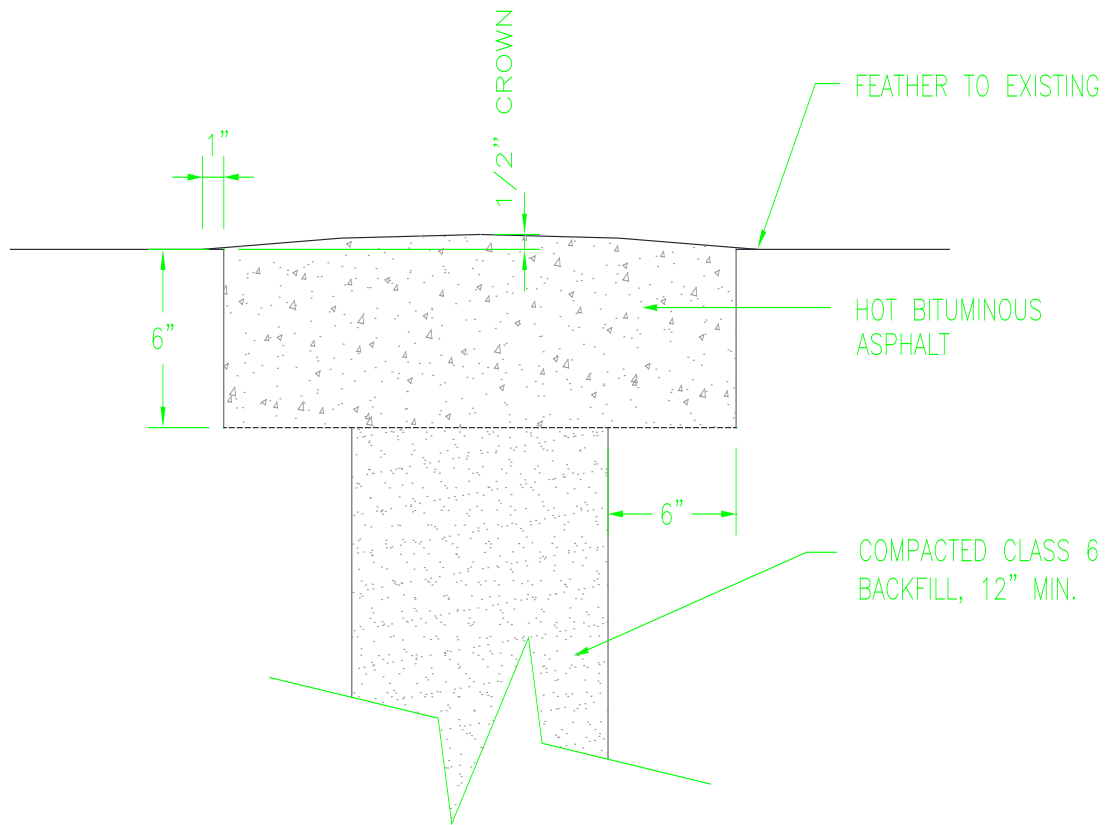
NOTE: TYPICAL CONSTRUCTION –  
PROTECTION ALL LOCATIONS EXCEPT  
BENDS AND STREET CROSSINGS



# SECTION D

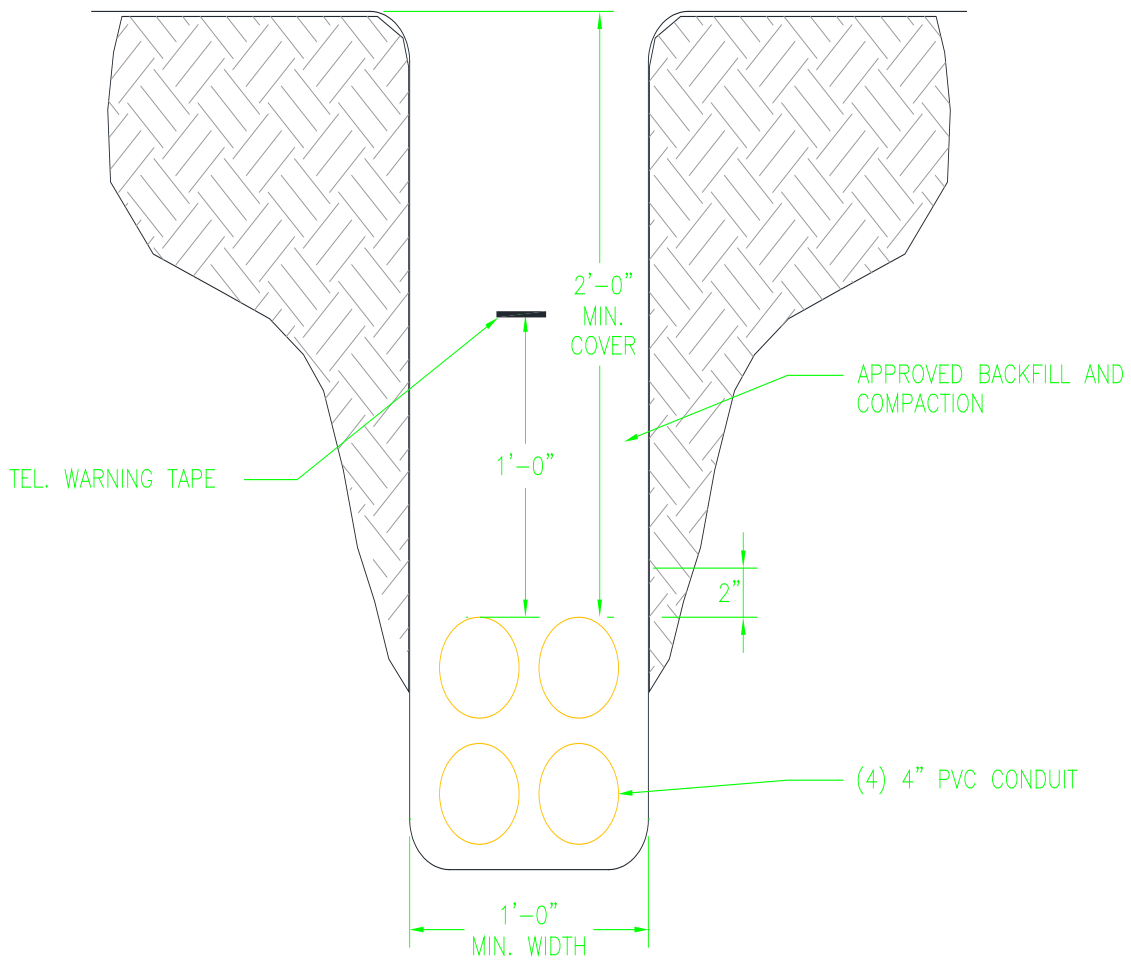
October 1, 2021

## DETAIL – PAVEMENT RESTORATION



## COMMUNICATIONS DUCTING TRENCH TYPE 1

NOTE: TYPICAL CONSTRUCTION –  
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BENDS AND STREET CROSSINGS

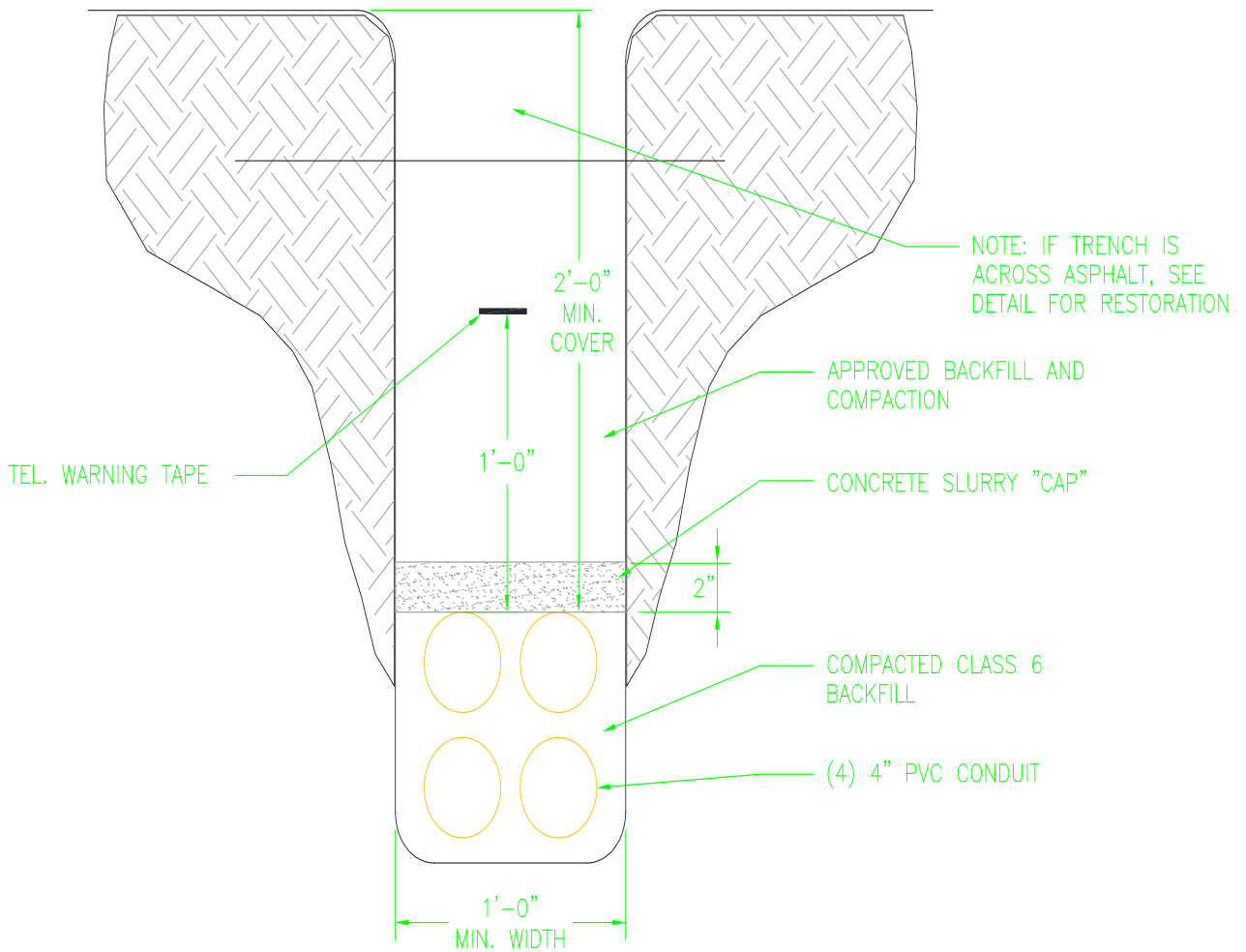


# SECTION D

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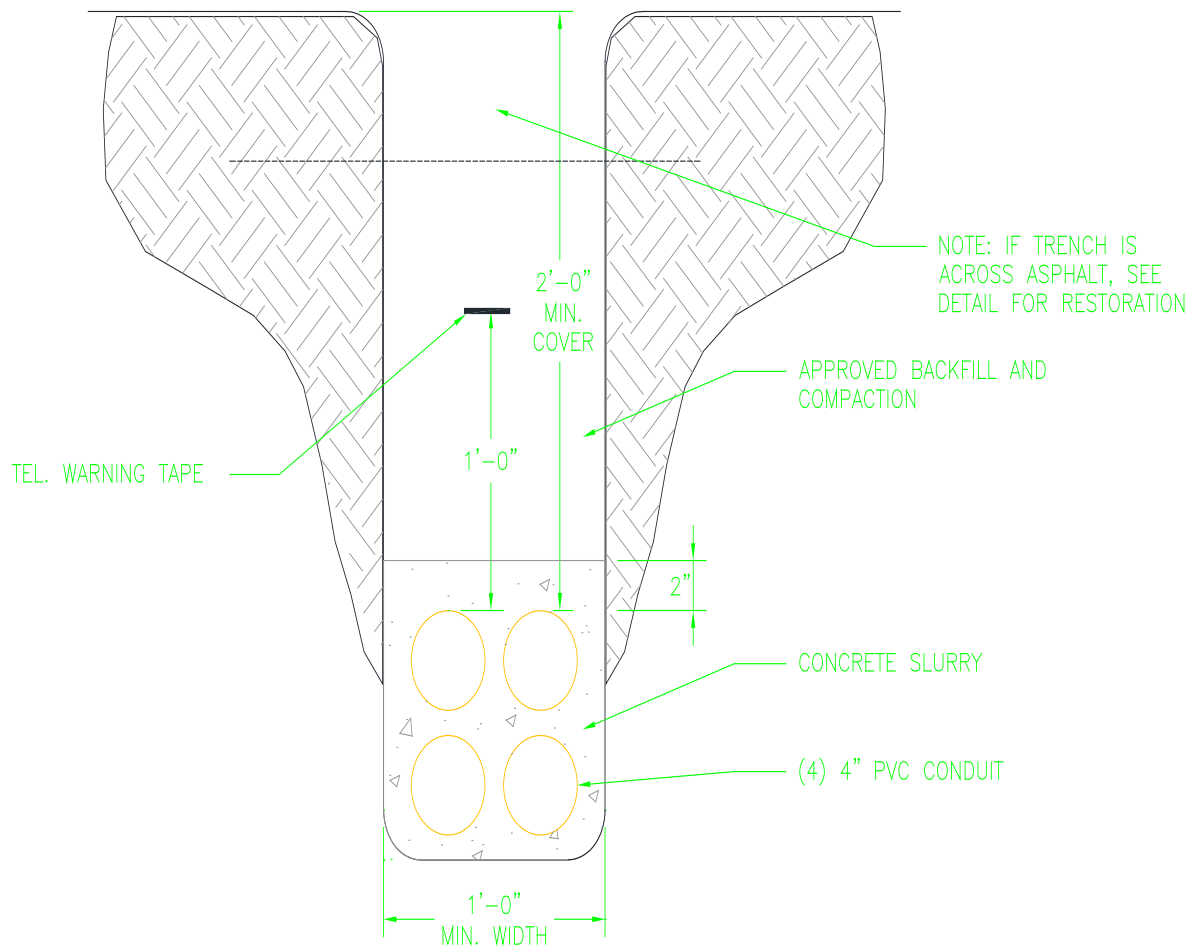
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NOTE: TYPICAL CONSTRUCTION - PROTECTION



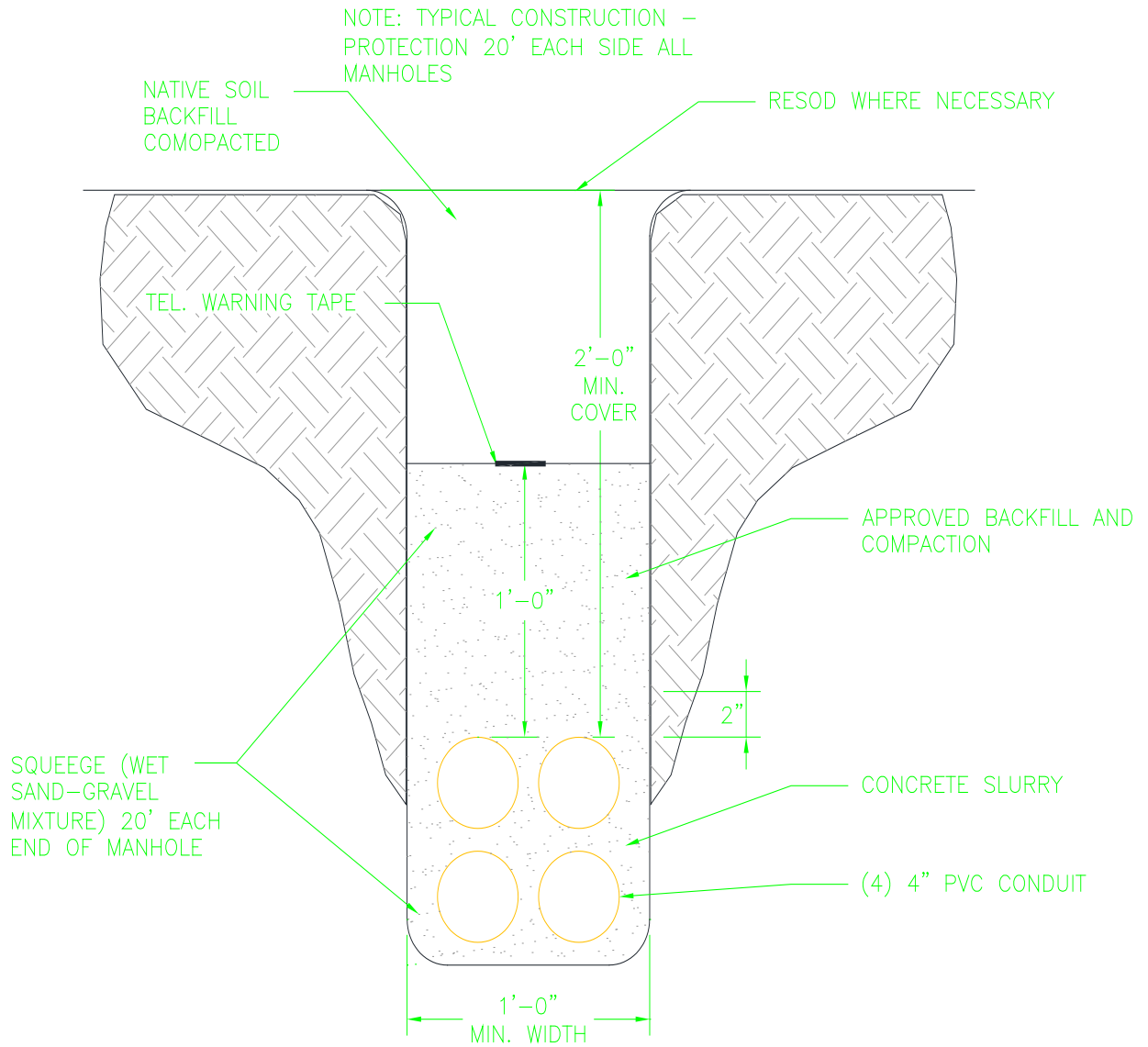
## COMMUNICATIONS DUCTING TRENCH TYPE 3

NOTE: TYPICAL CONSTRUCTION -  
PROTECTION ALL BENDS AND  
WHERE SPECIFIED





## COMMUNICATIONS DUCTING TRENCH TYPE 4

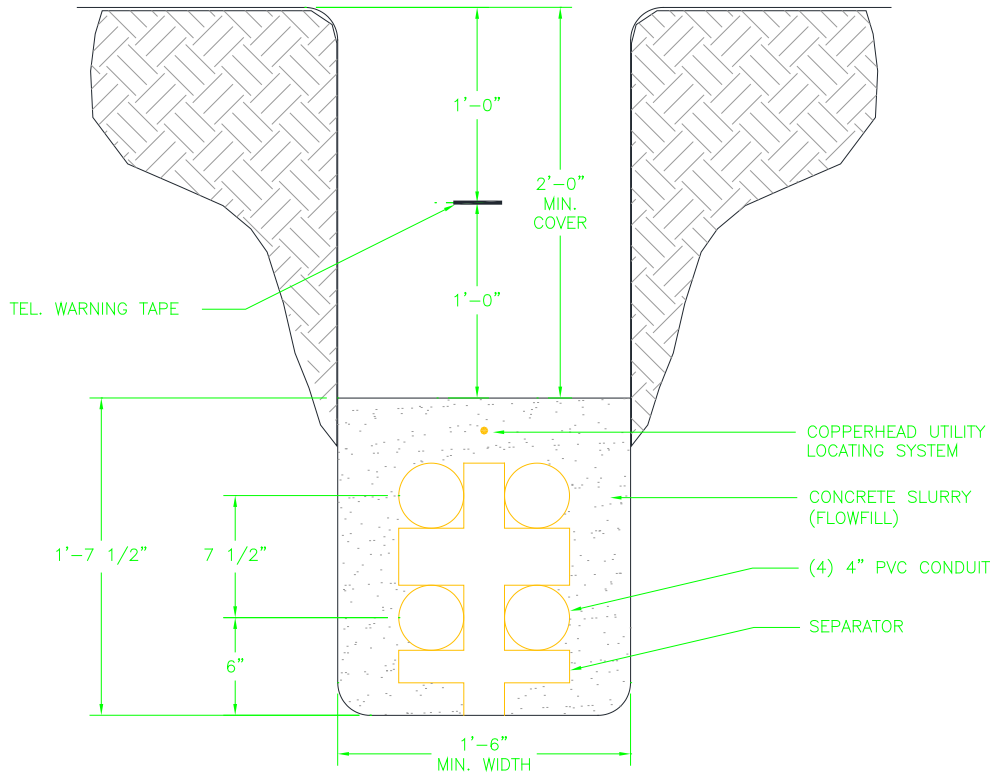


# SECTION D

October 1, 2021

## COMMUNICATIONS DUCTING TRENCH TYPE 5

NOTE: TYPICAL CONSTRUCTION –  
PROTECTION 4-WAY DUCT BANK



SCALE: 1" = 1'-0"