SECTION A10
CONTROLLED DENSITY FILL

GENERAL

The Contractor shall furnish Controlled Density Fill to be used as backfill material for all locations shown on the plans, specified herein or ordered by the Engineer. The Contractor shall not encapsulate gas pipes, including gas services, with controlled density fill.

MATERIALS

Controlled Density Fill (CDF) shall be excavatable after setting and be designated as either CDF-VFE (very flowable, excavatable) or CDF-FE (flowable, excavatable).

CDF-FE and CDF-VFE are backfill materials, which are delivered by ready mixed concrete mixers (R/M). CDF-FE and CDF-VFE are a flowable, excavatable, self-compacting and self-leveling material, which after solidifying will have the structural characteristics of a well-compacted load bearing soil. CDF-FE is used primarily for backfilling trenches, foundations, utilities, etc. in an efficient and complete manner with the minimum use of labor and equipment. CDF-VFE's are used for those purposes plus the areas where long flowable horizontal movements are required such as filling pipes, annular rings in jacked pipes, hard to access areas requiring long lateral movements.

The mixes for CDF-VFE and CDF-FE will have the following ingredients and appropriate quantities:

1. Portland Cement- ASTM C150- the range of cement content will be between 40 lbs. to 100 lbs. per cubic yard. Trial batches by the R/M operator should be done as soon as possible, if the R/M intends to be a bona fide supplier of CDF-FE or CDF-VFE.

2. Flyash - Type F - Fly Ash shall be used in CDF-VFE mixes. The flyash content may vary, subject to a minimum content of 250 lbs. per cubic yard, which can be increased for more flowability and/or pumpability.

Type C flyash or high lime Flyash is not to be used, since it tends to increase the long term strength and may render the mix unexcavatable in the future.

3. Water - shall be potable and shall be used as needed to achieve the proper flowability (slump).

4. Air-Entraining Admixture - the air content shall be in the 12-18% range.

5. No admixtures that tend to increase strength with time may be used without the written consent of the Engineer and an appropriate change of the mix where required.

6. Aggregate-ASTM 33 for the excavatable mixes - well-graded concrete sand shall make up the remaining volume of the mix to achieve the full one cubic yard.

ACCEPTANCE OF MIX AND SUPPLIER

The acceptance of the mix and the supplier will be based on the range and length of experience of the supplier and the mix backup data. The primary properties are the maximum and minimum strengths, air content, setting times, flowability and yield. The supplier shall submit to the Contractor and then to the Engineer, documentation of his experience with his mixes and his personnel's ability to deliver them. If these are sufficient to start the placement, the Engineer can waive pre-job testing and the testing can be done on the initial placements.

The Engineer requires a testing program that should begin as soon as possible after the contract award. The Contractor shall submit the materials to be used to the designated approved laboratory along with the suppliers proposed mix. The lab will perform all the tests required by the specification at the suppliers cost, to include setting times, 3,7,28 and 90-day strength tests, air contents, and the ASTM tests on the Cement and Aggregate. In lieu of trial mixes, the materials Engineer may allow the use of the following mix until there is sufficient test feedback. NOTE: The mix is a guideline only and should be adjusted for proper yield, SP.GR and other properties specified.

TYPE		CDF-FE		CDF-VFE		
PROD	WGT	SP GR	VOL	WGT	SP GR	VOL

cement	60	3.15	.29	60		.29
fly ash		2.3	0.00	250		1.74
sand	2800	2.62	17.00	2650		16.21
air		12%	3.24		12%	3.24
water	406	1.0	6.52	347	1.0	5.57
			27.05			27.05

LAB MIX TARGETS

SLUMP11"
AIR 14%
STRENGTH 25 PSI @ 7 DAYS MIN
80 PSI @ 28 DAYS MAX
100 PSI @ 90 DAYS MAX

NOTE: The use of slump, on the job, lower than the design slump can push the strength beyond its excavatable property. It should not be allowed. If a lower slump is desired, the mix should be designed for that lower slump. Test cylinders should not be rodded but simply overfilled and struck off. Use waxed cardboard cylinders that can be torn apart with little damage to the cylinder to be tested. Low early strengths (3 day) may require a soil bearing plate test in lieu of cylinders.

SPECIFICATIONS: The following is the specification format:

CEMENT- Range of cement content 40-100 LBS/C.Y.
FLYASH - 250 lbs. MIN when used
SLUMP - 8"-11" or, an alternative method is to achieve an 8"-15" diameter spread from a 6" long 3" diameter tube filled vertically and lifted off vertically

Unconfined	Compressive	Strength	Targets:
@ 3 days	@ 7 days	@ 28 days	@ 90 days
MIN 10 PSI	25 PSI	30 PSI	
MAX		80 PSI	100 PSI

NOTE: If strength targets are not reached, the Engineer may direct the Contractor to increase the testing pace until he is satisfied with the results.

CONSTRUCTION METHODS

In general, Control Density Fill shall be placed in two layers. The first layer shall be placed from the bottom of the trench to a point 6 inches above the crown of the pipe. The CDF material shall be poured from one side of the pipe at the lowest slump (approximately 4") necessary to allow the CDF to flow under the pipe. The Contractor shall allow sufficient setting time for the embedment layer prior to pouring the full height CDF backfill in order to prevent uplift of the pipe. The setting time will vary, but typically shall be under one hour.

Bedding for sanitary or drain pipes shall consist of setting the pipe to the grade as shown on the plans and bedding the pipe in new bank run gravel at all bells, wyes or as ordered by the Engineer. The Contractor shall then follow the above procedures for backfilling with CDF materials.
Bedding for water pipes shall consist of supporting the water pipe at all bell connections, tees, gates or as ordered by the Engineer with new bank run gravel. The bank run gravel acts as a support for the pipe and is not to be used to backfill the entire trench width. The Contractor shall use extreme care when backfilling with CDF around gate valves, air valves or any other device needing direct access.

The Contractor shall carefully seal the riser pipes around gate valves to ensure that no CDF material interferes with the operation of the gate valves. If required, the Contractor will be required to re-excavate around the gate valve, verify the operation of the gate valve and backfill again at no cost to the Commission. The Contractor will not use CDF material for his backfill operations around fire hydrants, which will be backfilled with bank run gravel.

MEASUREMENT AND PAYMENT

ITEM A10-1	Controlled Density Fill-Flowable & Excavatable	CY
ITEM A10-2	Controlled Density Fill-Very Flowable & Excavatable	CY

The quantity of control density fill to be paid for shall be that quantity delivered to the site and used for backfill of

excavation. Such quantity shall be measured in place by the cubic yard. Such measurements shall be made by the Commission's Inspector.

Such measurements will be based upon the depth of normal trench excavation (or ordered below grade excavation); the length of the trench and the width of the trench minus the area of the pipe measured using the outside diameter. Such trench width shall not exceed the limits set forth in Section A1.

No payment shall be made for furnishing of controlled density fill to backfill any excavation performed for the Contractor's convenience or excavation beyond the limits set forth in Section A1, Excavation and Backfill.

No payment shall be made for re-excavating around a gate valve, service shut off, or any other device for which the Commission needs direct access that has been interfered with by CDF material entering the access tube. The Contractor will be required to excavate, remove and clean out the access tube, clean around the operating nut and backfill at no additional cost to the Commission.

This unit price shall also include all laboratory and test costs as specified herein and as ordered by the Engineer.

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