213-R-446 FLOWABLE BACKFILL

(Revised 08-20-08)

The Standard Specifications are revised as follows:

SECTION 213, BEGIN LINE 1, DELETE AND INSERT AS FOLLOWS:

SECTION 213 – FLOWABLE BACKFILL

213.01 Description

This work shall consist of placing flowable backfill in trenches for pipe structures, culverts, utility cuts, ~~and~~ other work extending under pavement locations, ~~to fill~~ cavities beneath slopewalls and other locations in accordance with 105.03.

Flowable backfill will be classified as either removable or non-removable.

MATERIALS

213.02 Materials

Materials shall be in accordance with the following:

Concrete Admixtures*.....912.03
Fine Aggregate~~*~~.....904.*02(a)*
Fly Ash 901.02
Portland Cement.....901.01(b)
Water.....913.01

~~*Except that steel furnace slag shall not be used~~
*Other admixtures that increase flowability may be used as approved by the Engineer.

~~If fly ash is used as a filler and not as a pozzolan, the fly ash shall be in accordance with 904.~~

The supplier may elect to use *nominal size No. 23 and No. 24* gradations in accordance with 904.*02(h)* or may propose the use of alternate gradations. The alternate gradation and proposed tolerances of material passing each sieve shall be included in the flowable backfill mix design.

213.03 Flowable Backfill Mix Design

The Contractor shall submit a flowable backfill mix design, FBMD, to the ~~Engineer~~ *DMTE a minimum of seven days* ~~and arrange a~~ *prior to the* trial batch. The FBMD will be ~~approved based on compliance~~ *accepted in accordance* with 213.04. The FBMD shall be submitted in a format acceptable to the ~~Engineer~~ *DMTE* and shall include the following:

(a) a list of all ingredients
(b) the source of all materials
(c) the gradation of the aggregates
(d) the batch weight (mass) *with the aggregates at the SSD condition*
(e) the names of all admixtures

(f) the admixture dosage rates and manufacturer's recommended range

~~FBMD's which were used on contracts in the current or previous calendar year, may be submitted to the District Materials and Tests Engineer for approval. Effective January 1, 2004, all FBMD's shall meet the requirements of 213.05.~~ *A FBMD in accordance with these specifications, which has been approved for use on a previous contract, may be submitted to the DMTE for approval. The submittal shall include copies of test results in accordance with 213.04 and 213.05.*

~~After the completion of the trial batch and all test results have been reviewed for compliance with the specifications, a mixture number will be assigned by the Engineer.~~

~~Mix design changes~~ *Changes in the FBMD* will not be allowed ~~after the FBMD approval,~~ except for adjustments to compensate for routine moisture fluctuations *or a change in sand source in accordance with 213.05 based on the dry flow determined from the trial batch testing*. All other changes *will* require a new FBMD.

213.04 Flowable Backfill Mix Criteria

The FBMD shall produce a workable mixture with the following properties.

~~Minimum Unconfined Compressive Strength~~
~~at 28 days ..... 50 psi (350 kPa)~~
~~Maximum Unconfined Compressive Strength~~
~~at 28 days ..... 150 psi (1050 kPa)~~
~~Minimum Fill Spread Diameter .....8 in. (200 mm)~~

(a) Flow Consistency

Flow consistency will be measured in accordance with ASTM D 6103. The diameter of the spread shall be at least 8 in (200 mm).

(b) Lightweight Dynamic Cone Penetration Blow Count Number

A lightweight dynamic cone penetration test will be performed in accordance with ITM 216 after the flowable backfill mix has cured for three days. The average penetration resistance blow count number for removable flowable backfill shall not be less than 12 nor greater than 30. Non removable flowable backfill mixes shall have an average penetration resistance blow count greater than 30.

(c) Removability Modulus

The removability modulus, RM, will be determined for the FBMD by the formula as follows:

$$RM = 0.000104(U_w)^{1.5}\sqrt{1.72N_{14} - 15.64} \qquad \textit{(English Units)}$$

$$(RM = 0.00000162(U_w)^{1.5}\sqrt{1.72N_{14} - 15.64}\,) \qquad \textit{(SI Units)}$$

Where:

N_{14} = average lightweight dynamic cone penetration blow count after 14 days in accordance with ITM 216.

U_w = dry unit weight, pcf (kg/m^3), of flowable backfill after 14 days in accordance with ITM 218.

The RM shall be 1.0 or less for removable flowable backfill.

After all test results have been reviewed for compliance with the specifications, a mixture number will be assigned by the DMTE.

213.05 Flowable Backfill Trial Batch

A trial batch shall be produced by the Contractor and *will be* tested by the ~~District Materials and Tests Engineer~~ *Department* to verify that the FBMD meets the flowable backfill mix criteria. *The Department will verify the classification of the mix as either removable or non-removable from the results of the trial batch.* The flowable backfill shall be batched within the proportioning tolerances of 508.02(b). The ~~Engineer~~ *Department* will determine *the test results* and provide *them to* the Contractor ~~with test results for the unconfined compressive strength test and the flowable backfill spread diameter~~. The trial batch shall be of sufficient quantity to allow the ~~Contractor and the Engineer~~ *Department* to perform all required tests from the same batch. ~~Trial batch flowable backfill shall not be used for more than one test.~~

~~Compressive strength testing shall be conducted in accordance with ITM 588. Flow testing shall be conducted in accordance with ASTM D 6103.~~

~~The Contractor shall determine the penetration resistance of the flowable backfill produced during the trial batch in accordance with ITM 213 at one, three, seven, and fourteen days. The results shall be submitted to the Engineer.~~

~~FBMD's which were used on contracts in the current or previous calendar year, may be submitted to the District Materials and Tests Engineer for approval.~~

The Department will obtain a sample of the fine aggregate and fly ash described in the FBMD. The Department will test the dry flow in accordance with ITM 217 and record the results on the FBMD.

If the Contractor requests to change the source of the fine aggregate identified in an approved FBMD the Contractor shall submit a revised FBMD to the DMTE. The Department will obtain a sample of the new fine aggregate and, if applicable, a sample of the fly ash as identified in the approved FBMD. Dry flow will be tested in accordance with ITM 217. If the test result is within ± 2.0 s of the value shown on the approved FBMD, the revised FBMD will be approved and a new trial batch will not be required. Failure to meet the dry flow test requirement will require the Contractor to submit a new FBMD and perform a new trial batch for approval of the proposed new fine aggregate.

213.06 Mixing Equipment

The mixing equipment shall be in accordance with the applicable requirements of 702 or 722~~, except that in lieu of the calibration requirements of 722.11, the mixer operator shall make delivery in a properly calibrated continuous mixer~~.

CONSTRUCTION REQUIREMENTS

213.07 Placement

The flowable backfill shall not be placed on frozen ground. Flowable backfill shall be protected from freezing ~~until the material has set~~ *for 72 hr. Flowable backfill shall not be placed into or through standing water unless approved by the Engineer in writing*.

The diameter of the flowable backfill spread shall be at least 8 in. (200 mm) at time of placement. *Water may be adjusted from the FBMD to meet the minimum spread requirement if the initial measured spread is between 7 and 8 in. (175 and 200 mm).*

If using mixing equipment in accordance with 722, the yield will be checked using the 1/4 cu yd (0.2 m^3) box method as follows:

(a) The chute shall be cleaned and the box shall be positioned on a level surface to receive the discharged flowable backfill.

(b) The mixer shall be operated until the cement or fly ash counter indicates that 1/4 cu yd (0.2 m^3) of flowable backfill has been yielded.

(c) The contents of the box will be consolidated and struck off. If the box is not full, the gates shall be adjusted and the procedure shall be repeated until the actual and calculated volumes of flowable backfill agree.

(d) Yield will be checked on the first load of each truck and every third load per truck thereafter. Additional yield tests will be required after making any adjustments.

The flowable backfill shall be brought up uniformly to the fill line as shown on the plans or as directed. *When used as structure backfill, flowable backfill shall be placed uniformly so as not to induce unbalanced loading on any part of a structure.*

The flowable backfill shall not be subject*ed* to load nor disturbed by construction activities until *a lightweight dynamic cone* penetration *test has produced a minimum blow count* ~~resistance testing in accordance with ITM 213 has been completed~~. The minimum ~~penetration resistance~~ *blow count* shall be as follows:

~~For PCCP ..... 70 psi (500 kPa)~~
~~For all Other Applications..... 1200 psi (8000 kPa)~~

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213.08 Method of Measurement

Flowable backfill will be measured by the cubic yard (cubic meter) *of the type specified* as computed from the neat line limits shown on the plans, or as adjusted. If neat line limits are not shown on the plans, the volume in cubic yards (cubic meters) of flowable backfill furnished and placed will be computed from the nominal volume of each batch and a count of the batches. Unused and wasted flowable backfill will be estimated and deducted. Drilled holes will be measured by the number of holes drilled.

213.09 Basis of Payment

The accepted quantities of flowable backfill will be paid for at the contract unit price per cubic yard (cubic meter) *for the type specified,* furnished and placed. Holes drilled in the pavement will be paid for at the contract unit price per each.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Drilled Hole for Flowable Backfill	EACH
Flowable Backfill*, Non-Removable*	CYS (m3)
Flowable Backfill, Removable	*CYS (m3)*

The cost of material placed outside the neat line limits, material placed outside the adjusted limits, and unused or wasted flowable backfill shall be included in the cost of this work.