

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL – NOT USED

PART 2 - PRODUCTS

2.1 MISCELLANEOUS MATERIALS

- A. Backfill and Fill Materials: Use excavated or borrowed material for backfill. Prior to backfilling, remove rock and gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetable matter, and other deleterious matter. Use gravel or stone where so specified on details on drawings, or otherwise included in specifications.
- B. Nonshrink, Nonmetallic Grout: Provide premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.
- C. Subbase: Subbase refers to the compacted layer used in pavement systems between the subgrade and the pavement base course material. Provide subbase consisting of graded mixture of crushed gravel, crushed stone, crushed slag, or sand.

2.2 CONTROLLED LOW STRENGTH MATERIAL (CLSM – “FLOWABLE BACKFILL”)

- A. Description: Controlled-Low-Strength-Material (CLSM) is a material that has a specified compressive strength of 1200 pounds per square inch (PSI) at 28 days. This material is not concrete and is in a flowable state at the time of placement.
- B. Materials: Provide CLSM mixture consisting of water, Portland Cement (Type I or II conforming to ASTM C-150, Type "F" fly ash, and fine aggregate. If fly ash is not used, provide CLSM using high dosages of an air entraining admixture to help flowability and lower strength for removability. Non-standard materials may be used only after receiving special permission from Owner's Representative. Provide water used in mixing and curing that is as clean and free of oil, salt, acid, alkali, sugar, vegetable, and other substances injurious to the finished product as possible. Test water in accordance with the requirements to AASHTO T 26. Water known to be of potable quality may be used without testing. Use fine aggregates conforming to ASTM C 33 in CLSM.
- C. Mix Design: Provide proportion of materials used in CLSM as follows.
 - 1. Cement: 50-100 pounds (lbs) per cubic yard (cy)
 - 2. Type "F", Fly Ash: 250-300 lbs/cy
 - 3. Sand: 2700-2800 lbs/cy
 - 4. Water: 400-500 lbs/cy
 - 5. Other proportions may be used only after receiving special permission from Owner's Representative.

6. Conform to the following flowability test: Fill a 3-inch diameter by 6-inch long open-ended cylinder with the mixture, then strike off to level. Remove the cylinder by pulling straight up and ensure the diameter of the CLSM, after spreading, is a minimum of 8-inches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Subsurface conditions may have been investigated during the design of the project. If so, review reports of these investigations. Follow recommendations of these reports. Locate existing underground utilities in excavation areas, which are to remain. Support and protect these services during excavation operations. Contact utility owner immediately for instructions if uncharted or incorrectly charted utilities are encountered.
- B. General Installation.
 1. Coordinate trench locations in reference to other underground utilities. Ensure no other utilities are placed directly above or below, when parallel to conduits.
 2. Locate junction and pull boxes so they remain accessible after all construction work is complete. Coordinate all work with all other trades prior to commencement of the work.
 3. Layout and install all electrical work in strict compliance with Chapter 1, Part B, Section 110.26 of the latest adopted edition of NFPA 70. Locations and routing that may be shown on plans are schematic and diagrammatic in nature.
 4. Layout all proposed raceway routing, elevations, installation methods, etc. on coordination drawings and coordinate all proposed raceway routing with all affected trades prior to commencing with work. In addition, review the information with Owner and Design Professionals for all areas where work will be visible after completion of construction, to ensure a neatly organized installation occurs.
 5. Use of synthetic or plastic “tie-wraps”, “zip ties”, “wire ties” and similar products are not permitted as a permanent means of anchoring, securing, supporting or otherwise installing any cables, conductors, conduits, raceways, devices, equipment or other electrical work.
- C. Pathway Evacuation and Protection: Seal and protect raceways and boxes from moisture infiltration. Provide watertight fittings. Pressure or vacuum test below-grade conduits before and after concealing the conduits to ensure resistance to moisture ingress. Prior to the installation of cable:
 1. Clean and vacuum boxes and conduits.
 2. Remove solids or other hindrances that could impede its full utilization or that could damage cable during or after installation.

3. Remove liquid and moisture from the raceways. Blow out until raceway is dry, sufficiently that the installed cables will not be subjected to any contact with fluid or moisture.
- D. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations. Properly restore streets, sidewalks, concrete and blacktop surfaces that were broken for installing piping.
- E. Comply with codes in jurisdiction. Provide sloped sides, and shore and brace as required when trenching to achieve stability. Provide excavation and backfilling required for electrical work and consult with utilities prior to beginning excavation. Remove materials of every nature and description encountered in obtaining required lines and grades. Remove excess excavated earth materials from the site.
- F. Where subsidence occurs at electrical installation excavations during a period of 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.2 EXCAVATION

- A. **Shoring and Bracing:** Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation. Remove shoring and bracing when no longer required. Install sediment and erosion control measures in accordance with local codes and ordinances.
- B. **Dewatering:** Prevent surface water, subsurface water, and ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting/run-off areas. Do not use trench excavations as temporary drainage ditches.
- C. **Material Storage:** Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees. Remove from site, and legally dispose of, excess excavated materials and materials not acceptable for use as backfill or fill.
- D. **Trenching:** Excavate trenches to the uniform width, sufficiently wide to provide ample working room. Excavate trenches to depth indicated or otherwise necessary to full

project requirements. All trench widths indicated on drawings are minimum required widths.

- E. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees Fahrenheit.
- F. Backfilling and Filling: Place soil materials in layers to required elevations for each area classification listed below, using materials specified in Part 2 of this Section. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, and approval.
 - 2. Recording locations of underground utilities.
 - 3. Removing concrete formwork.
 - 4. Curing of concrete.
 - 5. Removing shoring and bracing, and backfilling of voids.
 - 6. Removing trash and debris.
- G. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, that are frozen, that contain frost, or that contain ice. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift. Compact each layer of backfill or fill material to 95 percent standard compaction.
- H. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- I. Separately stockpile excavated topsoil adjacent to the excavated areas and trenches and utilize it in the final stage of backfilling operation. Grade exposed earth and other erodible areas to a reasonably uniform, and satisfactory, cross section and slope, as soon as practicable.
- J. Excavation for Underground Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and inspections. Excavate by hand areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint. Take care not to disturb bottom of

excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

3.3 INSTALLATION OF CLSM

- A. General: See details and/or notes on drawings for applications where encasement is required for underground conduits/duct banks. Transport product by mixer truck. Provide continuous agitation from mixing to placement. Retain records of all mixes, tests, etc. and include in Operation and Maintenance Manuals. Submit copies during construction if requested.
- B. Forms: In general, unless directed otherwise in field or required otherwise by OSHA and/or other prevailing codes, regulations and standards, the sides of the excavated trenches may be used as forms for encasement. Otherwise, provide forms made of steel, wood, or other suitable material of size and strength to resist movement during encasement product placement, and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends. Do not remove forms for at least 48 hours after encasement product has been placed. Set forms to required grades and lines, rigidly braced and secured. Provide sufficient quantity of forms to allow continuous progress of work, and so that forms can remain in place at least 24 hours after encasement product placement. Clean forms after each use, and coat with form release agent as often as required to ensure separation from encasement product without damage. Form areas that involve termination of spare conduits below grade, or that involve continuation of conduits by others, accordingly to accommodate easy future access to the ends of conduits for future extensions.
- C. Expansion Joints: Provide pre-molded joint filler for expansion joints abutting any structure, and as otherwise recommended by concrete supplier.
- D. Placement: Remove loose material from subbase surface immediately before placing concrete. Check subbase and forms for line and grade before placing concrete. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Place product directly from the truck chute or pump it. Place product using methods that prevent segregation of mix. Use splash boards to divert the flow of product away from the trench sides, and to avoid dislodging soil and stones. Smooth surface by screeding after striking-off and consolidating product. Broom finish aprons around boxes and structures. Coordinate with Owner's Representative at least 72 hours prior to placing product. Line up product trucks as required to achieve one continuous pour for each pathway. Do not backfill until a minimum of 48 hours have passed. Protect product from damage until acceptance of work. Exclude traffic over affected areas for at least 14 days after placement.

END OF SECTION 260543