

613.01

ITEM 613 FLOWABLE CONTROLLED DENSITY FILL (FCDF)

- 613.01 Description**
- 613.02 Materials**
- 613.03 Compatibility with Ductile Iron Pipe**
- 613.04 Mix Proportioning**
- 613.05 Mix Adjustment**
- 613.06 Flow Test**
- 613.07 Pumping**
- 613.08 FCDF Fast Setting, Type III and IV**
- 613.09 Mixing Equipment**
- 613.10 Placing Mixture**
- 613.11 Limitations of Operations**
- 613.12 Approval of Alternate Materials**
- 613.13 Method of Measurement**
- 613.14 Basis of Payment**

613.01 Description. This work consists of furnishing and placing a flowable mixture of Portland cement, fly ash and/or sand for backfilling trenches under various combinations of pavement within public right-of-way or other locations as shown on the plans or as specified. Do not use backfill as structure backfill for aluminum and aluminum-coated pipe culverts.

613.02 Materials. Furnish materials conforming to:

1. Cement 701.01 or 701.04
2. Use Fly Ash obtained from a source approved by the Laboratory and that meets ASTM C-618, Class C or Class F except, that requirements for moisture and pozzolanic activity are waived for Class F fly ash and Loss-On-Ignition (LOI) shall not exceed 12 percent for Class F fly ash.
3. Use Fine Aggregate of natural or synthetic sand manufactured from stone, gravel, or air-cooled slag. The gradation of the sand shall meet the requirements of Section 703.05, unless otherwise approved by the Engineer. The sand shall be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.
4. Use water for mixture that is free from oil, salts, acid, strong alkalis, vegetable matter, and other impurities that would have an adverse effect on the quality of the backfill material.
5. Polyethylene encasement ASTM-674-84

613.03 Compatibility with Ductile Iron Pipe. To ensure compatibility with ductile iron pipe, provide a polyethylene encasement conforming to ASTM A-674-84 and AWWA C-105.

613.04 Mix Proportioning. Proportion the initial trial mixture to include the following quantities of materials per cubic yard:

	Type I	Type II	Type III	Type IV
Cement	50 lb	100 lb	-0- lb	-0- lb

	(23 kg)	(45 kg)	(0 kg)	(0 kg)
Fly Ash, Class F	250 lb (113 kg)	**	-0- lb (0 kg)	1500 lb (680 kg)
Fly Ash, Class C	-0- lb (0 kg)	-0- lb (0 kg)	400 lb (181 kg)	500 lb (227 kg)
Sand (SSD)*	2910 lb (1320 kg)	2850 lb (1293 kg)	2900 lb (1315 kg)	-0- lb (0 kg)
Water (Maximum)	500 lb (227 kg)	500 lb (227 kg)	425 lb (193 kg)	850 lb (385 kg)

* Saturated-surface-dry

** Entrained air is substituted for fly ash in this mix

*** Fine aggregate may be natural or manufactured granular material of stone, gravel, or air cooled blast furnace slag with a gradation that allows 85 to 100 percent to pass the 3/8 inch (9.5 mm) sieve, and 100 percent retained on the No. 200 (75 µm) sieve.

These quantities of materials are expected to yield approximately 1 cubic yard of mixture of a flowable consistency. The proportioning of materials shall be the responsibility of the Contractor. Adjust proportions as necessary to maintain the total absolute volume and proportioning to ensure that unconfined compressive strength at 90 days does not exceed 150 psi (10.8 TSF) (1034.5 kPa). The minimum unconfined compressive strength shall not be less than 50 psi (3.6 TSF) (344.8 kPa). Provide test data from a laboratory inspected by the Cement & Concrete Reference Laboratory (CCRL) and approved by the City that shows the proposed proportioning will meet strength limitations.

613.05 Mix Adjustment. To expedite consolidation of Type I or Type II mixtures as defined in Section 613.04, ensure that bleed water appears on the surface immediately after the mixture is struck off. A delay in bleeding indicates there are too many fines in the mixture, so reduce the fly ash quantity in increments of 50 pounds (23 kg) until mixture is bleeding freely. Add approximately 60 pounds (27.2 kg) of sand to replace each 50-pound (23 kg) increment of fly ash to maintain the original yield.

To produce a flowable mixture, the Contractor may have to make one or more cubic yard trial batches at different water contents. Mixture is too dry when cracks develop in the mixture as it flows into place.

613.06 Flow Test. A test for the flow consists of filling a 3 inch (76 mm) diameter by 6 inch (152 mm) high open-ended cylinder, on a smooth level surface, to the top with flowable mixture. If necessary strike off the top of the cylinder so the mixture is level. Pull the cylinder straight up, within 5 seconds, and measure the approximate spread of mixture. Ensure that the diameter of the material spread is at least 8 inches (203 mm).

613.07 Pumping. The mix proportioning of Types I and II are not designed to be pumpable. If the Contractor elects to pump the flowable mixture, submit for approval a new mix, specifically designed for pumping.

613.08 FCDF Fast Setting, Type III and IV. Provide an initial mixture conforming to 613.04.

Use FCDF Fast setting mixture as directed by the Engineer for backfilling trenches under pavement within public right-of-way when it is deemed that the pavement must be quickly reopened to traffic so as to minimize inconvenience to vehicular traffic or as

613.09

shown in the plans. Use of FCDF Fast Setting mixture is intended to allow for placement of an asphalt concrete pavement within 4 hours of mixture placement.

FCDF Fast Setting mixture shall meet the following performance criteria:

1. Unconfined compressive strength as provided for in 613.04.
2. Four hour field penetrometer tests shall have an average resistance strength of 400 PSI (2759 kPa) for each trench; the Engineer may require up to 4 penetrometer tests per trench. If trench length exceeds 500 lineal feet (152.4 m), the Engineer may require additional tests as set forth herein at the rate of 4 per 500 feet (152.4 m) of trench or part thereof. In the absence of a penetrometer test, the Engineer may subject the FCDF material to a load when a rod (reinforcing bar) approximately 1/2 inch (12.7 mm) or larger in diameter will not penetrate the in-place mix.

613.09 Mixing Equipment. Provide sufficient mixing capacity and delivery equipment to permit the FCDF mixture to be placed without interruption as much as practical. The Contractor may place FCDF mixtures in intermittent horizontal lifts without having to provide for uninterrupted mixture placement as approved or directed by the Engineer.

Delivery equipment shall be as follows:

A. Type I and Type II FCDF Mixtures. Deliver and place Type I and Type II FCDF mixtures from ready mixed concrete trucks or volumetric mobile concrete mixers. The Contractor may pump these mixtures if modified according to 613.07.

B. Type III FCDF Mixtures. The Contractor may deliver and place Type III FCDF mixtures from ready mixed concrete trucks or volumetric mobile concrete mixers.

C. Type IV FCDF Fast Setting Mixtures. Deliver and place Type IV FCDF Fast Setting mixture from volumetric mobile concrete mixers. Calibrate volumetric mixers so as to combine mix materials according to the proportions of 613.04 and sufficiently mix the materials to obtain a uniform mixture meeting the requirements of this specification.

613.10 Placing Mixture. Discharge FCDF mixture from mixing and delivery equipment by any reasonable means into the space to be filled. Bring up the fill material uniformly to the fill line shown on the plans or as directed by the Engineer. The Contractor may begin placing any material over low strength mortar backfill, as specified herein, as soon as the surface water is gone, or as directed by the Engineer.

613.11 Limitations of Operations.

1. Do not place mixture on frozen ground.
2. Protect the mixture from freezing.
3. Each filling stage shall be as continuous as is practicable.
4. Temperature affects the cure time of FCDF. As temperatures near freezing or below, allow additional time for the proper curing of the material prior to any paving type of operations.
5. Ensure that the final mix has the required strength, fills the voids of the intended usage and sets up within 12 hours (4 hours for Type IV).

613.12 Approval of Alternate Materials. Manufacturers or suppliers of materials other than those approved by the Director and as indicated by these specifications may request to be added as an approved equal through the Director. Submit each request to the Director in writing for review and approval, in accordance with the current policy and procedure concerning such matters. If approved, the City will add the material to a list which will be kept on file in the office of the City testing facility located at the Construction Inspection Division.

613.13 Method of Measurement. The City will measure Flowable Controlled Density Fill mixture by the cubic yard (cubic meter). The City will determine quantities by calculations from dimensions shown on the plans, contract, field measurements, or as ordered by the Engineer. Should disputes arise in yield values the number of cubic yards (cubic meters) of FCDF will be measured by conversion of the total batch(s) weight(s). A conversion factor of 3, 650 pounds per cubic yard (2190 kg/m³) will be used for Types I and II. A conversion factor of 2850 pounds per cubic yard (1710 kg/m³) will be used for Types III and IV.

613.14 Basis of Payment. The City will pay for the volume of mixture furnished and placed, at the contract unit price per cubic yard (cubic meter). Payment is full compensation for placing the low strength mixture and for furnishing all materials, equipment and incidentals necessary to complete this item, unless included under other items on the plans.

The City will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
613	Cubic Yard (Cubic Meter)	Flowable Controlled Density Fill, Type I, Type II, or Type III
613	Cubic Yard (Cubic Meter)	Flowable Controlled Density Fill, Fast Setting, Type III and Type IV