

SECTION 31 23 23.33

CONTROLLED LOW STRENGTH MATERIAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for controlled low strength material (CLSM) as backfill material in specific locations.

1.02 REFERENCED SECTIONS

- A. The following Section is referenced in this Section:
 - 1. Section 01 33 00 – Submittals Procedures

1.03 DEFINITION

- A. Controlled Low Strength Material (CLSM): A highly flowable, lean concrete mix consisting of a mixture of cement, fly ash, densely graded mineral aggregates, water and admixtures. Characteristics include:
 - 1. Capable of freely flowing to fill excavations and voids without compaction or other additional effort.
 - 2. Used in trenches and for backfill adjacent to structures where clearance is limited, and in other areas specifically identified on the Drawings or specified.
 - 3. Low permeability to prevent migration of adjacent fines into the set mix.
 - 4. Easily excavated after curing with minimum risk of damage to buried utility.

1.04 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Mix Design: Identify name and/or number of the mix design. Provide the proportions and gradations of materials proposed for CLSM.
- C. Certified test results for compressive strength.

1.05 QUALITY ASSURANCE

- A. Demonstrate that the CLSM mix meets the specified requirements, including compressive strength.
- B. Enlist the services of a testing laboratory to prepare test cylinders and to transport cylinders to the laboratory for testing.
- C. Testing expenses shall be borne by the Contractor.
- D. Test Cylinders
 - 1. Procedure: Make 6-inch diameter by 12-inch high test cylinders in accordance with ASTM C31.

2. Required Number: Not less than 3 cylinders for each 200 cubic yards of CLSM placed, with a minimum of 3 cylinders for each location where CLSM is used.
 3. Test two cylinders at 28 days, third cylinder is spare.
- E. Field Testing: Furnish slump testing equipment and test slump in accordance with ASTM C143.

PART 2 - PRODUCTS

2.01 GENERAL

- A. CLSM Mix: A mixture of Portland cement, fly ash, aggregate, water, and admixtures that produce a material of controlled density and of low compressive strength capable of filling all spaces between the pipe, the bedding and the trench walls.

2.02 MATERIALS

- A. Cement: Conforming to ASTM C150, Type II or III with total alkali content not more than 0.8 percent.
- B. Water: Clean, potable water.
- C. Fly Ash
1. Mix Designs used for Pipe Bedding and Trench Backfill: Class C in conformance with ASTM C618.
 2. Mix Designs used for Backfill of Excavations: Class F in conformance with ASTM C618.
- D. Aggregate Materials
1. Densely graded rock conforming to the following gradation:

Sieve Size	Percentage Passing
1"	100
No. 8	50-100
No. 200	0-5

2.03 DESIGN REQUIREMENTS

- A. Water-cement Ratio: Not to exceed 3.5.
- B. Minimum Cement Content: 50 pounds per cubic yard.
- C. Use fly ash to improve flow-ability of the fresh CLSM and to regulate the strength. Do not use more than 300 pounds per cubic yard.
- D. Unit Weight Requirements
1. Density of CLSM when used as backfill of excavations: Between 100 pounds per cubic foot and 130 pounds per cubic foot in the as-placed condition as determined by ASTM D6023.

- E. Compressive Strength Requirements
 - 1. Mix Designs used for Pipe Bedding and Trench Backfill: Compressive strength at 28 days between 100 psi and 150 psi as determined in accordance with ASTM D4832.
 - 2. Mix Designs used for Backfill of Excavations: Compressive strength at 28 days between 150 and 300 psi as determined in accordance with ASTM C4832.

2.04 CONSISTENCY AND MIXING

- A. Consistency: Similar to that of a thick liquid so that it flows readily and fills spaces and voids around pipes and structures.
- B. Slump: Between 6 inches and 8 inches when tested in accordance with ASTM C143.
- C. Uniform consistency and appearance.
- D. Mixing Method and Time: As required to produce a uniform mixture of cement, fly ash, aggregate, admixtures, and water.

2.05 MEASUREMENT OF MATERIALS

- A. Use weighing equipment to determine the amount of cement, fly ash, and aggregate entering into each batch. Where batches are proportioned to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 lbs.
- B. Use a suitable water meter or other acceptable method of measuring the quantity of water entering the mixer.

PART 3 - EXECUTION

3.01 PLACEMENT

- A. Thoroughly settle and consolidate CLSM as the material is placed in excavations. Fill the entire depth of the layer that is being consolidated, into a dense, homogeneous mass, filling all spaces and voids and bringing only a slight excess of water to the exposed surface. Place and consolidate CLSM by means that will not cause segregation of the mix.
- B. Do not place CLSM under the following conditions:
 - 1. When the air temperature is below 40 degrees Fahrenheit.
 - 2. When the excavation contains water or when the bottom or walls of the excavation are frozen or contain frozen material.
- C. Prevent flotation of pipes by placing CLSM in two or more lifts, with each lift reaching an initial set before the succeeding lift is placed. Correct any flotation and displacement of pipelines.
- D. Placement of CLSM in Excavations: Limit lift thickness to 10 feet, place subsequent lifts after CLSM has achieved the minimum specified compressive strength.

3.02 PROTECTION OF CLSM

- A. Protect CLSM from equipment, traffic and backfilling operations until the surface has achieved an initial set and has hardened enough to develop a minimum penetration number of 650 when tested in accordance with ASTM C403.
- B. If the trench backfill is not to be placed over the CLSM within eight hours after CLSM placement, place a 6 inch layer of moist backfill over the CLSM.

-END OF SECTION-