

27 05 43 Underground Ducts and Raceways for Communications Systems

1.01 TELECOMMUNICATIONS SUBSTRUCTURE—OUTSIDE PLANT

- A. The Outside Plant Substructure is the physical pathway used to distribute backbone cabling between buildings, and to bring the entrance cable from the nearest campus backbone access point across Texas State University property to the Entrance Facility. Underground conduit is the standard method of distribution between buildings on campus. Input from Texas State University IT and site operations staff must be incorporated in developing the initial and on-going construction schedules. This input is especially important when an early or phased turn-up of buildings is required. Timing on the construction of the main telecommunications room and building, and the backbone cable plant connecting it to key buildings, would be a vital consideration in bringing key buildings online at required dates. In new construction, the outside plant substructure must be sized to accommodate all low voltage services planned for initial installation, plus a minimum of 25% growth capacity.

2.01 UNDERGROUND DISTRIBUTION

- A. Underground distribution of low voltage services on Texas State University property will consist of appropriately sized conduits and telecommunications manholes or hand-holes. Telecommunications services (voice and data) and other low voltage services such as fire alarm, security systems, and CATV distribution shall not share the same underground distribution conduits and manholes as electrical power distribution.
- B. UNDERGROUND CONDUIT
1. Direct burial of telecommunications cable is not desired, and will only be approved under unique circumstances on a case-by-case basis. Requests to direct bury cable must follow the “Approval for Alternative Design Solutions” process described in section 27 01 00. The major cost in placing underground utilities is the labor for digging the trench. Therefore, underground telecommunications distribution to permanent facilities shall always be placed in conduit, and encased in a concrete duct bank, to facilitate the easy installation of additional future cables. Key requirements for underground conduit installation include:
 - a. OSP conduit quantity and size shall be determined based on the requirements for the initial installation of cable **and a realistic prediction of future expansion in the area**. Always provide a minimum of 25% spare capacity above the initial installation requirements and known growth.

- b. OSP conduit quantities shall be based on a maximum of 40% cable fill per conduit.
- c. All OSP telecommunications conduit installations shall have a minimum of two spare conduits.
- d. All OSP telecommunications conduits shall be Schedule 40 or Schedule 80 Rigid Nonmetallic conduit, Polyvinyl Chloride (PVC), and must meet the requirements of NEMA TC 6. All conduit sections shall be glued with PVC pipe glue to form a watertight joint. All schedule 40 pipes to be embedded in sand. Spacers are required to maintain proper separation between multiple conduits in a run.
- e. All OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.
- f. Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable. Standard electrical elbows shall not be used.
- g. All campus distribution conduits must be buried a minimum of 24 inches below grade, with preferred depth of 36 inches. All conduit must be encased in concrete, and the concrete will be colored with “RED” dye.
- h. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.
- i. All OSP conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All OSP conduits shall have quarter (1/4)-inch polypropylene pull ropes installed. The pull ropes must be re-pulled each time an additional cable is installed. All OSP conduits must be tested with a mandrel to prove compliance with the bend radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.
- j. In new construction and new conduit, fiber optic backbone cables shall always be installed in fiber optic innerduct. Normally, three to four innerduct can be placed in a four (4)-inch conduit. Where

fiber optic cable is installed into existing conduits, the use of fiber optic innerduct is preferred if space is available. Innerduct is used to separate and segregate cables, and to prevent the tangling of cables in a conduit. Types of textile innerduct may be used if pre-approved by Texas State University Telecommunications.

- k. Splices in backbone fiber optic cable are not allowed, design OSP conduit accordingly.

3.01 TELECOMMUNICATIONS MANHOLES

A. Telecommunications manholes shall be placed in outside plant conduit runs at an interval no greater than every 500 feet. Conduits routing between two telecommunications manholes, or between a manhole and a building, shall contain no more than two 90°sweeps or a total of 180°of sweeps. If additional conduit sweeps are required, place additional manholes as needed. Telecommunications manholes are typically constructed in pre-fabricated cast concrete, and contain a floor section, wall section, and top section. Manholes are sized based on the ultimate duct structure and equipment that will be located in the manhole. Minimum size of any manhole shall be 6’X8’X7’. Key requirements for telecommunications manhole installation include:

1. Telecommunications manhole sections must be installed with a watertight joint sealer between the sections of the manhole.
2. Telecommunications manholes must be equipped with a pre-cast concrete floor section. Bare earth for the floor of a manhole is not allowed. The floor section must contain a sump to facilitate the use of a submersible pump for de-watering the manhole.
3. Install an automatic submersible sum pump in each manhole; with necessary power requirements.
4. Telecommunications manholes must be equipped with steel pulling eyes pre-cast in the walls opposite to each duct bank to facilitate cable-pulling apparatus.
5. Telecommunications manholes must contain 18 hole or 37 hole cable racks for dressing and securing cables that route through the manhole. Must contain at least two sets per manhole wall. Manhole must have a minimum 100 feet service loop of OSP cable. It shall be looped around on ladder rack in manhole. Network Operations personnel must approve any deviation.
6. Telecommunications manholes over five (5) feet deep must have permanently installed ladders.

7. All telecommunications manholes shall have a minimum of one grounding rod.
8. All metal hardware in the manhole or hand-hole (racks and ladders) must be grounded to the bonding tabs pre-cast in the manhole, with the bonding tabs bonded to the ground rod. Racks must be installed in the manhole.
9. The cover of all telecommunications manholes must be a minimum of one (1) inch above the finished grade after all landscaping is completed. If manholes are located in paved areas, the pavement must be tapered up to the manhole cover.

4.01 TELECOMMUNICATIONS HANDHOLE

- A. A hand-hole is similar to a miniature manhole that is used solely as a pulling point to expedite the installation of cable in conduit runs over 500 feet or with more than two 90°sweeps. Maximum size of hand-hole is 4X4X4. The following rules apply to the use of hand-holes:
 1. A hand-hole shall not be used if the ultimate or total requirements exceed the capacity of two four (4)-inch conduits, in and out.
 2. Where more than two four (4)-inch conduits are used in a duct bank, telecommunications manholes must be used in lieu of hand-holes.
 3. A hand-hole shall not be utilized for splicing cables together.
 4. Conduit entering the hand-hole shall be aligned on opposite walls of the hand-hole at the same elevation.

END OF SECTION 27 05 43