

SECTION 02705

EXCAVATION, TRENCHING, AND BACKFILL FOR ELECTRIC, GAS, AND OTHER MINOR UNDERGROUND FACILITIES BENEATH PAVEMENT

PART 1 - DESCRIPTION

The materials and work covered under this section shall cover excavation, trenching, and backfill for electric, gas, and other minor underground facilities trenched beneath roadway surfaces that have been improved with asphalt, concrete, or gravel.

1.01 Definitions

- A. Control density backfill shall also be referred to as flow-fill, cement treated fill, non-shrink backfill or sand-cement slurry material. Controlled density backfill is a composite material that consists of water and a cement binding medium within which are embedded particles or fragments of aggregate.
- B. "Underground facility" means any item of personal property buried or placed below ground for use in connection with the storage or conveyance of electronic telephonic or telegraphic communications, cablevision, electric energy, oil, gas, hazardous liquids, or other substances and including, but not limited to, pipes, conduits, cables, lines, wires, manholes, attachments, and those parts of poles below ground. Underground facility excludes water, sanitary, or storm sewer conveyance or storage systems covered under other sections of this specification.

PART 2 - Materials

2.01 Submittals

Before placement of control density backfill, the contractor shall provide to the engineer and/or owner for review, information on the product data, mixture composition, and material testing characteristics.

2.02 Materials

- A. Cement. Cement shall conform to all requirements for cement set forth under Section 03050.
- B. Aggregate. Aggregate shall consist of fine aggregate and shall conform to all requirements for fine aggregate set forth under Section 03050.
- C. Admixtures. Pozzolan admixtures shall conform to all requirements of Section 03050..

D. Pipe Encasement Material. Pipe encasement material shall conform to all requirements set forth herein this paragraph.

1. Granular Material Gradation Classifications

a. Granular materials furnished for use in Foundation, Bedding, or Encasement installations shall be:

MATERIAL USE DESIGNATION
Percent Passing

Sieve Size	Foundation	Bedding & Encasement
1 inch (25mm)	100	100
3/4 inch (20mm)	90-100	90-100
3/8 inch (9.5mm)	20-55	50-100
No. 4 (4.75mm)	0-10	
No. 8 (0.075mm)	0-5	
No. 200 (0.075 MM)	0-15	

b. Other gradations may be used if written approval is obtained from the City Engineer.

c. Other approved material for bedding and encasement shall consist of sand, sandy gravel, or fine gravel having a maximum size of three-quarter inch (3/4") (20mm), uniformly graded and a maximum plasticity of 6 as determined by AASHTO T-89 and T-90.

2.03 Control Density Backfill Mixture Requirements

A. Control density backfill shall meet the following requirements:

Mixture Requirements

Property	Min.	Max.
Cement factor (lbs. per cubic yard) (kg/cu.m)	50 (38)	60 (45)
Pozzolan admixture (lbs. per cubic yard) (kg/cu.m)	75 (57)	75 (57)
Water cement ratio (gal. per sack) (lit/sack)	6 (23)	
Slump (inches) (m)	7 (175mm)	

Minimum Compressive Strength

Date of Break	Compressive Strength
7 day	11 psi minimum (76 kPa)
28 day	30 psi minimum (210 kPa)
28 day	60 psi maximum(415 kPa)

B. The mix design for flow-fill can vary greatly provided that it meets a twenty eight day (28) compressive strength of between thirty and sixty pounds per square inch (30 – 60 psi) (210 – 415 kpa). The Engineer may modify this design to allow reject or recycled materials provided that the twenty eight day (28) compressive strength is confirmed by lab testing to be between thirty and 60 pounds per square inch (30 – 60 psi) (210 – 415 kpa). Non-specification material is not recommended for heavy loading or water and sewer crossings in which structural support depends on the flow-fills shear strength.

C. Air may be entrained at 1.5 – 2.5 % to improve workability.

2.04 Proportioning of Materials.

A. All materials shall be separately and accurately measured by weight, and each batch shall be uniform. Fine aggregates shall be weighed separately. A sack of cement shall weigh ninety-four pounds (94#) (43kg). When bulk cement is used, ninety-four pounds (94#) (43kg) shall be considered as one sack. The contractor shall furnish and use approved weighing devices, which, in operation, will give the exact quantity of materials required for the class of concrete. When the cement is in contact with the aggregate, it shall not remain more than forty-five (45) minutes before being deposited into the mixer.

2.05 Measurement of Aggregate.

A. Where sack cement is used, the quantities of aggregate for each batch shall be exactly sufficient for one or more sacks of cement. No batch requiring a fraction of a sack of cement will be permitted. All measurements shall be by weight, upon approved weighing scales and shall be such as will insure separate and uniform proportions. Scales shall be of either beam or springless dial types, and shall be suitable for supporting the hopper or hoppers. They shall be set accurately in substantial mountings which will insure a permanent spacing of the knife edges under all conditions of loading and use. They shall be so designed and maintained that they will at all times be accurate to within one-half (1/2) of one (1) percent throughout the entire weight range. Clearance shall be provided between the scale parts and the hopper or the bin structure to prevent displacement of the scale parts due to vibrations, accumulations, or any other cause. The value of the minimum gradations on any scale shall not be greater than five pounds (5#) (2kg). The weighing beam or dial shall be so placed that it will be in full view of the operator during the operation of the gate which delivers the material to the hopper. Scales shall be protected from air currents that may affect the accuracy of weighing.

- B. Separate hoppers shall be provided for weighing fine and coarse aggregate. They shall be of suitable size and tight enough to hold the aggregate without leakage, and shall be supported entirely upon the scales. Suitable provisions shall be made for removal of overload from the hopper by the operator while he operates the bin gates.
- C. The contractor shall provide a sufficient number of fifty pound (50#) (23kg) standard test weights for calibrating the weighing equipment.
- D. The volume of control density backfill mixed per batch shall not exceed the manufacturer's guaranteed capacity of the mixer.

2.06 Mixing Control Density Backfill.

- A. Consistency. The quantity of water to be used shall be determined by the engineer and shall not be varied without his consent. The contractor shall furnish and use with the mixer an approved adjustable, water measuring device which will prevent excess water flowing into the mixer, in order that the consistency may be under positive control and that all batches may be of the same consistency.
 - 1. In general, the minimum amount of water shall be used which will produce the required workability.
- B. Mixer. The mixing machine used shall be of an approved type known as a batch mixer, and of a design having a suitable device attached for automatically measuring the proper amount of water accurate to one percent (1%) and for automatically timing each batch of control density backfill so that all materials will be mixed together for the minimum time required. Such device shall be easily regulated and controlled to meet the variable conditions encountered.
 - 1. The normal mixing time for each batch shall be one (1) minute, and the measuring of this period shall begin after all the materials are in the drum. During this mixing period, the drum shall revolve at the speed for which the mixer is designed, but shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute.
 - 2. No materials for a batch of control density backfill shall be placed in the drum of the mixer until all of the previous batch has been discharged therefrom. The discharge of water into the drum shall commence with the flow of the aggregate, but shall not be started before the entrance into the drum of part of the aggregate. The discharge of all of the mixing water for any batch shall be completed within ten (10) seconds after all of the aggregate is in the drum. The inside of the drum shall be kept free from hardened control density backfill.
 - 3. Control density backfill from a central mixing plant delivered at the work ready for use, will be permitted, provided the mixture is transported to the job site in an agitating truck

having the control density backfill contained in a revolving drum and provided there is no segregation of the mixture at the point of placing. Control density backfill from a central batching plant and mixed in transit will be permitted; however, the mixing and transporting equipment will be subject to the special approval of the engineer. Any control density backfill shall comply with all of the requirements of these specifications. The control density backfill must be of workable consistency when placed. No mixer which has a capacity of less than a two-sack batch shall be used.

4. Hand mixing will not be permitted except with the permission of the engineer and then only in very small quantities or in case of an emergency.

PART 3 - Execution.

3.01 Excavation

A. Excavation for Underground Facilities (General)

1. Excavate to the lines and grades shown, or as approved to accomplish construction. Allow for forms, working space, and materials types where required.
2. Do not excavate deeper than the elevations shown or approved. Excavations carried deeper than the elevations shown or approved shall be backfilled with approved compacted material. Excavation carried deeper than the elevations shown or approved shall be corrected by similarly cutting adjoining areas and creating a smooth transition to facilitate backfill and compaction. Backfill material type, placement, and compaction requirements shall be as determined by the engineer. The contractor shall bear all cost for correcting cuts below grade.
3. The bottom of all excavations shall be neat and clean, containing no abrupt changes in grade except as shown and shall be free from all slough. Suitable methods shall be used to produce an excavated surface without disturbance to the underlying material. The contractor shall correct any disturbance to underlying material by compacting soil material to at least 95% standard proctor, ASTM D698.
4. The engineer may direct excavations to be carried below the lines and grades shown on the drawings if, in the opinion of the engineer, such work is necessary to ensure adequate support of the proposed structure or pipe.

B. Dewatering

1. Dewatering, if required by site conditions, shall be provided by the contractor. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering the excavations, trenches, or other parts of the work.

2. All trench excavations which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations twelve inches (12") (300mm) or more below the bottom of the excavation.
3. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.
4. The contractor shall be responsible for the conditions of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

C. Limits of Excavation

1. Conditions of the excavation permit may set limits of excavation designating the location of the completed utility and/or maximum dimensions of the excavation to prevent encroaching on adjacent improvements. Contractor shall confine excavation to those limits. Limits of excavation to safely accomplish the work shall be determined by the contractor. All excavations shall be free of overhangs and the sidewalls shall be kept free of loose material. As a minimum, slope all excavations to prevent these conditions and to comply with state OSHA regulations.

D. Disposal of Excess Material

1. Except as otherwise permitted, dispose of excess excavated materials in a legal manner.
2. Dispose of broken concrete, rock and other debris resulting from utility construction activities in a legal manner, off-site.

3.02 Installation of Underground Facilities.

A. Trench Excavation.

1. Safety. The contractor shall not open up more trench in advance of the underground utility operations than what can be completely backfilled properly in one day's operation.
3. Asphalt and Concrete Removal. Where trench excavation or structure excavation requires the removal of curb and gutter, concrete sidewalks, or asphaltic or concrete pavement, the pavement or concrete shall be cut in a straight line parallel to the edge of the excavation by use of a spade bitted air hammer, concrete saw, or similar approved equipment to obtain a straight, square, clean break. Concrete shall be cut at the location of standard joint spacing. One half inch (1/2") (12.5mm) expansion joint material shall be installed between existing concrete and new concrete.

3. Limiting Pipe Zone Widths. Trenches shall be excavated to a width which will provide adequate working space and clearances for proper installation, jointing, and embedment of the underground utility. Excavated material shall be placed at a distance away from the sides of the trench equal to the depth of the trench. Install sheeting, shoring, bracing, and sloping as excavation proceeds.

B. Underground Utility Installation.

1. Reasonable care shall be exercised in handling and laying the underground utility materials and fittings. When strung along the trench, materials shall be placed where they will not be subject to injury from vehicles or equipment. The Contractor's facilities for lowering the utility into the trench shall be such that neither the underground utility materials nor trench will be damaged or disturbed.
2. Open excavation shall be satisfactorily protected at all times.

3.03 Trench Backfilling.

A. Trenches.

1. Encasement Material. Encasement material shall be placed to six inches (12") (155 mm) above the utility, but in no case closer than four inches (4") to finish grade. Spread and surface grade encasement material to provide continuous and uniform support beneath the underground utility at all points. Encasement material shall be placed, prepared, and compacted simultaneously on both sides and lateral movement shall be prevented. Encasement material shall be compacted to 90% maximum density, as determined by ASTM D698 at a moisture content of $\pm 3\%$ of optimum for depths over forty-eight inches (48") (1.2m) below finish grade. Between forty-eight inches (48") (1.2m) below finish grade, compaction shall be a minimum of 95% of maximum density. Encasement material shall not exhibit pumping (horizontal or vertical displacement) after compaction.
2. Trench Backfill Above the Encasement. Trench backfill above the encasement shall consist of control density backfill (CDB) material unless other procedures are permitted by the City Engineer. CDB material shall be used when trenching beneath asphalt or concrete paved streets for gas, electric, irrigation, or other minor underground facility. CDB material shall be placed into the excavated trench by means of concrete chutes or tremie tubes. CDB material shall be placed to the bottom of the asphalt mat. CDB material shall be vibrated using a mechanical vibrator to consolidate the material. Trench backfill above the encasement material and below the base course of the roadway may be select material moisture conditioned to $+2\%$ to -4% of optimum and compacted to 95% of maximum density as determined by ASTM D698 as a substitute for CDB upon approval of the City Engineer.
3. All trenches awaiting final paving shall be backfilled with a temporary material. Paving

shall be completed within two (2) weeks of the date the excavation was opened.

B. Care of Utilities.

1. In excavating and backfilling for pipelines or structures, extreme care shall be taken so as not to damage or injure any adjacent gas, telephone, sewer, water, power, television lines, or other utilities. In the event of damage to a utility, the utility owner and the City Engineer, shall be notified immediately.

3.04 Pavement Replacement

Asphalt or concrete paving, curb and gutter and sidewalk construction shall comply with applicable sections of the City of Lakeland standard specifications.

3.05 Cleanup.

- A. Construction cleanup and all backfill operations shall immediately follow installation of underground facilities. Cleanup shall be completed to allow local traffic on the street and access to driveways, parking lots, etc.
- B. During construction, all existing gutters, storm drains, runoff channels, etc., shall be kept clean of dirt, rubble, or debris which would impede the flow of storm sewer.

3.06 Protection.

- A. It shall be the responsibility of the Contractor to protect from damage all freshly poured CDB material regardless of the location or type of structure for a minimum period of seven (7) days from date of installation.

3.07 Quality Control Testing.

- A. The owner or consultant shall employ a testing laboratory to perform test and submit test reports. Test reports will be reported in writing to City Engineering Office, consultant, owner, and Contractor as soon as possible upon completion of tests.
 1. Control Density Backfill. Concrete test cylinders will be made by a qualified technician from a certified material testing laboratory.
 - i. Tests may be required for each day's run or according to the following schedule:

Total Cubic Yards of Control Density Backfill <u> </u> (cu.m)	Minimum Number of Tests <u>(3 Cylinders Each)</u> (cu.m) One for 7 days, two at 28 days
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0 – 100 (0-75)	One for each 50 cu. yds.(40)
100 – 1000 (75-760)	One for each 125 cu. yds. (95)
1000 – 2000 (760-1525)	One for each 175 cu. yds. (135)
2000 and Over (1525)	One for each 250 cu. yds. (190)

- i. Results of all tests shall be furnished to the engineer as soon as they are available.
 - ii. Slump. Slump tests shall be conducted in accordance with ASTM C172. A test shall be performed for each day's pour of control density backfill and for each set of compressive strength tests.
2. Compaction. Compaction testing shall be performed a minimum of once for each trench, for each two hundred feet (200') (61m) of trench and for each material used including asphaltic cement paving.

END OF SECTION