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

SECTION 270543 - EXTERIOR PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Subject to the General and Special Conditions, this section shall specify underground ducts, and utility holes designated as maintenance holes, and hand holes.

B. Section Includes:

1. Rigid steel conduit.
2. Plastic conduit.
3. Plastic duct.
4. Utility holes, maintenance holes (MH), hand holes (HH)
5. Underground duct markers.

C. Division 31 – Trenching & Backfilling: Execution requirements for trenching, backfill and compaction required by this section.

1.2 REFERENCES

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

B. Related Sections:

1. Div 01
2. Section 270526 Grounding and Bonding for Communications Systems
3. Section 270543 Exterior Pathway for Communications Systems
4. Section 270553 Identification for Communications Systems
5. Section 271100 Communications Equipment Room Fittings
6. Section 271300 Communications Backbone Cabling
7. Section 271500 Communications Horizontal Cabling
8. Section 272100 Data Communication Network Equipment

1.3 DESCRIPTION

A. Interconnected system of encased conduits, ducts, MH, and HH to distribute medium-voltage power, low-voltage power, data communications, and video.

B. Conduit and duct routing and utility hole locations are shown in approximate locations unless dimensions are indicated. Field route and locate to complete duct bank system.

C. Underground Ducts:

1. Medium-voltage: Use rigid plastic underground conduit.
2. Low-voltage: Use rigid plastic underground conduit.
3. Data communication: Use rigid plastic underground conduit.

D. Above ground conduit shall be rigid, hot-dipped galvanized steel manufactured according to UL and ANSI No. C80.1, threaded before galvanizing. Install according to NEC and AISI Handbook for Steel Electrical Raceways.

E. Conduit size shall be as indicated on the Drawings.

1.4 COORDINATION

A. Refer to General or Special Conditions.

B. Refer to Division 26, Electrical Work

C. Coordinate Work with existing underground utilities and structures.

1.5 QUALITY ASSURANCE

A. Refer to section 270000

B. Verify duct banks do not interfere with existing or new underground facilities.

C. Assure that the "as installed" system is correct and complete per construction documents: including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

D. Owner/Architect/Engineer retains the right to access and inspect all work during the entire duration of the project and any items that do not adhere to the standards, reference, contract, bid, or project documents will be corrected immediately at the expense of the contractor.

E. UL Compliance: Provide products that are UL-classified and labeled.

1.6 SUBMITTALS

A. Refer to section 270000

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped.

1. Store nonmetallic ducts with supports to prevent bending, warping, and deforming

B. The contractor shall endeavor to make the site ready for installation of manholes when delivered so that they can be placed off of the truck into final position.

1. When this is not possible, store precast concrete and other factory-fabricate underground utility structures as Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

D. Clearly mark containers "For Communications Duct Banks Only".

E. Refer also to section 270000

1.8 WARRANTY

A. Refer also to section 270000

1.9 MAINTENANCE

A. Refer also to section 270000

PART 2 PRODUCTS

2.1 RIGID STEEL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings: NEMA FB 1, steel.

2.2 PLASTIC CONDUIT AND DUCTS

A. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.3 MAINTENANCE HOLE (MH)

A. Nominal Inside Dimensions: (Minimum 3'H x 3'W x 3'L)

1. Oldcastle

2. Locke Solutions

3. Christy

4. Or approved equal.

B. Maintenance Hole shall include the following:

1. Description: Pre-cast concrete utility hole with sloid bottom

2. Minimum ANSI Tier 22 rating

3. All walls shall have standard 4" duct terminators or thin wall knockout panels

4. Furnish cover with custom plate marked "TELECOM COH MH##" (## manhole No.). Cover and service lettering shall be abrasion, corrosion, chemical resistant and slip resistant surface.

5. Include hasp and locking plate so it can be locked with a padlock.

6. Include pulling eye - 1,000 lb and 3,000 lb at each end

7. Include stainless steel bonding ribbon and /or 1" knockout for ground stainless steel

rod connection.

2.4 HAND HOLE (HH)

A. Nominal Inside Dimensions: minimum 2'x3'x3'

1. Oldcastle

2. Locke Solutions

3. Christy

4. Or approved equal.

B. Handhole Hole shall include the following:

1. Description: Pre-cast concrete utility hole with sloid bottom

2. Minimum ANSI Tier 22 rating

3. All walls shall have standard 4" duct terminators or thin wall knockout panels

4. Furnish cover with custom plate marked "TELECOM COH MH##" (## manhole No.). Cover and service lettering shall be abrasion, corrosion, chemical resistant and slip resistant surface.

5. Include hasp and locking plate so it can be locked with a padlock.

6. Include pulling eye - 1,000 lb and 3,000 lb at each end

7. Include stainless steel bonding ribbon and /or 1" knockout for ground stainless steel

rod connection.

2.5 UNDERGROUND DUCT MARKERS

A. Underground Warning Tape: 4-inch wide detectable plastic tape (6 mil thickness min.) with warning label stating, "CAUTION: BURIED COMMUNICATIONS LINE."

1. Follow NESC411E, and NEC300.50
2. Metallic tape or metallic strip for above ground detection
3. Orange tape for Communications line
4. **Installed at 12" below finished grade.**

2.6 MANUFACTURERS

A. Conduit Measuring Tape:

1. Neptco
2. Greenlee
3. Garvin Industries

B. Caution Tape:

1. Reef Industries
2. Repnet
3. Panduit

C. Maintenance/Hand Hole Covers

1. Oldcastle
2. Locke Solutions
3. Neehan Foundry
4. Dabico Inc.
5. Inland Foundry

2.7 FLEXIBLE MULTI-CELL INNERDUCT

A. Manufacturers:

1. MaxCell
2. Or COH approved equivalent

B. Flexible Innerduct

1. Flexible innerduct is the COH standard for multi-path applications within conduit.
2. All backbone fiber shall be installed in flexible innerduct.
3. Flexible Innerduct shall be UL Listed with Flame Propagation compliant with UL 2024A.
4. All flexible innerduct shall be installed per manufacture requirements.
5. Only manufacturer's fittings, transition adapters, terminators, accessories, and installation kits shall be used.

6. All flexible innerduct will be populated with a measured pull tape.
7. All interior flexible innerduct shall be plenum rated.
8. Flexible innerduct shall only be used when installed in conduit and shall consist of a different color for the Maxcell.
9. Design consultant shall specify/select the proper size Maxcell products to meet the project requirements.

Min Conduit ID	Suggested Product	Number # of Packs	Max # of Cables	Maximum Cable Diameter per Cell	Rec. Pull Length*	Max Pull Length*
3"	MaxCell 4" 3-Cell	1	3	1.34"	1500'	2000'
4"	MaxCell 4" 3-Cell	2	6	1.34"	1500'	2500"

*Use of Optical Fiber Nonconductive Riser (OFNR) cable may result in reduced pulling lengths

2.8 CONDUIT PULL LINE

A. Description

1. Minimum pulling tension greater than 900 lb.
2. Ready-to-use cable pull line,
3. Use directly from the container.
4. Resists tangling when dispensing.
5. Rot and mildew resistant.
6. Handy reusable plastic dispenser pail with handle keeps the line dry.
7. Neptco #WP900P or approved equivalent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to General Conditions regarding verification of existing conditions before starting work.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of utility holes prior to excavating for installation.

3.2 PREPARATION

A. Verify materials are on site in proper condition and of sufficient quantity.

B. Before encasement, verify ducts are free of debris and properly installed in support and spacer system, are properly fitted together and hold-down hardware is properly installed.

3.3 INSTALLATION

A. Install all work following drawings, manufacturer’s instructions and approved submittal data.

B. The minimum depth of a trench must allow 36 inches of cover from the top of the duct bank to the final grade point.

C. The following minimum vertical or horizontal separations must be maintained between telecommunications facilities and other facilities sharing a common trench.

1. Power or other foreign conduits: 3 inches of concrete, 4 inches of masonry, or 12 inches of well-tamped earth.

2. Pipes such as gas, oil, water: 6 inches when crossing, 12 inches when parallel.
3. Railways: 3 feet below top of rails.

D. Conduit must be encased in concrete when the following conditions exist.

1. Reinforcing bars and or crutches within the concrete must be used at any location subject to potentially extreme stress.
2. Minimum conduit depth cannot be attained.
3. Conduit must pass under roads, driveways, railroad tracks, or when bend points are subject to movement.

E. The inside-the-building end of the conduit must be sealed to prevent rodents, water, or gases from entering the building.

F. Install watertight penetrations through foundation, HH and MH walls. Wherever a hand hole is used to simply pass through, the conduit entrances and exits will be situated at opposite ends of the hand hole instead of 90 degree angles.

G. Provide reinforcement at the point where ductbanks enter manhole or building walls/floors to sustain shear forces that may be exerted on the ductbank by soil settlement or heaving.

H. Reinforcement shall consist of PVC-coated or tape-wrapped galvanized rigid steel (GRS). The inside-the -building end of the conduits (vertical section and the bend) shall be reinforced.

I. Specify end bells manufactured of GRS or heavy-wall fiberglass at the points of penetration/termination.

J. Assemble duct banks with non-magnetic saddles, spacers and separators. Position separators for 2-inch minimum concrete separation between outer surfaces of adjacent ducts.

1. All bends must be long, sweeping bends. Make uniform required bends with a minimum of a 24 inch radius for conduits less than 3 inch diameter, and a 48 inch radius for conduits 3 inches and larger.
2. Maintain vertical or horizontal separations of 12 inches of well-packed topsoil from any electrical service conduit run parallel to Communications conduits.

K. Extend below grade conduits to 4 inches above the finished floor inside a building.

L. Install conduit and duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope conduit and duct toward manholes and away from building entrances.

M. Cut conduit and duct square using saw or pipe cutter; de-burr cut ends.

N. Insert conduit and duct to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit and duct using adhesive as recommended by manufacturer.

P. Wipe nonmetallic conduit and duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Q. Install no more than equivalent of three 90-degree bends between pull points for electrical conduits and two (2) 90-degree bends for communications conduits.

R. Install fittings to accommodate expansion and deflection.

S. Terminate conduit and duct at manhole entries using end bell.

T. Stagger conduit and duct joints vertically in concrete encasement six (6) inches minimum.

U. Use suitable separators and chairs installed not greater than 4 feet on centers. Secure separators and chairs to trench bottom prior to concrete pour.

V. Band conduits and ducts together before backfilling or placing concrete.

W. Securely anchor conduit and duct to prevent movement during concrete placement.

X. Place concrete in accordance with Section 03 3000.

Y. Install ducts with minimum 3 inch concrete cover at bottom, top, and sides.

Z. Reinforcing steel:

1. Reinforcing steel shall have a minimum yield strength of 60,000 psi for No. 4 bars and smaller, and 60,000 psi for No. 5 bars and larger.

2. The reinforcing steel shall run parallel in the underground duct bank with one No. 4 (0.5 inch diameter) bar at each corner of the duct bank, lapped 24 diameters at splices.

3. Install two No. 4 steel reinforcing bars in top of bank under paved areas.

AA. Connect to manhole wall using dowels.

BB. Provide suitable pull string in each empty duct except sleeves and nipples.

CC. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

DD. Backfill trenches in accordance with Division 31.

EE. Interface installation of underground duct markers with backfilling specified in Division 31.

3.4 PRE-CAST UTILITY HOLE

A. All pull boxes, hand-holes, man-holes, and utility holes shall be dedicated for either electrical or communications. Under no circumstances shall electrical cables and communication cables be installed in the same box.

B. Install and seal precast sections in accordance with ASTM C891.

C. Install utility holes plumb.

D. Size hand-hole in accordance with NEC unless noted otherwise on drawings.

E. Backfill utility hole excavation

F. The utility hole shall rest on a 4-inch blanket of 2 sack stabilized sand, and 4 inches around the side walls shall be filled with 2 sack stabilized sand.

3.5 CLEANING

A. Refer to section 270000

3.6 LABELING

A. All communication pathway components shall be properly labeled.

B. Refer to section 270553

3.7 GROUNDING AND BONDING

A. Refer to Section 270526.

3.8 ACCEPTANCE

A. Refer to Section 270000.

END OF SECTION 270543